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Childhood parental divorce and cortisol in young adulthood: Evidence for mediation by family income

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Received 10 June 2008; received in revised form 13 April 2009; accepted 13 April 2009

KEYWORDS

Divorce;
Family;
Childhood;
Cortisol;
HPA;
Income

Summary Childhood parental divorce has been linked with negative physical and psychological health in adulthood, potentially due to alterations in adrenocortical activity resulting from chronic stress. The current study evaluated cortisol in 94 young adults (mean age 19.9) from families characterized by parental divorce ($n = 43$) or intact parental marriages ($n = 51$). Salivary cortisol was assessed prior to and at 3 time points after a challenging speech task. Participants from divorced families had significantly lower cortisol across the experimental period than those from intact families, even after controlling for family conflict and current depression and anxiety. Lower family income was also associated with lower cortisol, and partially mediated the relationship between parental divorce and cortisol. Findings suggest that childhood parental divorce is associated with attenuated cortisol in young adulthood, which may be explained by lower income in divorced families.

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Parental divorce is experienced by approximately 18–23% of children (Anda et al., 2006; Amato, 2001; Kessler et al., 1997), with divorce or separation of parents estimated to affect one-third of children in the United States (Bumpass and Lu, 2000). Parental divorce has been associated with increased risk for mental and physical illness across the lifespan (Amato, 2001; De Goede and Spruijt, 1996; Borkhuis and Patalano, 1997; Tucker et al., 1997; Maier and Lachman, 2000), which may, in part, be a consequence of neuroendocrine dysregulation (Luecken and Lemery, 2004; Troxel and Matthews, 2004). Dysregulated cortisol activity has been linked to a variety of negative health outcomes, including depression, anxiety, cardiovascular disease (McEwen, 2003), damage to the frontal

lobes, excessive immune system responses (Raison and Miller, 2003), increased risk of substance abuse, and externalizing and internalizing disorders (Bauer et al., 2002; McEwen, 2003).

A growing literature finds alterations in components of the HPA axis, and in particular regulation of the stress hormone cortisol, in children, young adults, and adults exposed to significant childhood adversity (Luecken, 2000; Gunnar and Vazquez, 2001; McEwen, 2003; Saltzman et al., 2005). Under chronic stress exposure, the body may compensate for over-exposure to cortisol by decreasing baseline and response levels of cortisol (DeBellis, 2002; Tarullo and Gunnar, 2006). Accordingly, a number of recent reports have found that individuals who experienced trauma or high conflict exhibit lower levels of cortisol in response to stress provocation (Davies et al., 2007; Gunnar and Quevedo, 2007; Tarullo and Gunnar, 2006) as well as lower afternoon baseline measures (Joyce et al., 2007) and lower morning cortisol levels (Gunnar and Quevedo, 2007; Tarullo and Gunnar, 2006).

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Early loss experiences defined as parental separation, parental divorce, or death of a family member have been associated with lower levels of cortisol upon awakening for young adults (Meinlschmidt and Heim, 2005). Recently, Tyrka et al. (2008) reported attenuated cortisol in adults who experienced parental desertion and low parental care during childhood. Although little is known about long-term effects of parental divorce, preliminary findings suggest lower levels of cortisol during a CRH stimulation task (Bloch et al., 2007). Identified risk factors for negative health outcomes in children of divorce also lend support to a link between parental divorce and cortisol. Well-established risk factors for children of divorce include elevated family conflict (Dixon et al., 1998; Kot and Shoemaker, 1999; Fabricius and Luecken, 2007), changes in socioeconomic status (Amato, 1993; Fischer, 2007; Lansford, 2009; Thomas and Sawhill, 2005), and increases in depression and anxiety (Storksen et al., 2006), all of which have also been linked to dysregulated cortisol in general population samples (Flinn and England, 1997; Furlan et al., 2001; Lupien et al., 2001; Varghese and Brown, 2001; Vedhara et al., 2003; Saltzman et al., 2005; Duval et al., 2006; Chaudieu et al., 2008). However, these factors have not been examined in relation to childhood parental divorce and cortisol in adulthood.

The present study predicted that young adults from divorced families would exhibit attenuated cortisol relative to those from nondivorced families. In addition, several known risk factors associated with childhood parental divorce were evaluated for their potential to explain the relation between parental divorce and attenuated cortisol, including current depression and anxiety, family conflict, and family income.

Methods

Participants

Demographics

Participants included 94 undergraduate students from a large southwestern US university (age 18–29 years, mean age 19.9 years, $SD = 2.2$; 57 females and 37 males) whose biological parents were continuously married (“Intact”, $n = 51$) or whose married, biological parents divorced before the participant turned 17 (“Divorced”, $n = 43$). Mean age at parental divorce was 8.1 years ($SD = 3.9$; range 1–16). At least 2 years had elapsed since the divorce. Parental remarriage did not affect eligibility. All participants’ parents were still living.

Recruitment and selection criteria

Participants were recruited from Introductory Psychology courses and the student newspaper after completing a large screening survey to determine eligibility. Participants were excluded if they had a history of serious illness, acute illness, or if they were taking medications known to influence hormonal function, although hormonal contraceptive use was allowed. Participants were asked to abstain from alcohol the night before, cold medicine the day of, and smoking, exercising, eating, and consuming caffeine or energy drinks for 2 h prior to the experimental session.

Measures

Speech task

This task was adapted from the protocol described by Saab et al. (1989) and included standardized instructions that were read to each participant and standardized behavior of the study experimenter and lab supervisor. Participants were instructed to imagine that while they were shopping at a store, they were falsely accused of shoplifting by a plainclothes police officer. Participants were then given 4 min to prepare and 4 min to deliver a speech defending themselves to a magistrate, including recommendations for their compensation for this false accusation and for disciplinary action against the police officer. Participants were told that their speech performance would be rated by other students. The speech was videotaped and delivered in front of the experimenter and the lab supervisor.

Questionnaires

The widely used *Moos Family Environment Scale* (FES; Moos and Moos, 1994) provided a self-report measure of the amount of conflict in the family environment prior to age 17, using the 9-item conflict subscale (Chronbach’s $\alpha = .78$). Additional measures included the *Beck Depression Inventory II* (BDI-II; Beck et al., 1996; $\alpha = .90$), and the *State-Trait Anxiety Inventory* (Spielberger et al., 1983; $\alpha = .94$). Participants were asked to report current family income on a seven-point likert-type scale.

Cortisol measures

Five saliva samples were collected using the Salivette device (Sarstedt, Rommelsdorf, Germany). Samples were frozen at 0 °F for 1–3 months and were shipped on dry ice to be analyzed at Salimetrics (State College, PA) where high-sensitive enzyme immunoassays were performed in duplicate to analyze free cortisol. The coefficient of variation (CV) of duplicates was calculated; if the CV was greater than 15% and the difference between the two values was greater than .030 $\mu\text{g}/\text{dL}$, the test was repeated. The test had sensitivity from .007 to 1.8 $\mu\text{g}/\text{dL}$, and average intra- and inter-assay coefficients of variation 4.13% and 8.89%.

Procedure

Participation occurred between 1:00 and 5:30 pm, Monday–Thursday and took a total of 90 min, from consent to debriefing. Participants read and signed informed consent forms, and then rinsed their mouths with water. Twenty minutes later, the first saliva sample was collected, after which participants completed the speech task. Saliva samples were collected immediately after the task and at 15, 30, and 45 min after the task.

Data analysis

Preliminary analyses

The divorce and intact family groups were compared for equivalence on demographic information, including gender, ethnicity, age, body mass index, smoking status, hormonal contraceptive use, caffeine intake, recent exercise and meals, and time of day of participation using *t*-tests and Chi-square tests. None of these variables were significantly

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