The Effects of Father Involvement in Adolescence on Cortisol Reactivity in Young Adulthood: The Mediating Role of Perceived Mattering

by

Mariam A. Hanna

A Thesis Presented in Fulfillment
of the Requirements for the Degree
Master of Arts

Approved June 2015 by the
Graduate Supervisory Committee:

Linda Luecken, Chair
Sharlene Wolchik
William Fabricius

ARIZONA STATE UNIVERSITY

August 2015

ABSTRACT

Research suggests that early family relationships have critical influences on later physical and psychological health, but most studies have focused on the influence of mothers ignoring the unique impacts of fathers. One mechanism by which families may transmit risk is by repeated activation of the hypothalamic-pituitary-adrenal (HPA) axis in the short-term that leads to adult neurobiological dysregulaton, evident in hyper- or hypo-cortisol levels. Using 218 father-child dyads from the Parent and Youth Study (PAYS), the current study investigated whether father involvement in adolescence predicted youth cortisol AUCg and reactivity to a stress task in young adulthood, and whether this relation was mediated by youth perceptions of mattering to their fathers in adolescence. Results revealed that higher father-reported father involvement predicted lower cortisol AUCg in youth when mattering was included in the model, although father involvement was not a statistically significant predictor of AUCg or cortisol reactivity when mattering was not included. Additionally, children who reported higher father involvement also reported higher feelings of mattering, but this association was only statistically significant for girls and European American youth. Youth feelings of mattering did not predict their cortisol reactivity or AUCg in young adulthood. Results suggest that future research should include fathers when investigating the effects of family relationships on youth psychophysiological development.

TABLE OF CONTENTS

Page

Page

LIST OF TABLES

Table Page

The Effects of Father Involvement in Childhood on Cortisol Reactivity in Young Adulthood: The Mediating Role of Perceived Mattering

Research across multiple disciplines consistently demonstrates that childhood experiences exert critical influences on later health. Specifically, negative family relationships characterized by conflict, poor relationship quality, or deficient nurturing put children at risk for numerous physical and psychological health consequences (Repetti, Taylor, Seeman, 2002). For example, children who experience emotional or physical neglect are at an increased risk for a range of internalizing problems, such as depression and anxiety, and externalizing problems, such as oppositional or delinquent behavior (Repetti et al., 2002). Lack of supportive childhood family relationships or deficient nurturing have also been linked to higher rates of illness, general health complaints, obesity, or more chronic illnesses later in life (Repetti et al., 2002). Findings from the Adverse Childhood Experiences study (ACEs) show that adults who retrospectively reported undergoing a dysfunctional home life (characterized by negative experiences such as psychological, physical, or emotional abuse) were more likely to develop health risk behaviors or disease in adulthood such as alcoholism, substance use, ischemic heart disease, cancer, chronic lung disease, skeletal fractures, liver disease, and autoimmune disease (Felitti et al., 1998; Dube et al., 2009).

Although associations have been made between childhood family environments and later health consequences, the mechanisms by which families transmit health risks are still unclear. A commonly studied mechanism that may partially explain this association is physiological stress reactivity. Adverse childhood family environments

may predispose children onto poor health trajectories by influencing the development of their physiological stress regulatory systems. Physiological stress reactivity has commonly been studied with the hypothalamic-pituitary-adrenal (HPA) axis, a neuroendocrine stress response system that produces the hormone cortisol when activated by encountering aversive or challenging events in the environment.

Within the context of the family, the theory of allostatic load posits that repeated activation of the HPA axis in the short term due to a chronically stressful family environment disrupts the ability to effectively mount adaptive responses to stress, and recover from those responses, later in life (Repetti, Robles, & Reynolds, 2011). A review by Luecken & Lemery (2004) suggests that early caregiving experiences can affect the development of the HPA system over the course of child development by first affecting the short-term responses to stress that over time can have long-term effects on adult physiological reactivity, increasing vulnerability to stress-related illnesses over time. Therefore, negative family upbringings may get "under the skin" and transmit lifelong health risk via enduring neurobiological dysregulation (Gunnar & Quevedo, 2007), evident in either hyper- or hypo-cortisol levels in response to stress. This neuroendocrine dysregulation is associated with a range of pathologies including cardiovascular diseases, diabetes, hypertension, and cancer (Seeman & McEwen, 1996).

Children reared in families characterized by conflict or neglect are prone to dysregulated cortisol patterns (Repetti et al., 2002). For example, family environments characterized by low positive affection and high negative interactions are associated with abnormal diurnal cortisol profiles (usually high and variable but sometimes low) in infants, children, and adolescents (Flinn & England, 1997). Interparental conflict is

associated with lower cortisol reactivity patterns during a stress task in kindergarten children (Davies et al., 2007). Also, adolescents who report poor parent-child relationship quality, characterized by lower levels of closeness, warmth, and time spent with their parents, display increased HPA activity (indicated by either exacerbated sAA or cortisol levels) to a conflict discussion with their parents (Afifi et al., 2011). Evidence suggests that this biological dysregulation can persist into adulthood. For instance, college students who report negative childhood family relationships characterized by high conflict, low cohesion, and low expressiveness in their family-of-origin show blunted cortisol responses to a laboratory stressor (Luecken, Kraft, & Hagan 2009). Varied forms of cortisol dysregulation (blunted and exacerbated) can result from early adversities, which suggest that cortisol regulation is a result of a complex mix of factors. These can include children's perceptions, social contexts, and temperament (Flinn & England, 1997), as well as different aspects of the timing and controllability of the stressor (Miller, Zhou, & Chen, 2007). However, there is consistent evidence that negative family relationships are associated with some form of dysregulation in cortisol reactivity both in early childhood and young adulthood.

In general, studies that have examined the impact of family relationships on children's physiology have either solely focused on maternal parenting, or averaged maternal and paternal parenting measures. For example, several studies on infants and toddlers indicate that mother-child attachment patterns impact cortisol reactivity to varying types of stressors such as laboratory challenges (Hertsgaard et al., 1995; Bernard & Dozier, 2010; Roque et al., 2011), or life events such as transitioning to childcare (Ahnert et al., 2004). Maternal warmth and sensitivity are shown to have critical

influences on children's diurnal cortisol levels (Pendry & Adam, 2007), and cortisol reactivity to a laboratory stress task (Atkinson et al., 2013). Also, families have been characterized by combining behaviors from the parenting dyad or by asking about the holistic family environment. For example, studies average the means of maternal and paternal parenting scores to obtain a single measure of parenting (Tyrka et al., 2012; Luecken, 2000), or evaluate the effects of overall family functioning on youth cortisol without distinguishing the unique contributions of each parent (Hardie, et al., 2002; Luecken, 1998).

As links have been made between early parent-child relationships and cortisol reactivity in offspring, there remain important methodological and theoretical gaps in the literature. First, most research on families has focused on the impact of mothers on child physiology, or assessed the combined influence of mothers and fathers, ignoring the unique impact of fathers. An examination of the isolated effects of fathers on youth cortisol reactivity, and the mechanisms by which these effects occur, would provide a more nuanced understanding of how individual parents can specifically impact youth neuroendocrine regulation. Second, the HPA does not operate in a vacuum but is responsive to the cognitions and interpretations individuals make of their social environments (Seeman & McEwen, 1996). Therefore, youth perceptions of how much they matter to their parents may be an unexplored mechanism by which early caregiving impacts youth cortisol regulation. Third, studies have typically examined the links between early parenting relationships and cortisol reactivity using young adult samples retrospectively reporting on parenting in childhood (Luecken, Kraft, & Hagan, 2009; Bloch et al., 2007). As these studies provide insight on how adults' perceptions of their

early family environment impacts their HPA reactivity, longitudinal designs would help explain how these processes unfold over time as youth perceive their family environment across different stages of development.

Fathers: Forgotten Contributors to Child Development

Historically, research on families has focused on the influence of mothers as primary caregivers in child development and typically ignoring the impact of fathers. Lamb (1975) was the first monumental paper to recognize fathers as significant contributors to child development, stating, "Perhaps researchers, by stressing so insistently the importance of the mother-child relationship while failing to discuss other important relationships, have contributed unwittingly to the devaluations of the father's role…Psychology now urgently needs to pay more attention, in research and in theory, to the role of fathers in the socialization of children." A more recent review of the father literature by Parke (2004) notes that in the 21st century fathers are clearly recognized as central players in children's social, emotional, and cognitive development.

Few studies isolate the impact of fathers on youth, and even fewer have examined how fathers specifically influence youth physiological stress reactivity. Findings from existing studies on paternal parenting and youth physiological stress reactivity suggest intriguing associations. Among young adults from divorced families, higher perceived father control is associated with elevated cardiovascular reactivity following a laboratory stressor (Roubinov & Luecken, 2010). Early father involvement moderates the impact of cortisol reactivity at age seven on the development of mental health problems at age nine; nine-year-olds who exhibit the most symptoms of mental health were those who

experienced low father involvement early in life and had high cortisol reactivity patterns at age seven (Boyce et al., 2006). Also, poor father-daughter relationship quality is associated with elevated cortisol reactivity during a lab stressor (Byrd-Craven et al., 2012). Fathers have also been demonstrated to influence HPA activity as early as infancy: observed father negativity is associated with increased cortisol reactivity to a lab stressor at seven months of age (Mills-Koonce et al, 2010). Altogether, existing data on fathering and children's stress reactivity suggest a promising link between the two, however, more research using a developmental framework is needed to examine how early fathering impacts stress reactivity at later stages in life.

Studies have focused on the impact of paternal presence or absence on child outcomes because fathers are typically the less available or sometimes absent parent. Fatherlessness, or lack of a father presence in the home, has been associated with a range of negative child outcomes including higher levels of emotional or behavioral problems (Osborne & McLanahan, 2007), higher rates of youth incarceration (Harper & McLanahan, 2004), increased risk for teen pregnancy (Teachman, 2004), increased youth substance use (Hoffmann, 2002), and childhood obesity (National Longitudinal Survey of Youth). Father involvement, on the other hand, is associated with better school performance, even in single-parent father families (Nord, Winquist, & West, 2001), as well as better cognitive functioning in children (e.g., higher IQ levels; Yogman et al., 1995) and greater educational attainment (Flouri & Buchanan, 2004). The National Fatherhood Initiative states, "there is a 'father factor' in nearly all social issues facing America today," and father involvement, or lack thereof, is associated with a range of important psychosocial child outcomes.

Research has expanded beyond mere distinctions of father absence or presence, and has distinguished different types of father involvement behaviors (Parke, 2000). For example, Lamb and colleagues (1985) outlined three main components of father involvement: 1) interaction, or the fathers direct contact with the child through child care or shared activities, 2) availability, or the fathers potential availability for interaction by virtue of being present or accessible, 3) and responsibility, or the role fathers take to ensure a child is taken care of and adequate resources are available for the child. Links have yet to be made between these specific father involvement behaviors and physiological reactivity in offspring.

A Potential Mechanism: Mattering

Previous research has examined the link between children's reports of various parenting behaviors (e.g. involvement and warmth) and cortisol reactivity. However, little work has been done on the mechanisms by which parenting behaviors exert their influence. The ways children mentally process their father-child relationship may be key factors by which parenting behaviors impact youth cortisol reactivity. Youth feeling like a priority or object of concern to their pattern, e.g. mattering (an antithesis to feeling neglected or uncared for), may be an important means by which parenting behaviors influence youth physiological regulation later in life. Youth may report low levels of parental warmth and involvement, but could conceivably still feel like a priority or object of concern to their parent. Therefore, although they are likely to be correlated, mattering may not be totally dependent on a positive or close parent-child relationship, or on pro-social parenting behaviors (Schenck et al., 2009).

The impact of an involved or uninvolved father on cortisol reactivity in youth may depend on youth feeling like a priority to their father. Children's perceptions of mattering to their father may be especially important to consider as fathers are often viewed as the less physically or emotionally available caregiver. For example, having an involved father in childhood may lead children to feel like they matter to their father, and this perception of mattering to their father is hypothesized to affect children's cortisol reactivity later in life. In contrast, having an uninvolved father in childhood may lead children to feel like they do not matter, and children's perceptions of not mattering is hypothesized to promote dysregulated cortisol reactivity later in life. Therefore, youth's perceptions of mattering may be a key mechanism by which father involvement impacts youth cortisol reactivity.

A study by Schenck et al. (2009) demonstrated that children's perceptions of mattering to their father or stepfather predicted mental health outcomes: adolescents who reported mattering to their nonresidential biological father were less likely to exhibit internalizing problems as reported by parents, teachers, and youth. Adolescents who reported mattering to their stepfathers were less likely to exhibit both externalizing problems, as reported by stepfathers and youth, and internalizing problems, as reported by the youth. The question still remains, however, if mattering also predicts physiological outcomes.

The concept of mattering has been relatively unstudied, so researchers have not yet examined whether mattering affects physiological reactivity. However, based on the logic of existing studies, some hypothesizes can be drawn. First, several studies suggest that the lack of parental care and warmth, possibly paralleling low mattering, is

associated with heightened cortisol reactivity (Flinn & England, 1997; Afifi et al., 2011). It can be hypothesized then that lower perceived mattering will also be associated with exaggerated cortisol reactivity. Second, studies suggest that youth internalizing and externalizing problems are associated with dysregulated cortisol reactivity, although results are mixed in terms of the direction of the effects. For example, Hartman et al. (2013) finds that self-reported internalizing problems are associated with exaggerated cortisol levels after a stress task. Internalizing behaviors are associated with stronger initial increases in cortisol reactivity levels to a laboratory stressor among adolescents (Klimes-Dougan et al., 2001). Results from a meta-analysis suggested that externalizing behaviors were associated with increased basal cortisol levels in preschoolers and decreased basal cortisol levels in elementary-aged children, but there was no relation between externalizing and cortisol reactivity in either age group (Alink et al., 2008). As mattering has been shown to protect against the development of youth internalizing and externalizing symptoms (Schenck et al., 2009), and internalizing and externalizing symptoms are associated with cortisol regulation, mattering may be related to cortisol reactivity as well.

Current Study

The current study examines how fathers impact youth cortisol reactivity, and evaluates mattering as a potential cognitive mechanism by which these impacts may occur. The current study will use data from the longitudinal Parent and Youth Study to examine the association between father involvement in early adolescence and cortisol reactivity in young adulthood, and whether this association is mediated by adolescent's

perceptions of mattering to their father. The longitudinal design of this study appeals to calls in the literature to integrate the study of the HPA system in family processes within developmental frameworks (Repetti, Taylor, & Seeman, 2002).

Father involvement was assessed with a questionnaire administered when adolescents were in 7th to 9th grade. A comprehensive measure of father involvement was used that parallels Lamb's (1985) conceptualization constituting three key aspects of involvement outlined previously: availability, interaction, and responsibility. In the current study, availability was examined as the amount of time fathers spend physically around their children; interactions was examined as the fathers' interactions in various activities with their children; responsibility, or in this case behavioral evidence, was examined as evidence that fathers are providing instrumental and emotional support to their children. Youth reports of mattering to their father were assessed when youth were adolescents (10th grade). Cortisol reactivity was measured during a challenging speech task conducted when youth were 19 years old.

The study aims to: 1) examine whether father involvement in early adolescence is associated with cortisol reactivity in young adulthood, 2) examine whether father involvement in early adolescence predicts perceived mattering in adolescence, and 3) examine if mattering in adolescence mediates the effects of father involvement on cortisol reactivity in young adulthood. It is hypothesized that the impact of father involvement on youth's cortisol reactivity patterns occurs because of the effects father involvement has on adolescent's perceptions of mattering. In terms of the proposed direction of cortisol reactivity patterns, a meta-analytic review by Miller, Zhou, and Chen (2007) suggested that chronic, ongoing stressors tend to be related to greater overall

diurnal cortisol output and flatter slopes. As Miller et al. (2007) theoretically characterize *diurnal* cortisol patterns, the current study is assessing cortisol AUCg output and reactivity. However, cortisol AUCg and reactivity are likely influenced by individual's overall diurnal cortisol output (e.g. individuals with higher overall cortisol output during the day are likely to show higher overall output during a stress task). In the current study, father involvement is assessed during childhood within a span of three years, and is conceptualized as a chronic experience. It is hypothesized that youth who experience lower levels of father involvement in early adolescence will report lower levels of mattering in adolescence, and therefore will show greater overall cortisol AUCg output and less reactivity (i.e. smaller values between baseline and peak cortisol) to the stress task. Conversely, it is hypothesized that youth who experience higher levels of father involvement in early adolescence will report higher feelings of mattering in adolescence, and therefore will show lower overall cortisol AUCg output to the stress task and greater, or more expected, reactivity (i.e. higher values between baseline and peak cortisol).

Methods

Participants

The sample consists of 218 father-youth dyads that participated in the longitudinal Parent & Youth Study (PAYS), an 8-year, 5-wave, two-site investigation (Phoenix, AZ and Riverside, CA) designed to examine father-youth relationships in Mexican-American and Caucasian-American families. Data collection began at wave 1 when youth were in 7th grade. Wave 2 consisted of two cohorts that were assessed when youth were in 8th or 9th grade, wave 3 was conducted when youth were in 10th grade, wave 4 when youth were

age 19, and wave 5 when youth were 20-21 years. The current study will use data from waves 1 through 4 only. Eligibility for the study included: 1) the target child currently resided with the mother and biological father or stepfather, 2) the father and child were both of Mexican American (MA) or European American (EA) ethnic backgrounds, 3) the family was fluent in either English or Spanish, and 4) the in-house father was living with the family for at least one year prior to the beginning of the study (legal marriage between the parents was not a requirement). Data was collected using multiple informants (youth Y- and father F-) and multiple methods (questionnaires delivered via interviews and saliva samples). IRB approval was obtained at both sites, and prior to interview, youths assented and mothers and fathers gave informed consent regarding study procedures. Overall PAYS consisted of 393 families that included both intact and divorced families. For the purposes of the current study, divorced families will not be included, and analyses will focus on the remaining 218 intact families only.

Approximately equal numbers of participants came from both sites and included 105 (48%) boys and 113 (52%) girls, and 110 (50%) EA families and 108 (50%) MA families. The median annual income for the families ranged from $50,001 to $75,000. Approximately 206 (95%) families entered the study married and 12 (5%) were cohabiting.

In terms of retention, Wave 1 had a total of 218 participating intact families. At Wave 2, interviews were obtained from at least one family member for 206 families, at Wave 3, 194 families, and at Wave 4, 173 families, resulting in 80% retention from Wave 1 to Wave 4.

Recruitment strategies between the two sites differed due to different laws and school district policies. In California, families were recruited from two school districts in the metropolitan area of San Bernadino County. School staff used emergency cards and enrollment information to determine eligible families, who were later contacted and screened. Upon meeting eligibility requirements and agreeing to participate, research staff contacted potential families, explained details of the project, and obtained the appropriate consent based on university IRB procedures. In California, a total of 540 families were contacted and 192 (36%) were both eligible and initially agreed to participate. In Arizona, families were recruited from eight ethnically diverse schools in the Phoenix metropolitan area. Teachers administered a short survey to all 7th graders asking about students' ethnic backgrounds and family composition, which resulted in a total of 2,459 appearing to be eligible. Families were contacted in order to determine eligibility, explain the project, and ask for consent to have research staff contact the family. Research staff contacted a total of 640 families to explain details of the project and obtain consent based on university IRB procedures. In Arizona, a total of 204 (32%) families were both eligible and initially agreed to participate.

Procedures

During Waves 1, 3, and 4, all three family members at the Arizona site were interviewed in separate rooms at their homes, and family members at the California site were interviewed in separate rooms at the research lab. At Wave 2, interviews were conducted with family members over the phone. Across all four waves, family members were interviewed in the participant's preferred language. Interviewers read questions

aloud and entered responses into a computer. Participants received $100 each per interview.

Measures

Throughout the PAYS study, efforts were made to ensure measurement equivalence when items were translated from English to Spanish.

Father involvement (F- and Y-report, Waves 1 and 2). Father involvement is measured as a composite score comprised of F- and Y-report of father availability, F- and Y-report of father-child interactions, and Y-report of behavioral evidence that will be converted into z-scores and summed across waves 1 and 2.

Father availability is a two-item scale defined as the number of waking hours the father spends at home with the child (e.g. "On an average weekend day, when both of you are awake, how many hours are you at home with the (child)?" and the same question for weekdays). These two items originated from the Child Trends and DADS project and were modified slightly for this project. To get a weekly amount of hours fathers spent with their children, answers for the weekday items were multiplied by five, answers for the weekend items were multiplied by two, and the two were added together. Wave 1 reliability was $\alpha = .50$ for father report, and $\alpha = .58$ for youth report. Wave 2 reliability was $\alpha = .57$ for father report, and $\alpha = .51$ for youth report. The availability scale demonstrated adequate validity as W1 F-report of availability correlated with F-report of father-child relationship quality at W1 ($r = .14$, $p = .049$) and W2 ($r = .15$, $p = .049$); W1 Y-report of availability correlated with Y-report of father-child relationship quality at W1 *(*$r = .25$, $p < .001$) and W2 ($r = .14$, $p = .046$); and W2 F-report of

availability correlated with Y-report of father-child relationship quality at W2 ($r = .18$, $p = .01$) and F-report of father-child relationship quality at W1 ($r = .21$, $p = .003$) and W2 ($r = .26$, $p < .001$).

Father-child interactions is a five-item scale measuring the frequency of interactions between fathers and their children on a variety of activities in the past three months (e.g. "In the past three months, how often did you play a video game, board game, or any other indoor game (with your child) (with your dad/stepdad) at home?" or "How often did you go to entertainment, movies, or sporting events together?"). Responses were on a 5-point scale (1 = *Never*, 2 = *Rarely*, 3 = *Sometimes*, 4 = *Fairly Often*, 5 = *Very Often*). This scale was shortened and adapted from its longer original form used in the Families First study (Coltrane, Parke, & Adams, 2004). Wave 1 reliability was $\alpha = .57$ for father report, and $\alpha = .68$ for youth report. Wave 2 reliability was $\alpha = .66$ for father report, and $\alpha = .71$ for youth report. The father-child interactions scale (FCI) demonstrated adequate validity as W1 F-report of FCI correlated with F-report of father-child relationship quality at W1 ($r = .27$, $p < .001$) and W2 ($r = .17$, $p = .02$); W1 Y-report of FCI correlated with W1 Y-report of father-child relationship quality ($r = .31$, $p < .001$); W2 F-report of FCI correlated with W2 F-report of father-child relationship quality ($r = .26$, $p < .001$); and W2 Y-report of FCI correlated with Y-report of father-child relationship quality at W1 ($r = .27$, $p < .001$) and W2 ($r = .33$, $p < .001$), and W2 F-report of father-child relationship-quality ($r = .21$, $p = .003$).

Behavioral evidence was originally a twenty-two item scale at wave 1 that measured specific acts the father does with the child that provides "behavioral evidence" of the father's involvement. However this scale was cut to ten items in wave 2. Therefore,

the current study only examined the consistent ten items across waves 1 and 2. Adequate reliability of the ten items at wave 1 supported this decision (α = .81); reliability for wave 2 was α = .70. Responses were on a 5-point scale (1 = *Very Often*, 2 = *Often*, 3 = *Sometimes*, 4 = *Not Very Often or Seldom*, 5 = *Never*). Items will be reverse coded so that higher values reflect higher levels of behavioral evidence. These items were developed by the PAYS research team. The behavioral evidence measure demonstrated adequate validity as W1 Y-report of behavioral evidence correlated with Y-report of father-child relationship quality at W1 ($r = .56, p < .001$) and W2 ($r = .35, p < .001$) and F-report of father-child relationship quality at W1 ($r = .15, p = .029$); W2 Y-report of behavioral evidence correlated with Y-report of father-child relationship quality at W1 ($r = .51, p < .001$) and W2 ($r = .65, p < .001$), and F-report of father-child relationship quality at W1 ($r = .20, p = .004$) and W2 ($r = .32, p < .001$).

Mattering (Y-report, Wave 3). Adolescents completed a seven-item scale assessing how much they mattered to their father or stepfather (e.g. "I believe I really matter to my dad," and "I am one of the most important things in the world to my dad"). This scale was adapted from Rosenberg & McCullough's (1981) review of correlates of mattering to parents, and was previous used with this sample (Schenck et al., 2009). Items were rated on a 5-point scale (where 1 = *Strongly Agree*, 3 = *Unsure*, and 5 = *Strongly Disagree*). Some items were reverse scored so that higher scores reflect higher levels of perceived mattering. Items were summed to create an overall mattering score. Reliability was acceptable at wave 3 (α = .92).

Cortisol reactivity (Y, Wave 4). Youth provided cortisol samples between 6:00 pm and 10:00 pm at four time points pre- and post- engaging in a modified Trier Social

Stress Task (Kirschbaum, Pirke, & Helhammer, 1993). The stress task included 3-minutes of mental arithmetic (Cacioppo et al., 1995), followed by a 4-minute interpersonal speech task discussing their personal strengths and weaknesses (van Eck, Nicolson, Berkhof, & Sulon, 1996). Saliva samples were collected at four points: immediately before the task, immediately after the task, 20-minutes post-task, and 40-minutes post-task. Youth were instructed to refrain from exercising, consumption of food, alcohol, and caffeine two hours prior to the task. Their compliance with instructions was recorded for use as a potential covariate.

Cortisol reactivity was operationalized in two forms: 1) area under the curve ground (AUC_g) which is a measure of total hormonal output (Fekedulegn et al., 2007) and, 2) reactivity in which baseline cortisol was subtracted from the peak cortisol (the highest value between either the immediate post-task or 20-minute post-task sample).

Data Analysis

Preliminary Analyses

Descriptive statistics of each variable included frequencies, distributions, skewness, kurtosis, means, standard deviations, and ranges. Zero-order correlations were computed between F- and Y-reports of the father involvement subscales to determine which reporters and scales were most sensible to combine in order to create a single father involvement measure. As an a priori decision, measures with $r \geq .40$ would be summed so that higher scores indicate higher father involvement; measures that correlated with $r < .40$ would be be assessed separately. Zero-order correlations were computed between the primary study variables. Analyses of attrition evaluated whether

the $N = 173$ youth at wave 4 significantly differed on any variables of concern from the full $N = 218$ sample at wave 1.

Potential covariates with cortisol reactivity included youth waist circumference, BMI waist-to-hip ratio, time of day, income, ethnicity, youth gender, and youth age. Zero-order correlations were computed with these variables and cortisol reactivity, and if any were significantly correlated, they were controlled for in the analysis where cortisol was an outcome. Similarly, zero-order correlations were computed between income, ethnicity, youth gender, and youth age and mattering, and if any were significantly correlated, they were controlled for in the analysis where mattering was an outcome.

Primary Analyses

Primary analyses tested a mediation model in which father involvement in childhood was hypothesized to predict child mattering in adolescence, which was hypothesized to predict cortisol reactivity in young adulthood. Mediation effects require a significant association between father involvement (IV) and child mattering (M, the proposed mediator), and an association between child mattering (M) and youth cortisol AUCg and reactivity (DV), after adjusting for the effects of father involvement (IV). First, it is hypothesized that lower father involvement will be associated with youth showing higher overall cortisol output (AUC_g) and lower values of reactivity to the stress task. Second, it is hypothesized that the relation between father involvement and cortisol will be explained to the extent that children feel like they matter to their father.

The following steps were assessed for the mediation analysis. First, regression analyses were conducted to test whether father involvement in early adolescence

predicted cortisol reactivity in young adulthood (regression coefficient *c*). Second, regression analyses were conducted to test whether father involvement in early adolescence predicted adolescent feelings of mattering (regression coefficient *a*). Third, a linear regression model was conducted to test whether adolescent feelings of mattering predicted cortisol reactivity in young adulthood controlling for father involvement (regression coefficient *b*). The mediated effect would be the product of *a* and *b* coefficients, *ab*, and would represent the amount by which a 1 unit change in father involvement impacted youth cortisol reactivity indirectly through mattering.

Exploratory Analyses

Whether or not the paths between father involvement, mattering, and cortisol reactivity are significant may differ depending on youth gender or family ethnicity (MA or EA). Exploratory analyses were conducted to examine whether the three paths in the mediation model differed across these subgroups using two methods. First, interaction terms for gender and ethnicity were included in the separate regression models to assess whether males and females or EA and MA participants significantly differed from each other in any of the mediation pathways. Second, mediation analyses were separately conducted on boys and girls and MA families and EA families to assess whether the paths were significant for some subgroups and not others.

Results

Preliminary Analysis

Descriptive Statistics

Table 1 presents descriptive statistics for the primary study variables including means, standard deviations, ranges, and skewness and kurtosis. Table 2 presents correlations among the primary study variables.

Combining Father Involvement Reports

Father and child reports of availability, father-child interactions, and behavioral evidence at both wave 1 and wave 2 were each converted to z-scores. Table 3 presents zero-order correlations between father and child reports of availability, father-child interactions, and behavioral evidence at both waves.

Because few correlations reached the a priori criteria of $r \geq .4$, the data did not support combining reports. Correlation results indicated good agreement within reporters, however, which merited combining child report scales across both waves and father report scales across both waves. After combining within reporters, father report of father involvement significantly correlated with child report of father involvement ($r = .34$, $p < .001$). Child report of father involvement significantly correlated with mattering ($r = .17$, $p = .02$).

Attrition

T-tests were used to analyze whether those who dropped out by wave 4 differed on wave 1 income, age, or levels of father involvement or on wave 3 mattering compared to those who were retained in the study. Chi-square tests were used to analyze whether those who dropped out differed by ethnicity or youth gender compared to those retained. Families with lower gross household income were more likely to attrit compared to those with higher gross household income ($t(201) = -2.36$, $p = .02$, attriter $M = \$49,486$, $SD = \$31,653$ versus non-attriter $M = \$70,056$, $SD = \$47,126$). Families with male youth were

more likely to drop out than families with female youth ($X^2 = 4.97, p < .05$). Family ethnicity ($X^2 = 2.97, p = .09$), father report of father involvement ($t(175) = -.48, p = .63$), and child report of father involvement ($t(187) = -1.18, p = .24$), youth age ($t(201) = 1.34, p = .18$), and mattering ($t(187) = -.90, p = .37$) did not significantly relate to attrition. Therefore, gross household income and youth gender were included in all regression models as covariates.

Cortisol

Wave 4 had a total of n = 173 youth participate in the study. From the Phoenix location, 11 youth did phone interviews while 1 youth refused to do the task. From the Riverside location, 24 youth either did phone interviews or refused the task. Therefore, 137 youth completed the cortisol task. Cortisol values from 12 youth were excluded from the current analyses and set as missing due to reasons listed below. Two youth had cortisol values greater than 3 standard deviations above the mean of the data; their cortisol data were excluded from analyses. Five were set as missing due to stimulant, steroid, or thyroid medications known to affect cortisol. Additionally, five youth did not complete both stress tasks and were set as missing in the current analyses. The final dataset included 125 youth with cortisol data.

Among the 125 youth with cortisol data, 83 youth completed the task outside the time window of 6:00pm to 10:00pm. Two youth completed the task earlier in the day (9:30am and 11:23am), 13 youth completed the task between 1:00pm and 4:00pm, and 68 youth completed the task between 4:00pm and 6:00pm. The remaining 42 youth completed the cortisol task in the specified 6:00pm to 10:00pm window. Due to the

variability in the time when cortisol was sampled, time of day will be included as a covariate in all regression models with cortisol as an outcome.

The modified TSST did elicit a spike in cortisol for almost half the sample immediately after the task. For 44.8% of youth, their cortisol reactivity score was negative (peak cortisol value exceeded their baseline value) suggesting that the task potentially elicited a stress response for these youth.

Covariates

Table 4 presents correlations between potentially relevant covariates to AUCg and cortisol reactivity which included: youth waist circumference, use of birth control, youth BMI, youth waist-to-hip ratio, time of day, gross household income, family ethnicity, youth gender, and youth age. Time of day was the only variable that significantly correlated with AUCg ($r = -.34, p < .001$). None of the variables significantly correlated with cortisol reactivity. Thus, time of day was included as a covariate in models where cortisol was an outcome.

Table 5 includes correlations between potentially relevant covariates (including gross household income and youth age) and mattering and father involvement. Gross household income ($r = .18, p = .04$) significantly correlated with mattering. None of the covariates had statistically significantly correlations with father involvement. ANOVA was also conducted to test whether mattering differed based on youth gender or ethnicity. Youth gender differences in reports of mattering were marginally significant ($F = 5.39, p = .06, d = -.27$) (male $M = 4.53$, male $SD = .54$, female $M = 4.68$, female $SD = .50$). Differences in reports of mattering between MA and EA youth were statistically significant ($F = 6.60, p = .01, d = .37$) such that EA youth reported higher rates of

mattering ($M = 4.70$, $SD = .41$) than MA youth ($M = 4.50$, $SD = .61$). Thus, ethnicity and income were included as a covariates in the models where mattering was an outcome.

Primary Analyses

Path C: Waves 1 and 2 Father Involvement Predicting Wave 4 Cortisol AUCg & Reactivity

First, regression analyses were used to predict AUCg separately from child and father reports of father involvement controlling for time of day, youth gender, and income. Also, regression analyses were used to predict cortisol reactivity separately from child and father reports of father involvement controlling for time of day, youth gender, and income. Results are presented in Table 6 for AUCg, and Table 7 for reactivity. Neither father-reported nor child-reported father involvement predicted cortisol AUCg or reactivity.

Path A: Waves 1 & 2 Father Involvement Predicting Wave 3 Mattering

In order to test the proposed mediation model, regression analyses were used to predict mattering separately from child and father reports of father involvement controlling for income, ethnicity, and youth gender. Child report of father involvement significantly predicted mattering ($b = .02$, $t = 2.19$, $p = .03$), but father report did not ($b = -.01$, $t = -.45$, $p = .65$). Path *a* results are presented in Table 8.

Path B: Wave 3 Mattering Predicting Wave 4 AUCg & Cortisol Reactivity

Regression analyses were conducted to predict AUCg or reactivity from mattering controlling for time of day, youth gender, income, and W1-W2 father involvement. In all models, mattering was not a statistically significant predictor of AUCg or cortisol

reactivity (see Tables 9 & 10). However, there was a main effect of father report of father involvement on AUCg (b = -12.04, t = -2.02, p = .046) such that higher levels of father involvement predicted lower AUCg. Father report of father involvement alone predicted 1.2% of variance in AUCg (based on adjusted R^2 value of .012). With the addition of mattering to the model, both father report of father involvement and mattering predicted 2.4% of variance in AUCg (based on adjusted R^2 value of .024); both values are considered small effect sizes (Cohen, 1992).

Exploratory Analysis

Path A: Youth Gender as a Moderator of the Relation between Father Involvement and Mattering

Regression analyses were conducted to predict mattering from the interaction of father involvement and youth gender controlling for income, ethnicity, and father involvement. Results are presented in Table 11. The interaction between father involvement and youth gender was not statistically significant in the prediction of mattering.

Next, the models were analyzed separately for boys and girls, controlling for income and ethnicity. For boys, neither father report of father involvement (b = -.01, t = -.62, p = .54) nor child report of father involvement (b = .01, t = .93, p = .36) were statistically significant predictors of mattering. For girls, father report of father involvement was not a statistically significant predictor of mattering (b = .00, t = .09, p = .93), however child report of father involvement was statistically significant as higher

reported father involvement for girls predicted higher mattering (b = .04, t = 2.21, p = .01).

Path B: Youth Gender as a Moderator of the Relation between Mattering and Cortisol

Regression analyses were conducted to separately predict AUCg and cortisol reactivity from the interaction between mattering and gender controlling for father involvement, income, youth gender, and time of day. Results are presented in Tables 12 and 13. The interaction between mattering and youth gender was not statistically significant in the prediction of AUCg or cortisol reactivity.

Next, the models were analyzed separated for boys and girls, controlling for income and time of day. For boys, mattering was not a statistically significant predictor of AUCg (b = 14.14, t = .32, p = .75) or cortisol reactivity (b = -.14, t = -.22, p = .83). For girls, mattering was not a statistically significant predictor of AUCg (b = 9.44, t = .20, p = .84) or cortisol reactivity (b = -.20, t = -.40, p = .69).

Path A: Ethnicity as a Moderator of Father Involvement Predicting Mattering

Regression analyses were conducted to predict mattering from the interaction of father involvement and ethnicity controlling for income and gender. Results are presented in Table 14. The interaction between father involvement and ethnicity was not statistically significant in the prediction of mattering.

Next, the models were analyzed separated for MA and EA participants, controlling for income and gender. For EA youth, father report of father involvement was not a statistically significant predictor of mattering (b = .01, t = .51, p = .62). However, child report of father involvement did significantly predict mattering (b = .03, t = 3.13, p < .05). For MA youth, neither father report (b = -.03, t = -.90, p = .37) nor child report (b

= .01, t = 1.52, p = .13) of father involvement was a statistically significant predictor of mattering.

Path B: Ethnicity as a Moderator of Mattering Predicting Cortisol

Regression analyses were conducted to separately predict AUCg and cortisol reactivity from the interaction between mattering and ethnicity controlling for father involvement, time of day, youth gender, and income. Results are presented in Tables 15 and 16. The interaction between mattering and ethnicity was not statistically significant in the prediction of AUCg or cortisol reactivity.

Next, the models were analyzed separated for MA and EA, controlling for time of day, income, and gender. For EA youth, mattering was not a statistically significant predictor of AUCg (b = -25.85, t = -.57, p = .57) or cortisol reactivity (b = .04, t = .07, p = .95). For MA youth, mattering was not a statistically significant predictor of AUCg (b = 24.86, t = .57, p = .57) or cortisol reactivity (b = -.01, t = -.02, p = .99).

Discussion

The current study investigated whether father involvement when youth were 12-14 years old predicted youth perceptions of mattering to their father at ages 15-16, and whether mattering to their father predicted youth cortisol patterns in young adulthood at age 19. Father involvement was operationalized to include three constructs outlined by Lamb (1975), which include availability, or the amount of time fathers are physically present around their child, interaction, or the how much fathers and children engage in different activities, and behavioral evidence, or material and emotional support provided by the father as evidence of involvement. Higher father involvement in adolescence was

hypothesized to predict youth feeling like they mattered more to their fathers, which was expected to predict greater (or adaptive) cortisol reactivity and lower cortisol output (AUCg) when youth participated in a stress task as young adults. Results revealed that higher father-reported father involvement predicted lower cortisol AUCg in youth when mattering was included in the model, although father involvement was not a statistically significant predictor of AUCg or cortisol reactivity when mattering was not included. Additionally, children who reported higher father involvement also reported higher feelings of mattering, but this association was only statistically significant for girls and EA youth. Youth feelings of mattering did not predict their cortisol reactivity or AUCg in young adulthood.

Father Involvement and Cortisol

Having an involved father in adolescence may influence youth's HPA functioning in young adulthood. W1-W2 father involvement alone predicted 1.2% of the variance in AUCg, and W1-W2 father-report of father involvement and W3 mattering together predicted 2.4% of the variance in AUCg; both effect sizes would be considered a small according to Cohen's (1992) criteria. However, when mattering was included in the model, father involvement was a statistically significant predictor of AUCg such that higher father involvement was associated with lower cortisol AUCg output to the task, a potentially adaptive response compared to youth reporting lower father involvement. Attachment theory posits that secure attachments with caregivers provide youth with positive "internal working models" of their self in relation to others, which promote positive social and emotional development (Pleck, 2007). Having an involved father may

indicate or promote a secure father-child attachment relationship, leading to better socioemotional functioning in youth, and influencing long-term HPA development. Gunnar, Doom, & Esposito (2015)-demonstrated that secure attachment to caregivers prevents elevations in cortisol in distressing situations for infants, whereas children with insecure attachments tend to react with increased levels of cortisol to threatening situations (Luthar, Crossman, & Small, 2015). Having secure attachment to caregivers may shape the lens by which youth appraise others as sources of support and their ability to cope with threatening situations, which may be enhanced by involved fathering. Pendry & Adam (2007) suggest that high quality parenting in the context of stress acts as a coping resource that may enhance children's emotional security or increase youth's ability to positively appraise stressful situations and their ability to cope with them. Father involvement may serve as a coping resource and source of support in the face of stress by enhancing youth emotional security and providing added instrumental and emotional support.

The relation between father involvement and cortisol only reached statistical significance when mattering was in the model, which suggests that mattering may be functioning as a suppressor variable. A suppressor variable is one that "increases the predictive validity of another variable by its inclusion in a regression equation" (MacKinnon, Krull, & Lockwood, 2000). Mattering may be enhancing the predictive validity of father involvement on cortisol by removing irrelevant variance unrelated to AUCg. Father involvement may have a stronger relation to AUCg at different levels of mattering so that when mattering is held constant, father involvement is more predictive of AUCg. The mattering variable was negatively skewed such that the majority (76%) of

youth reported mattering scores of 4.5 or above out of a maximum score of 5. Post-hoc analyses were conducted evaluating the relation of father involvement to AUCg among participants in the lowest quartile of mattering scores in which 24% of the youth in the sample reported a mattering score less than 4.5 out of 5. For youth in the lowest quartile, father involvement was not significantly associated with AUCg (b = -8.58, p = .614); for youth in the higher quartile, father involvement had a near significant negative association with AUCg (b = -13.96, p = .08). The relation between father involvement and AUCg seems to be primarily evident among youth who feel like they are a priority to their fathers. That is, for youth who feel like they highly matter to their fathers, more involved fathering may be associated with lower cortisol AUCg in response to a stressor relative to youth with less involved fathers. In contrast, for youth who feel like they matter less to their fathers, father involvement does not appear to influence youth cortisol.

When mattering was not controlled in the model, neither father nor child reports of father involvement were statistically significant predictors of cortisol AUCg or reactivity. There are a few possible explanations for the lack of a statistically significant effect. First, father involvement alone may not exert a strong enough influence on youth cortisol in young adulthood. Rather, the presence of negative or harsh fathering behaviors may be more predictive of long-term youth cortisol outcomes. Previous studies have found that negative fathering behaviors, such as control, rejection, and coercion are associated with elevated biological stress responses (Roubinov & Luecken, 2010; Byrd-Craven et al., 2012). Mills-Koonce et al. 2011 found statistically significant effects of father negativity on cortisol reactivity (peak cortisol values following a stress task) but

did not find independent effects of father caregiving behaviors (e.g. sensitivity) on this same outcome. A review of the resilience literature by Luthar, Crossman, & Small (2015) suggests that "bad is stronger than good" as the presence of negative parenting such as criticism, disparaging words, and maltreatment may have greater impact on youth adjustment than the presence of involved, positive parenting behavior.

Second, it may be important to consider youth's relationships to their mothers in conjunction with their relationship to their fathers when examining youth cortisol. Evidence suggests an association between maternal emotional unavailability and elevated adrenocortisol responses in youth (Sturge-Apple et al., 2012), and lower mother involvement and warmth was associated with flatter diurnal cortisol slopes in childhood and adolescence (Pendry & Adam, 2007). Mother involvement may be an important influence on youth ability to adaptively cope and respond to stress. In compensatory models, if the child has an uninvolved father but a warm and involved mother, the effects of low father involvement may be compensated for by a strong relationship to their mother. The opposite may also be true: if a child has an involved father but an uninvolved mother, the effects of the uninvolved mother may trump the effects of an involved father on youth cortisol.

Third, marital conflict may confound the relation between father involvement and cortisol. Even in the context of involved parents, conflict over disciplinary practices may have negative effects on child adjustment (Luthar, Crossman, & Small, 2015). Marital conflict has been associated with reduced father involvement (Christensen & Heavey, 1990) and elevated diurnal cortisol patterns (Pendry & Adam, 2007). Pendry & Adam (2007) conclude that maternal behaviors have an effect on youth cortisol outcomes due to

impaired emotional functioning in the home as a result of higher anxiety and depression in the context of poor marital functioning. Also, the father vulnerability hypothesis posits that marital conflict has greater spillover effects on fathers' relationships with their children on than on the mothers' relationships with their children (Cummings et al., 2004). Therefore, marital conflict may be an important variable to consider in the association between father involvement and youth cortisol.

Father Involvement & Mattering

Although father report of father involvement did not predict youth feelings of mattering, youth report of father involvement did predict mattering. Youth report of parenting behaviors may be a better predictor of how much youth perceive they matter to their parents. In this case, youth feelings of mattering depended more on their *own* perceptions of father involvement than on their fathers' perceptions of involvement. Alternatively, the statistically significant relation between father involvement and mattering could be due to shared method or reporter biases since both were self-reported by the child.

Exploratory analyses found that the association between youth report of father involvement and mattering was only statistically significant for girls. Previous studies on fathering have found statistically significant effects between fathering behaviors and outcomes in girls but not boys. For example, the link between paternal acceptance and lower depressive symptoms is stronger for girls than boys (Garcia, Manongdo, & Ozechowski, 2014); father support is linked to lower rates of depression among Latina girls but not boys (Behnke et al. 2011); and lack of father involvement increases the risk

of early sexual promiscuity among girls but not boys (DelPriore & Hill, 2013). In the current study, father involvement seems to carry more weight for girls' feelings of mattering than it does for boys. The current study's operationalization of father involvement (e.g. time, shared activities, and support) may be more salient for girls to feel like they matter than it is for boys. Girls are prone to place more emphasis on harmonious interpersonal relationships (Helgeson, 1994), and so may feel like they matter less to a father who engages in fewer activities with them or provides less behavioral evidence of involvement. For boys, other fathering behaviors, not measured in the current study, may be more strongly linked to feelings of mattering. An alternative explanation may be that only certain components of father involvement may be most salient for boys to feel like they matter. For example, Stevenson et al. (2013) found that the same father-child interaction variable at waves 1 and 2 also from the PAYS dataset was associated with mattering for boys at wave 3, but not for girls. Adding availability and behavioral evidence to the father involvement composite measure in the current study made father involvement more salient for girls to feel like they matter and not for boys. Boys may be more receptive to fathers' engagement in shared activities in order to feel like a priority to their fathers, while girls may feel like a priority when their fathers are spending time around them and providing emotional and material support in addition to engaging in shared activities.

The association between youth reported father involvement and mattering was also only statistically significant for EA youth. The manner in which the current study measured father involvement may not be culturally salient for MA youth to feel like they matter. Father involvement was measured as a function of available time, father-child

interactions, and behavioral evidence of involvement. MA youth may still perceive that they matter to their fathers even if their father is "less involved" based on this study's operationalization. In MA culture, mothers are often cast as caregivers and fathers as providers (Dreby, 2006). If fathers are more absent in quantity of hours or less engaged in shared activities, MA youth might still feel like a priority because their father is providing for the family.

Mattering and Cortisol

Mattering in adolescence was not a statistically significant predictor of cortisol AUCg or reactivity in young adulthood. Rosenberg & McCullough (1981) explain that mattering entails feeling like one has the attention of another and is important in their eyes. Rosenberg & McCullough (1981) found that mattering was associated with greater self-esteem in youth. This study predicted that mattering could be protective from HPA dysregulation because mattering may be a proxy for self-esteem or self-worth. Self-esteem is related to physiological reactivity: lower self-esteem predicts elevated cortisol reactivity (Liu et al., 2014), and higher self-esteem predicts better biological regulation (Pruessner et al., 1999). However, when contrasted with self-esteem, mattering is conceptualized as feeling like a priority *to others,* while self-esteem is one's global positive or negative attitude *toward oneself* (Rosenberg & McCullough, 1981), and so the two can be independent. Adolescents may feel like they matter to their parents but still have a poor self-concept, possibly due to other reasons not evaluated in the current study. For example, poor peer relationships or academic inadequacies, which are salient issues in adolescence, may lead to youth poor self-esteem even in the context of youth feeling

like they matter to their parents. Youth's poor self-esteem due to other, possibly more salient factors may have a greater impact on their cortisol reactivity later in life.

Mattering was hypothesized to predict better HPA regulation because youth who feel like they matter are likely to feel like their parents are a resource and protection in times of stress. However, parents may serve as a source of stress for youth who feel like they matter rather than a resource. Youth may feel like a priority to controlling parents who have high, demanding expectations for their children, which can lead children to feel inadequate. Youth may also feel like a priority to parents who are overly harsh and critical precisely because those parents care about their child (Rosenberg & McCullough, 1981). Mattering can be independent of parental approval (Rosenberg & McCullough, 1981) or parental warmth (Schenck et al., 2009). Therefore, mattering alone may not be a strong enough influence on youth HPA regulation without considering other factors such as parental harshness and criticism.

Youth mattering to mothers is important to assess alongside youth mattering to fathers. Regardless of how youth feel they matter to their fathers, youth feelings of mattering to mothers may carry greater weight on youth cortisol regulation. A review by Luthar, Barkin, & Crossman (2013) suggests that mothers are disproportionately the primary caregiver and the quality of mother-child relationships has greater ramifications for child adjustment. For example, attachment to mothers as opposed to fathers explained much more variance across various teen adjustment outcomes (Luthar & Barkin, 2012; Luthar & Becker, 2002). Not examining youth feelings of mattering to mothers may exclude an important predictor of variance in youth cortisol.

Other mechanisms besides mattering may better explain the pathway between father involvement in adolescence and cortisol in young adulthood. For example, father involvement may impact the development of other psychological and behavioral processes in youth that could be more predictive of youth's ability to physically regulate to stress. For example, having a more involved father is associated with better coping strategies and less risky behaviors such as substance abuse (National Fatherhood Initiative), which may lead to more adaptive HPA regulation. Previous research has also found a link between father-child relationship quality and cortisol (Byrd-Craven et al., 2012). Father involvement may be indicative of better father-child relationship quality or the presence of warmth and support, and these may be more predictive of long-term cortisol reactivity than youth feeling like they matter.

Limitations

Although the current study uses longitudinal methods within a developmental framework, several methodological limitations should be noted. The first consideration is the creation of the composite variable for father involvement. Although Lamb (1975) outlined three important constructs that make up father involvement – availability, interaction, and responsibility (in this case behavioral evidence) – these constructs did not fully correlate with one another, or correlate very highly within reporters in this study. Availability correlated the least with the other two constructs, perhaps due to the poor reliability of the availability measure (α = .50-.58), or because this measure had a different prompt than the other two. For example, the availability items asked youth and fathers to recall the number of hours their father is present on a typical weekend or

weekday, and it may be difficult for reporters to determine an exact number of hours of the fathers' physical presence. The ambiguity in the availability measure contrasts to the more concrete measures of the frequencies of interactions and behavioral evidence of overt father behaviors, which were both measured using the same response scales.

Also conceptually, father availability (or being physically present around the child) may be a separate construct from the frequency of father-child interactions and behavioral evidence (doing overt involvement behaviors). For example, a father can be physically present around their child for many hours in the week without being involved in activities or doing things with them, e.g. watching TV in the next room or occupied with other things. Future analyses should use more sophisticated statistical techniques to create a father involvement measure, e.g. confirmatory factor analysis to better capture the essence of father involvement and measurement invariance analysis to see if the measure holds well across different ethnic groups.

Additionally, the mattering variable was highly negatively skewed and demonstrated little variability, e.g. 87% of youth reported mattering scores of 4 or above on the 5 point mattering scale. The lack of variability in the mattering measure may help explain why mattering was not a strong predictor of cortisol. Also, although the longitudinal design of this study is a methodological strength, temporal erosion may explain why the study failed to find statistically significant main effects of father involvement and mattering in adolescence and cortisol in young adulthood. Other developmental experiences that may have occurred between adolescence and young adulthood may account for more variance on youth HPA regulation than father involvement and mattering, e.g. substance use, presence of mental health disorders,

experiences of trauma. Also, the sample size of the current study, especially with limited number of cortisol samples (n = 125), may have limited statistical power to find statistically significant effects. Missing data techniques would assist in increasing statistical power of the study and avoid losing data due to listwise deletion. Finally, the current study only focused on intact, two-parent families, the developmental period of adolescence to young adulthood, and middle to upper class families. The results may not be generalized to single parent, divorced, or stepfamilies, infancy or early childhood, and lower income populations.

Conclusions

Existing data suggest a link between fathering and youth physiological stress regulation (Davies et al., 2007; Afifi et al., 2011; Luecken, Kraft, & Hagan 2009); however, few studies have examined these effects longitudinally using a developmental framework or explored potential mechanisms explaining this link. Contrary to expectations, the current study suggests that mattering to one's father is not a mechanism by which father involvement in adolescence affects cortisol in young adulthood. However, higher levels of father involvement predicted higher levels of youth mattering, and higher levels father involvement predicted lower cortisol AUCg when mattering was included in the model.

The results support a biopsychosocial model in explaining how childhood family environments can influence physiological outcomes later in life. Specifically, the results suggest greater attention should be given to how fathers affect youth biological regulation. Future research would particularly benefit from more in-depth analysis of how

to conceptualize father involvement by creating a measure that is salient across genders and diverse cultures, as well as pay attention to how various fathering behaviors may influence male and female development differently. Overall, the current results suggest that fathers play a role in development of the HPA axis in youth. Prior research links HPA regulation to future physical and mental health; therefore, fathers require greater attention in the domain of families and health research.

References

Afifi, T. D., Granger, D. A., Denes, A., Joseph, A., & Aldeis, D. (2011). Parents' Communication Skills and Adolescents' Salivary α-Amylase and Cortisol Response Patterns. *Communication Monographs*, *78*(3), 273–295.

Ahnert, L., Gunnar, M. R., Lamb, M. E., & Barthel, M. (2004). Transition to child care: associations with infant-mother attachment, infant negative emotion, and cortisol elevations. *Child Development*, *75*(3), 639–50.

Alink, L. R. A., van Ijzendoorn, M. H., Bakermans-Kranenburg, M. J., Mesman, J., Juffer, F., & Koot, H. M. (2008). Cortisol and externalizing behavior in children and adolescents: mixed meta-analytic evidence for the inverse relation of basal cortisol and cortisol reactivity with externalizing behavior. *Developmental Psychobiology*, *50*(5), 427–50.

Behnke, A. O., Plunkett, S. W., Sands, T., & Bámaca-Colbert, M. Y. (2011). The relationship between latino adolescents' perceptions of discrimination, neighborhood risk, and parenting on self-esteem and depressive symptoms. *Journal of Cross-Cultural Psychology, 42*(7), 1179-1197.

Bernard, K., & Dozier, M. (2010). Examining infants' cortisol responses to laboratory tasks among children varying in attachment disorganization: stress reactivity or return to baseline? *Developmental Psychology*, *46*(6), 1771–8.

Bloch, M., Peleg, I., Koren, D., Aner, H., & Klein, E. (2007). Long-term effects of early parental loss due to divorce on the HPA axis. *Hormones and Behavior*, *51*(4), 516–23. doi:10.1016/j.yhbeh.2007.01.009

Boyce, W. T., Essex, M. J., Alkon, A., Goldsmith, H. H., Kraemer, H. C., & Kupfer, D. J. (2006). Early father involvement moderates biobehavioral susceptibility to mental health problems in middle childhood. *Journal of the American Academy of Child and Adolescent Psychiatry*, *45*(12), 1510–20.

Byrd-Craven, J., Auer, B. J., Granger, D. A., & Massey, A. R. (2012). The father-daughter dance: the relationship between father-daughter relationship quality and daughters' stress response. *Journal of Family Psychology, 26*(1), 87–94.

Christensen, A., & Heavey, C. L. (1990). Gender and social structure in the demand/withdraw pattern of marital conflict.*Journal of Personality and Social Psychology, 59*(1), 73-81.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159.

Coltrane, S., Parke, R., & Adams, M. (2004) Complexity of Father Involvement In Low Income Mexican American Families. *Family Relations, 53,* 179-189.

Cummings, E. M., Goeke-Morey, M., & Raymond, J. (2004). Fathers in family context: Effects of marital quality and marital conflict. In M. E. Lamb (Ed.), *The role of the father in child development* (4th ed., pp. 196–221). New York, NY: Wiley.

Davies, P. T., Sturge-Apple, M. L., Cicchetti, D., & Cummings, E. M. (2007). The role of child adrenocortical functioning in pathways between interparental conflict and child maladjustment. *Developmental Psychology*, *43*(4), 918–30.

DelPriore, D. J., & Hill, S. E. (2013). The effects of paternal disengagement on women's sexual decision making: An experimental approach. *Journal of Personality and Social Psychology, 105*(2), 234-246.

Dreby, J. (2006). Honor and virtue: Mexican parenting in the transnational context. *Gender & Society, 20*(1), 32-59.

Dube, S. R., Fairweather, D., Pearson, W. S., Felitti, V. J., Anda, R. F., & Croft, J. B. (2009). Cumulative childhood stress and autoimmune diseases in adults. *Psychosomatic Medicine*, *71*(2), 243–50.

Fekedulegn, D. B., Andrew, M. E., Burchfiel, C. M., Violanti, J. M., Hartley, T. A., Charles, L. E., & Miller, D. B. (2007). Area under the curve and other summary indicators of repeated waking cortisol measurements. *Psychosomatic Medicine*, *69*(7), 651–9.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Marks, J. S. (1998). Household Dysfunction to Many of the Leading Causes of Death in Adults The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, *14*(4), 245–258.

Flinn, M. V, & England, B. G. (1997). Social economics of childhood glucocorticoid stress response and health. *American Journal of Physical Anthropology*, *102*(1), 33–53.

Flouri, E., & Buchanan, A. (2004). Early father's and mother's involvement and child's later educational outcomes. *The British Journal of Educational Psychology*, *74*, 141–53.

García, J. I. R., Manongdo, J. A., & Ozechowski, T. J. (2014). Depression symptoms among mexican american youth: Paternal parenting in the context of maternal parenting, economic stress, and youth gender. *Cultural Diversity and Ethnic Minority Psychology, 20*(1), 27-36.

Gunnar, M. R., Doom, J. R. and Esposito, E. A. 2015. Psychoneuroendocrinology of Stress. Handbook of Child Psychology and Developmental Science. 3:4:1–46.

Gunnar, M., & Quevedo, K. (2007). The neurobiology of stress and development. *Annual Review of Psychology*, *58*, 145–73.

Hardie, T. L., Moss, H. B., Vanyukov, M. M., Yao, J. K., & Kirillovac, G. P. (2002). Does adverse family environment or sex matter in the salivary cortisol responses to anticipatory stress? *Psychiatry Research*, *112*(2), 121–31.

Harper, C. C., & McLanahan, S. S. (2004). Father Absence and Youth Incarceration. *Journal of Research on Adolescence*, *14*(3), 369–397.

Hartman, C. A., Hermanns, V. W., de Jong, P. J., & Ormel, J. (2013). Self- or parent report of (co-occurring) internalizing and externalizing problems, and basal or reactivity measures of HPA-axis functioning: a systematic evaluation of the internalizing-hyperresponsivity versus externalizing-hyporesponsivity HPA-axis hypo. *Biological Psychology*, *94*(1), 175–84.

Helgeson, V. S. (1994). Relation of agency and communion to well-being: Evidence and potential explanations. *Psychological Bulletin, 116,* 412– 428.

Klimes-Dougan, B., Hastings, P. D., Granger, D. a, Usher, B. a, & Zahn-Waxler, C. (2001). Adrenocortical activity in at-risk and normally developing adolescents: individual differences in salivary cortisol basal levels, diurnal variation, and responses to social challenges. *Development and Psychopathology*, *13*(3), 695–719.

Lamb, M. E. (1975). Fathers: Forgotten Contributors to Child Development. *Human Development*, *18*, 245–266.

Lamb, M.E., Pleck, J.H., & Levine, J.A. (1985). The role of the father in child development: The effects of increased paternal involvement. In B. Lahey & E. E. Kazdin (Eds.), *Advances in clinical child psychology*, Vol. 8 (pp. 229-266). New York: Plenum.

Liu, S. Y., Wrosch, C., Miller, G. E., & Pruessner, J. C. (2014). Self-esteem change and diurnal cortisol secretion in older adulthood. *Psychoneuroendocrinology, 41*, 111-120.

Luecken, L. J. (1998). Childhood Attachment and Loss Experiences Affect Adult Cardiovascular and Cortisol Function. *Psychosomatic Medicine*, *60*, 765–772.

Luecken, L. J. (2000). Parental caring and loss during childhood and adult cortisol responses to stress. *Psychology and Health*, *15*, 841–851.

Luecken, L. J., Kraft, A., & Hagan, M. J. (2009). Negative relationships in the family-of-origin predict attenuated cortisol in emerging adults. *Hormones and Behavior*, *55*(3), 412–7.

Luecken, L. J., & Lemery, K. S. (2004). Early caregiving and physiological stress responses. *Clinical Psychology Review*, *24*(2), 171–91.

Luthar, S. S., & Barkin, S. H. (2012). Are affluent youth truly "at risk"? vulnerability and resilience across three diverse samples. *Development and Psychopathology, 24*(2), 429-449.

Luthar, S. S., Barkin, S. H., & Crossman, E. J. (2013). "I can, therefore I must": Fragility in the upper-middle classes.*Development and Psychopathology, 25*(4), 1529-1549.

Luthar, S. S., & Becker, B. E. (2002). Privileged but pressured?: A study of affluent youth. *Child Development, 73*(5), 1593-1610.

Luthar, S. S., Crossman, E. J. and Small, P. J. 2015. Resilience and Adversity. Handbook of Child Psychology and Developmental Science. 3:7:1–40.

MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science, 1*(4), 173-181.

Miller, G. E., Chen, E., & Zhou, E. S. (2007). If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. *Psychological Bulletin*, *133*(1), 25–45.

Nord, Christine Winquist, and Jerry West. Fathers' and Mothers' Involvement in Their Children's Schools by Family Type and Resident Status. (NCES 2001-032). Washington, D.C.: U.S. Department of Education, National Center for Education Statistics, 2001.

Osborne, C., & Mclanahan, S. (2007). Partnership Instability and Child Well-Being. *Journal of Marriage and Family*, *69*(4), 1065–1083.

Parke, R. D. (2000). Father Involvement: A developmental psychological perspective. *Marriage and Family Review*, *29*(2), 37–41.

Parke, R. D. (2004). Fathers, Families, and the Future: A Plethora of Plausible Predictions. *Merill-Palmer Quarterly*, *50*(4), 456–470.

Pendry, P., & Adam, E. K. (2007). Associations between parents' marital functioning, maternal parenting quality, maternal emotion and child cortisol levels. *International Journal of Behavioral Development, 31*(3), 218-231.

Pleck, J. H. (2007). Why could father involvement benefit children? theoretical perspectives. *Applied Developmental Science,11*(4), 196-202.

Pruessner, J. C., Hellhammer, D. H., & Kirschbaum, C. (1999). Low self-esteem, induced failure and the adrenocortical stress response. *Personality and Individual Differences, 27*(3), 477-489.

Repetti, R. L., Robles, T. F., & Reynolds, B. (2011). Allostatic processes in the family. *Development and Psychopathology*, *23*(3), 921–38.

Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky Families : Family Social Environments and the Mental and Physical Health of Offspring, *128*(2), 330–366.

Roque, L., Veríssimo, M., Oliveira, T. F., & Oliveira, R. F. (2011). Attachment security and HPA axis reactivity to positive and challenging emotional situations in child-mother dyads in naturalistic settings. *Developmental Psychobiology*, *54*(4), 401–11.

Rosenberg, M., & McCullough, B. C. (1981). Mattering: Inferred significance and mental health among adolescents. *Research in Community & Mental Health, 2*, 163-182.

Roubinov, D. S., & Luecken, L. J. (2010). Father bonding and blood pressure in young adults from intact and divorced families. *Journal of Psychosomatic Research*, *69*(2), 161–8.

Schenck, C. E., Braver, S. L., Wolchik, S. a, Saenz, D., Cookston, J. T., & Fabricius, W. V. (2009). Relations between Mattering to Step- and Non-Residential Fathers and Adolescent Mental Health. *Fathering*, *7*(1), 70–90.

Seeman, T. E., & McEwen, B. S. (1996). Impact of social environment characteristics on neuroendocrine regulation. *Psychosomatic Medicine*, *58*(5), 459–71.

Stevenson, M. M., Fabricius, W. V., Cookston, J. T., Parke, R. D., Coltrane, S., Braver, S. L., & Saenz, D. S. (2014). Marital problems, maternal gatekeeping attitudes, and father–child relationships in adolescence. *Developmental Psychology, 50*(4), 1208-1218.

Sturge-Apple, M., Davies, P. T., Cicchetti, D., & Manning, L. G. (2012). Interparental violence, maternal emotional unavailability and children's cortisol functioning in family contexts. *Developmental Psychology, 48*(1), 237-249.

Teachman, J. D. (2004). The Childhood Living Arrangements of Children and the Characteristics of Their Marriages. *Journal of Family Issues*, *25*(1), 86–111.

Tyrka, A. R., Price, L. H., Marsit, C., Walters, O. C., & Carpenter, L. L. (2012). Childhood adversity and epigenetic modulation of the leukocyte glucocorticoid receptor: preliminary findings in healthy adults. *PloS One*, *7*(1), e30148.

Yogman, M. W, Kindlon, D., Earls, F. (1995). Father involvement and cognitive development, Yogman et al 1995.pdf. *American Academy of Child and Adolescent Psychiatry*, *34*(1), 58–66.

APPENDIX A

FATHER INVOLVEMENT AND MATTERING

Father Availability
Father Report:
1. On an average WEEKEND DAY, when both of you are awake, how many hours are you at home with (child)?
2. On an average DAY DURING THE WEEK, when both of you are awake, how many hours are you at home with (child)?

Child Report:
1. On an average WEEKEND DAY, when both of you are awake, how many hours are you at home with your (dad)?
2. On an average DAY DURING THE WEEK, when both of you are awake, how many hours are you at home with your (dad)?

Father-Youth Interactions
Father Report:
In the past three months…
1. How often did you play a video game, board game, or any other indoor game with (child) at home?
2. How often did you go shopping together?
3. How often did you play a sport or participate in an outdoor activity together?
4. How often did you bake or cook a meal together?
5. How often did you go to entertainment, movies, or sporting events together?

Child Report:
In the past three months…
1. How often did you play a videogame, board game, or any other indoor game with your (dad) at home?
2. How often did you go shopping together?
3. How often did you play a sport or participate in an outdoor activity together?
4. How often did you bake or cook a meal together?
5. How often did you go to entertainment, movies, or sporting events together?

Behavioral Evidence
Child Report Only:
1. How often does he hug you, pat you on the back, or show other signs of physical affection?
2. How often does he give you money and/or other things?
3. How often does he stop what he is doing if you need his attention?
4. How often does he yell or scream at you?
5. How often does he listen and talk with you?
6. How often does he make fun of you in a way that makes you feel bad?
7. How often does he take an interest in your activities?
8. How often does he take your side?
9. How often does he take an interest in your friends, or include them in activities?

10. How often does he teach you right from wrong or to be respectful?

Child Report
1. My (dad) really cares about me.
2. I believe I really matter to my (dad).
3. I think my (dad) cares about other people more than me.
4. I sometimes wonder if my (dad) wants me around.
5. I'm not that important to my (dad).
6. I'm not that important to my (dad).
7. I know my (dad) loves me.
8. I am one of the most important things in the world to my (dad).

APPENDIX B

TABLES

Table 1. Descriptive statistics of primary study variables.

	N	Mean	SD	Skewness	Kurtosis	Range
Father Report						
W1 Father Availability	208	43.49	20.99	1.98	6.84	2.00 – 148.00
W1 PC Interactions	218	14.58	3.38	.19	.12	5.00 - 24.00
W2 Father Availability	189	37.61	15.36	1.03	2.98	8.00 - 114.00
W2 PC Interactions	194	13.76	3.30	.38	.35	5.00 – 25.00
W1 & W2 Father Involvement	178	.07	2.58	.09	-.19	-6.81 - 6.58
Child Report						
W1 Father Availability	209	47.27	20.47	1.51	6.25	2.00 – 160.00
W1 PC Interactions	218	14.14	3.90	-.02	-.28	5.00 – 24.00
W1 Behavioral Evidence	218	3.95	.55	-.65	.51	2.10 – 5.00
W2 Father Availability	199	45.66	24.28	2.12	6.45	6.00 – 168.00
W2 PC Interactions	201	13.58	3.83	-.11	-.41	5.00 – 24.00
W2 Behavioral Evidence	204	3.89	.58	-.82	1.55	1.70 – 5.00
W1 & W2 Father Involvement	189	-.26	3.63	-.25	.15	-11.57 - 7.49
W3 Mattering	194	4.61	.52	-2.03	4.64	2.00 - 5.00
W4 Cortisol Reactivity	125	-.13	2.00	-1.20	4.51	-8.78 - 6.56
W4 AUCg	125	276.01	160.15	1.01	.83	38.90 - 821.16

Table 2. Pearson product correlation coefficients between primary study variables.

	1	2	3	4	5
1. W1 & W2 Father Involvement Father Report	1				
2. W1 & W2 Father Involvement Child Report	.341**	1			
3. Mattering	-.071	.174*	1		
4. Cort_Reactivity	.043	-.016	-.070	1	
5. AUCg	-.120	.142	.126	-.216*	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 3. Pearson product correlation coefficients between father and child reports of father availability, parent-child interactions, and behavioral evidence across waves 1 and 2.

	1	2	3	4	5	6	7	8	9	10
1. Father report of father availability (W1)	1									
2. Child report of father availability (W1)	-.031	1								
3. Father report of parent-child interactions (W1)	.111	.048	1							
4. Child report of parent-child interactions (W1)	-.022	.265**	.268**	1						
5. Child report behavioral evidence (W1)	.010	.148*	.126	.456**	1					
6. Father report availability (W2)	.219**	.096	.151*	.054	.120	1				
7. Father report of parent-child interactions (W2)	.136	-.044	.626**	.230**	.038	.114	1			
8. Child report of father availability (W2)	.118	.180*	.133	.116	.125	.154*	.057	1		
9. Child report of parent-child interactions (W2)	.072	.143*	.322**	.476**	.231**	.181*	.391**	.216**	1	
10. Child report Behavioral Evidence (W2)	.075	.157*	.111	.299**	.594**	.153*	.141	.153*	.502**	1

** Correlation is significant at the 0.01 level
*Correlation is significant at .05 level

Table 4. Pearson product correlation coefficients between covariates and cortisol variables.

	1	2	3	4	5	6	7	8	9	10
1. AUCg	1									
2. Cortisol Reactivity	-.216*	1								
3. YA Waist to Hip Ratio	-.089	-.054	1							
4. Time Sample 1 Given	.341**	.098	.178*	1						
5. Income	.082	-.032	.075	.154	1					
6. Ethnicity	-.123	.027	.101	-.236**	-.384**	1				
7. YA Gender	-.108	-.042	-.271**	-.137	-.098	.029	1			
8. YA Age	-.063	.150	.146	.214*	-.065	-.038	-.052	1		
9. YA Waist Circumference	-.092	-.172	.588**	.064	-.055	.166	-.139	.082	1	
10. YA BMI	-.080	-.152	.309**	.015	-.096	.095	.019	.034	.784**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 5. Pearson product correlation coefficients between covariates and mattering and father involvement.

	1	2	3	4	5	6	7
1. Income	1						
2. Ethnicity	-.381**	1					
3. YA Gender	-.108	.019	1				
4. YA Age	-.010	-.029	-.117	1			
5. FI Father Report	-.008	.087	-.135	-.115	1		
6. FI Child Report	.091	-.094	.008	.009	.341**	1	
7. Mattering	.145*	-.182*	.135	-.029	-.071	.174*	1

Table 6. Path *c* regression models of AUCg predicted from father involvement.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Father Report							
Overall model results					7.11	.22	<.001**
Father Involvement	-10.15	-.16	-1.75	.08			
Time Sample 1 Given	**-.01**	**-.44**	**-4.94**	**<.001****			
YA Gender	-49.74	-.15	-1.70	.09			
Income	.00	.12	1.34	.18			
Child Report							
Overall model results					5.20	.16	.001**
Father Involvement	5.70	.14	1.53	.13			
Time Sample 1 Given	**-.01**	**-.38**	**-4.16**	**<.001****			
YA Gender	-41.56	-.13	-1.45	.15			
Income	.00	.10	1.14	.26			

Table 7. Path *c* regression models of cortisol reactivity predicted from father involvement.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Father Report							
Overall model results					.52	.02	.72
Father Involvement	.00	.00	.02	.98			
Time Sample 1 Given	3.74	.10	1.03	.30			
YA Gender	-.36	-.08	-.85	.40			
Income	-2.32	-.04	-.40	.69			
Child Report							
Overall model results					.53	.02	.71
Father Involvement	-.04	-.08	-.82	.42			
Time Sample 1 Given	3.65	.09	.97	.33			
YA Gender	-.23	-.05	-.56	.58			
Income	-3.08	-.01	-.05	.96			

Table 8. Path *a* regression models of mattering predicted from father involvement.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Father Report							
Overall model results					2.21	.05	.07
Father Involvement	-.01	-.04	-.45	.65			
Income	1.11	.10	1.20	.23			
Ethnicity	-.13	-.12	-1.45	.15			
Gender	.14	.14	1.75	.08			
Child Report							
Overall model results					5.14	.12	.001**
Father Involvement	**.02**	**.16**	**2.19**	**.03***			
Income	1.10	.10	1.25	.21			
Ethnicity	**-.18**	**-.17**	**-2.21**	**.03***			
Gender	**.18**	**.17**	**2.34**	**.02***			

Table 9. Path *b* regression models of AUCg predicted from mattering.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Overall model results					5.90	.23	<.001**
Mattering	22.78	.07	.76	.45			
FI Father Report	**-12.04**	**-.18**	**-2.02**	**.046***			
Time Sample 1	**-.01**	**-.42**	**-4.60**	**< .001****			
Gender	-51.27	-.16	-1.73	.09			
Income	.00	.13	1.39	.17			
Overall model results					4.02	.16	.002**
Mattering	33.24	.10	1.07	.29			
FI Child Report	2.84	.07	.70	.48			
Time Sample 1	**-.01**	**-.37**	**-3.95**	**< .001****			
Gender	-44.18	-.14	-1.51	.14			
Income	.00	.10	1.06	.29			

Table 10. Path b regression models of cortisol reactivity predicted from mattering.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Overall model results					.42	.02	.84
Mattering	-.17	-.04	-.40	.69			
FI Father Report	.02	.03	.26	.80			
Time Sample 1	2.43	.07	.68	.51			
Gender	-.41	-.10	-.94	.35			
Income	-7.59	-.00	-.01	.10			
Overall model results					.28	.01	.93
Mattering	-.14	-.03	-.33	.74			
FI Child Report	-.02	-.03	-.29	.78			
Time Sample 1	2.43	.07	.65	.52			
Gender	-.23	-.06	-.56	.58			
Income	1.38	.02	.24	.81			

Table 11. Path *a* regression models of mattering predicted from father involvement moderated by gender.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Father Report							
Overall model results					1.81	.05	.11
Father Involvement	.00	.01	.05	.96			
Gender	.14	.14	1.76	.08			
Income	1.18	.11	1.26	.21			
Ethnicity	.13	-.12	-1.42	.16			
FI*Gender	-.02	-.06	-.50	.62			
Child Report							
Overall model results					4.34	.11	.001**
Father Involvement	.04	.24	2.92	.02*			
Gender	18	.18	2.41	.02*			
Income	1.08	.10	1.23	.22			
Ethnicity	-.19	-.18	-2.32	.02*			
FI *Gender	-.02	-.11	-1.06	.29			

Table 12. Path *b* regression models of AUCg predicted from mattering moderated by gender.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Overall model results					4.03	.18	.001**
Mattering	-4.45	-.01	-.10	.92			
FI Father Report	-13.62	-.17	-1.95	.05			
Time Sample 1 Given	-.01	-.40	-4.40	< .001**			
Gender	-52.34	-.14	-1.55	.12			
Income	.01	.10	1.08	.28			
Mattering*Gender	18.67	.03	.27	.79			
Overall model results					3.32	.15	.005**
Mattering	10.15	.03	.23	.82			
FI Child Report	6.93	.14	1.54	.13			
Time Sample 1 Given	-.01	-.36	-3.98	< .001**			
Gender	-44.82	-.12	-1.36	.18			
Income	.00	.08	.90	.38			
Mattering*Gender	-13.75	-.02	-.20	.84			

Table 13. Path *b* regression models of cortisol reactivity predicted from mattering moderated by gender.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Overall model results					.40	.02	.88
Mattering	-.10	-.02	-.02	.98			
FI Father Report	-.01	-.01	-.08	.94			
Time Sample 1 Given	3.53	.09	.93	.36			
Gender	-.38	-.09	-.86	.40			
Income	-1.85	-.03	-.30	.77			
Mattering*Gender	-.32	-.05	-.36	.72			
Overall model results					.42	.02	.86
Mattering	-.09	-.02	-.15	.88			
FI Child Report	-.05	-.09	-.88	.38			
Time Sample 1 Given	3.62	.09	.94	.35			
Gender	-.25	-.06	-.58	.57			
Income	7.94	.01	.13	.90			
Mattering*Gender	-.06	-.01	-.07	.95			

Table 14. Path *a* regression models of mattering predicted from father involvement moderated by ethnicity.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Father Report							
Overall model results					2.03	.06	.08
Father Involvement	.01	.04	.41	.69			
Ethnicity	-.12	-.11	-1.35	.18			
Income	1.20	.11	1.29	.20			
Gender	.14	.14	1.75	.08			
FI*Ethnicity	-.04	-.12	-1.14	.26			
Child Report							
Overall model results					4.30	.11	.001**
Father Involvement	.03	.22	2.29	.02*			
Ethnicity	-.18	-.17	-2.17	.03*			
Income	1.06	.10	1.20	.23			
Gender	.17	.16	2.21	.03*			
FI*Ethnicity	-.02	-.09	-.97	.33			

Table 15. Path *b* regression models of AUCg predicted from mattering moderated by ethnicity.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Overall model results					4.04	.19	.001**
Mattering	15.30	.04	.30	.77			
FI Father Report	-13.64	-.17	-1.96	.053			
Time Sample 1 Given	-.01	-.40	-4.40	< .001**			
Gender	-51.40	-.14	-1.52	.13			
Income	.00	.09	1.01	.32			
Mattering*Ethnicity	-21.22	-.04	-.31	.76			
Overall model results					3.38	.15	.004**
Mattering	-21.27	-.06	-.37	.71			
FI Child Report	7.57	4.63	1.64	.11			
Time Sample 1 Given	-.01	-.36	-3.96	< .001**			
Gender	-46.26	-.13	-1.41	.16			
Income	.00	.09	.97	.33			
Mattering*Ethnicity	41.47	.08	.57	.58			

Table 16. Path *b* regression models of cortisol reactivity predicted from mattering moderated by ethnicity.

	Unstandardized Beta	Standardized Beta	*t*	*p*	*F*	R^2	*p*
Overall model results					.39	.02	.89
Mattering	-.05	-.01	-.08	.94			
FI Father Report	-.01	-.01	-.12	.90			
Time Sample 1 Given	3.38	.09	.88	.38			
Gender	-.38	-.09	-.87	.39			
Income	-1.85	-.03	-.30	.77			
Mattering*Ethnicity	-.18	-.03	-.20	.84			
Overall model results					.43	.02	.86
Mattering	-.07	-.00	-.01	.10			
FI Child Report	-.05	-.09	-.91	.37			
Time Sample 1 Given	3.57	.09	.92	.36			
Gender	-.25	-.06	-.58	.56			
Income	6.65	.01	.11	.91			
Mattering*Ethnicity	-.17	-.03	-.18	.86			