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Exploring Links between Interparental Discord, Children's Physiological Stress-System Activity, and Negative Affectivity

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Abstract

Associations between family functioning, children's stress system functioning, and child temperament are explored by examining 1) how interparental conflict relates to children's average cortisol levels (AUC) and 2) whether aspects of child temperament moderate these associations. Parents of 86 children completed questionnaires regarding family, individual, and child functioning. Children's salivary cortisol samples were collected by parents on two consecutive weekdays at home immediately upon waking, 30 minutes after waking, at 3:30 in the afternoon and at bedtime, such that various important cortisol parameters could be estimated. Higher levels of interparental discord were significantly associated with higher average levels of child cortisol levels (AUC), but associations between parents' marital discord and child cortisol levels were not moderated by aspects of child temperament.

Keywords: Cortisol, Hypothalamic Pituitary Adrenal Axis, Stress Hormones, Marital Discord, Family Functioning, Child Development

Exploring Links between Interparental Discord, Children's Physiological Stress-System Activity and Negative affectivity

Interparental conflict is a controversial phenomenon that often precedes or accompanies family instability, including instability related to changes in family structure, such as parental separation and divorce. Interparental conflict is controversial in part because its consequences for the well-being of children and their parents are by no means clearly understood, particularly when simultaneously considering the short and long-term consequences of a change in family structure. Divorce proponents view interparental conflict as damaging to children and warranting the dissolution of the marriage. In contrast, marriage proponents argue that less than 30% of families experience interparental conflict that is intense enough to pose a psychological threat to children, that conflict tends to be temporary, and that conflict is rarely alleviated by divorce or separation. Rather than focusing on the consequences of family instability related to changes in family structure for young children, this paper attempts to identify the underlying pathway that may help explain these effects by focusing on the *processes* that may proceed and/or accompany family instability, particularly interparental conflict.

The main goal of this study is to better understand how exposure to interparental conflict in early childhood is associated with child maladjustment in behavioral domains, with an emphasis on discovering a *physiological pathway* by which interparental conflict leads to child maladjustment. One aspect of particular interest is to examine if children living in higher-conflict environments are more likely to exhibit deviations from what are thought to be adaptive, diurnal rhythms of stress hormone production (i.e., cortisol). A secondary goal is to understand the role of a relatively stable child characteristic (i.e., child temperament) as potentially moderating associations between interparental conflict, children's physiological stress-system activity and child maladjustment, to better understand why some children are negatively affected by exposure to interparental conflict, while others are not, or less so.

Links between Interparental Discord and Child Physiological and Behavioral Functioning

There is a strong body of work that has consistently found significant, positive associations between interparental conflict and child maladjustment (Buehler et al., 1997; Cummings & Davies, 1994; Grych & Fincham, 1990, 2001). Associations have been found between interparental conflict and internalizing and externalizing behavior problems, cognitive competence, social competence, post-traumatic stress symptoms, and problems with physical health, mood, academics, and peer relationships (Grych & Fincham, 1990). Interestingly, while theoretical and empirical evidence suggest that interparental discord constitutes a *stressor* leading to children's emotional and physiological arousal, much remains unknown about exactly *how* this stressor affects child physiological functioning and well-being. In fact, there are only a few studies (Davies et al., 2007; Pendry & Adam; 2003, 2005, 2007) examining how child exposure to interparental conflict is related to the activity of one of the body's main physiological systems for responding to stress, the hypothalamic-pituitary-adrenal axis (HPA axis).

Why Study Child Cortisol Levels?

The current study focuses therefore on the activity of the HPA axis and its main hormonal product cortisol for the following reasons. First, HPA axis activity and related cortisol levels are extremely sensitive to social stressors and supports, particularly those emerging from close interpersonal relationships (Gunnar & Donzella, 2002; Repetti, Taylor, & Seeman, 2002; Adam, Klimes-Dougan, & Gunnar, 2006). Of particular relevance for this study are results that show children who were very distressed by exposure to interparental conflicts in a lab setting showed increases in levels of cortisol in response to their parents fighting (Davies et al., 2007).

Second, HPA axis functioning affects a wide variety of physiological systems important for short-term behavioral, emotional, and cognitive functioning as well as long-term physical and mental health outcomes (Chrousos & Gold, 1992). As such, HPA axis functioning is an important variable when considering *how* exposure to interparental conflict may lead to child maladjustment (Pendry & Adam, 2003; 2007). Third, cortisol can be non-invasively, reliably, and inexpensively measured in small amounts of human saliva in naturalistic settings (Kirschbaum & Hellhammer, 1989; 1994).

Why Study Child *Basal* Cortisol Production?

Basal patterns of cortisol production are a variable of interest for several reasons. First, the HPA axis is responsible for basic physiological processes related to the regulation of – among other things – physiological and emotional arousal. Its activity exhibits a regular, diurnal pattern; cortisol levels are typically highest in the morning about a half hour after waking, dropping off rapidly in the first few hours after waking, then continuing to drop more slowly across the day, reaching a low point or nadir around midnight (Kirschbaum & Hellhammer, 1989). Because the described diurnal rhythm of cortisol production is the *normative or expected* pattern, researchers have interpreted a strong rhythm – higher levels of cortisol levels in the morning, a significant increase in cortisol levels in response to awaking (CRTA), and a significant drop from morning to evening levels – as a sign of healthy HPA functioning. Individual differences in what are thought to be ‘healthy’ HPA functioning, especially when associated with exposure to interparental discord, can thus be explored as an early sign of potential HPA dysregulation, potentially underlying associations between exposure to discord and child maladjustment.

This rationale is supported by findings from several recent studies with children that show associations between high stress exposure with weaker cortisol rhythms (Kauffman, 1991; Hart, Gunnar, & Cicchetti, 1996), as well as work by this author (Pendry & Adam, 2003; 2005; 2007). Pendry & Adam (2003; 2005; 2007) found that children living in higher-conflict homes had higher average levels of cortisol levels, and that this association was similar for kindergartners as well as adolescents. They also found that younger children living in higher conflict homes showed flatter diurnal cortisol rhythms that were explained by significantly higher levels of children's cortisol levels at bedtime and patterns thought to reflect less 'healthy' functioning of the HPA axis.

In addition, deviations of expected cortisol levels are linked to child functioning. For example, elevated *average* child cortisol levels were related to child internalizing behavior (Scerbo & Kolko, 1994), whereas lower average levels were found in aggressive, delinquent, or antisocial children (Flinn & England, 1995). High *morning* cortisol levels were found in children who were socially wary and inhibited (Kagan et al., 1987; Schmidt et. al., 1997), whereas low *afternoon* cortisol levels have been associated with aggressive and angry behavior in boys (Smider et. al., 2002). Considering the complexity of observed links, this study elucidates whether exposure to interparental conflict constitutes a stressor potent enough to affect children's diurnal rhythms of cortisol production.

Interparental conflict and Child Temperament

This study also examines whether individual differences in children's relatively stable aspects of child temperament moderate the nature of the associations between exposure to interparental conflict and children's cortisol levels for the following reasons. Very few studies have examined the role of child temperament as potentially moderating the effects of interparental discord on child outcomes (Lengua, 1992; Tschann, Kaiser, Chesney, Alkon, & Boyce, 1996; Hetherington, 1989; Kennedy, 2000). Negative affectivity is of interest because it involves individual differences in arousal to negative environmental cues (Rothbart, 1989; Watson & Clark, 1999; Lengua, 2002), processes which are related to HPA axis functioning. Since children high in negative affectivity are prone to negative affect and cognitions, as well as high levels of perceived stress (Clark & Watson, 1999), they may respond to interparental conflict with increased appraisals of threat, heightened physiological arousal, and more maladaptive coping (Lengua, 2002) making these children more vulnerable to potentially negative consequences of conflict exposure in physiological and behavioral domains.

The Present Study

The present study examines associations between parents' reports on interparental conflict, child negative affectivity, and children's diurnal cortisol levels collected in a naturalistic setting. Participants in this study represent a combination of normal, low-risk families and families engaged in individual, marital, or family counseling addressing various aspects of family instability, including marital distress and/or impaired emotional functioning, i.e., depression. Children in this study are between the ages of 3-7 because this age group represents distinct developmental periods in children's lives, particularly regarding levels of dependence on parents in regulating emotions and abilities to make cognitive attributions about and to derive explanations for negative interactions in the family.

Method

Participants

Participants included 86 children and their parents from two-parent families drawn from within and around a medium-sized university community in the Midwest, and several, mostly rural and/or University towns throughout two Northwestern states. Families were recruited through posting of flyers in early childcare settings, schools, health care facilities and through soliciting at individual and family counseling facilities and various programs for at-risk families. Children (46 girls and 40 boys) had a mean age of 5.8 years (ranging from 3.2 to 7.9 years) and mothers and fathers had a mean age of 37.9 and 38.8 years, respectively. Most children were living in married families (94%), with average total family income of US $59,487. For additional samples descriptive on education and employment, see Table 1.

Procedures

After informed consent was obtained over the phone and in writing, both parents were sent individual packages of questionnaires asking about aspects of couple functioning (marital adjustment, conflict tactics), parental involvement, parent emotional functioning, and various aspects of child behavior and personality (behavior, temperament, social competence). Using materials and instructions sent to the home, parents assisted their child in obtaining salivary cortisol samples, four times a day, on each of two consecutive weekdays at prescribed events (wake-up, bedtime) or times (30 minutes after wake-up, 3:30 pm in the afternoon). Parents also provided information on activity and event reports about their child's health status, use of medications, quantity, quality, and timing of food and beverages, exercise, and sleep- and wake-times as well as conflict exposure during the two days of study participation.

Cortisol Sampling and Assay Procedures

Parents collected small samples of saliva (approximately 1.0 mL) from their children, immediately upon waking, 30 minutes after waking, at 3:30 in the afternoon and immediately prior to the child's normal bedtime. Parents collected eight samples over a period of two consecutive weekdays and recorded the exact time each sample was taken. Each family received a sampling kit including the saliva sampling materials, along with written and pictorial instructions, practice materials and a ‘reward’ booklet with a choice of stickers for each child. We also instructed parents thoroughly by telephone on how to collect, record, store and ship saliva samples. Substantial efforts were made to impress upon participants the importance of compliance with the study’s procedures, particularly with regards to the timing of saliva sampling immediately upon waking. These efforts included having participants take a practice sample a day before the study began, providing additional instruction by telephone if needed, explaining to participants *why* exact timing of the samples was essential to our study, asking participants to note any sampling problems that had occurred, and suggesting that participants conduct a third day of sampling if saliva sampling of the wakeup sample had been delayed for any reason. We also provided suggestions on how to help ensure compliance, e.g., putting sampling materials on a bedside table.

Our experience and those of other experts in the field of salivary cortisol collection with young children has shown that young children tend to have trouble producing an adequate amount of saliva necessary for reliable analysis without controlled use of stimulants. Hence, all children were asked to lick a few sweetened Kool-aid crystals off a sampling straw (first licked by the child, and then dipped into a vial containing less than 1/16 of a teaspoon of Kool-aid crystals for the entire sampling period) in order to stimulate saliva which the child was asked to swallow. The child was then asked to wait for 30 seconds, while thinking about (and pretending to chew their favorite food), after which they were asked to provide a sample by spitting directly into a sterile cryovial or sampling cup. While the use of stimulants such as Kool-aid can affect cortisol values (Schwartz et. al., 1998), the effects of stimulants are negligible for certain assays, and recent work by Talge, Donzella, Kryser, Gierens, & Gunnar (2005) found that the correlation between stimulant - treated (Kool-aid) and untreated samples ranges from .95 to .97. Parents were instructed to use a ‘dusting’ of the stimulant, and all samples were visually inspected for signs of stimulant contamination. Although the immunoassay kit used in this study is minimally affected by changes in sample pH associated with stimulant use, the pH value of all samples were tested to identify samples with a pH ≤ 3.5 or ≥ 9.0, which may artificially inflate or lower cortisol values. All saliva samples were found to have pH values within the acceptable range.

Compliance in the sample was extremely high indicating that 82 out of 86 children provided all eight samples as requested. Only children who provided seven or more of the eight requested samples were included in our analyses. For those who provided only seven samples (N = 4), we replaced the missing cortisol value with that child’s own cortisol value taken at the same time on the other sampling day, rather than exclude them from the analyses. Two children were dropped from the original sample (N = 88) due to insufficient number of samples or the use of steroid-based medications potentially influencing cortisol production (Kirschbaum & Hellhammer, 1989, 1994).

Parents were instructed to refrigerate samples as soon as possible after they were taken. Since experimental research has shown that salivary cortisol levels are not affected by variations in temperature and motion similar to those experienced during a trip through the mail system (Clements & Parker, 1998; Kirschbaum & Hellhammer, 2000), parents were asked to return the samples to our university-based laboratory by mail. When samples reached our laboratory they were then frozen at –20 degrees Celsius until samples were sent on dry ice to a professional laboratory specializing in the assaying by enzyme immunoassay. The test used for these assays has a range of sensitivity from .007 to 1.8 μg/dl, and average intra- and inter-assay coefficients of variation less than 3% and 7%, respectively.

Measures

Interparental Discord

We assessed interparental discord as reported by both mothers and partners using two measures in the parent questionnaire, marital adjustment and conflict tactics (i.e., approaches to conflict resolution). We assessed marital adjustment using the Dyadic Adjustment Scale (DAS; Spanier, 1978), which consists of a survey in which participants report on their perception of cohesion, conflict, satisfaction and commitment. Using items from the adjusted Conflict Tactics Scale (CTS-2; Straus & Hamby, 1996), participants indicated how often they and their partner generally employ various conflict tactics, including negotiation, psychological aggression and physical aggression when disagreement arises. Participants reported on a scale from 0 (*this never happened*) to (*more than 20 times in the past year)* or *7* (*not in the past year, but it did happen before*) how often they "discuss their disagreements calmly" (*negotiation)*, or "argue heatedly or shout at their partner" (*psychological aggression*), and "pushed, grabbed or hit their partner" (*physically aggressive*) during a disagreement. Physically aggressive items were excluded for these analyses due to a limited range of responses.

Parental involvement.

Parental involvement with the child was measured by averaging scores on a 40-item activities checklist designed for the purposes of this study. Both parents described how often they engaged in 40 different activities with their child, such as eating meals together, cooking together, discussing the events of the day, indicating how often they are involved in this activity with their child on a scale of 1 (*rarely or never*) to 4 (*every day*). The parental involvement checklist has a Chronbach's alpha coefficient of .86.

Emotional Functioning; Depressive symptoms

We assessed parents' depressive symptoms using the IDD, which is a 22-item self-administered questionnaire that assesses the frequency and duration of symptoms associated with depression in the preceding 2 weeks. Participants indicated how often they experienced cognitive, behavioral, affective and somatic symptoms of depression on a scale from 0 (rarely or none of the time/ less than once a day) to 4 (most or all of the time/ 5-7 days). Chronbach's coefficient alpha for this scale was .85.

Child Temperament

The Child Behavior Questionnaire (Rothbart & Ahadi, 1994;2001) for 3-7 year-old children was used to measure parents' perceptions of their child's temperament. This commonly used measure asks parents to rate how representative a particular item is of their child's behavior during the previous 6 months using 15 scales to tap traits such as impulsivity, negative affectivity, positive emotionality, sociability, shyness, and activity level. Scores were factor analyzed using a varimax rotation, resulting in three factors including Negative Affectivity, Surgency Extraversion, and Effortful Control. Scores were averaged across scales associated with the *Negative Affectivity* (NA) factor which demonstrated significant loadings for scales of Discomfort, Sadness, Fear, Anger/Frustration, and Soothability (loading negatively). NA scores were calculated for each child after which scores were standardized before calculate interaction terms. The internal reliability was 79, indicating good reliability.

Data reduction

Participants' use of negotiation and psychological aggressive conflict styles were significantly and negatively associated with each other (r = -.59, p = .00). Higher levels of negotiation were positively (r = .39, p = .03), and psychological aggressive styles were negatively (r = -.29, p = .04) related to marital adjustment. Hence, we standardized and aggregated scores representing constructive (reverse-scored) and verbally aggressive conflict styles with those of the DAS, to create a composite score for *interparental discord* for each participant, keyed to reflect greater scores for higher levels of interparental discord. Mothers' and fathers' scores of interparental discord were significantly associated with each other (r = .322, p = .012), hence, we averaged their scores to create a jointly reported score for each couple. We also standardized and aggregated scores for parental involvement and parental depression by combining mothers' and father's scores on each of these aspects of parental functioning. For each of these couple variables, the higher end of the scale reflects better functioning.

Data Reduction of Cortisol Values

To limit the influence of extreme cortisol values, days one and two cortisol values for each time point were first winzorised to three standard deviations before averaging. Wakeup cortisol values of days one and two were averaged, and similar means were calculated for the average cortisol response to awaking (CRT), average afternoon cortisol, and average bedtime cortisol. Each child's *average cortisol* level across waking hours (AUC) was calculated by calculating the area under the line fitted through children's four cortisol values for each day (with cortisol level plotted on the y-axis, and time of day on the x-axis), and dividing this value by the total time the child was awake. This resulted in an estimate of each child's average cortisol level (AUC) per waking hour, effectively controlling for the length of the child's waking day and timing of when the sample was taken. For the multivariate analyses, a natural logarithmic transformation for each aforementioned cortisol parameter was used to reduce positive skewness of the data. Although diurnal patterns -as estimated by calculation of the slope of the diurnal cortisol production curve are of interest to this study, analyses of these patterns has not yet been finalized for results to be presented at this time.

Analyses proceeded in several steps. Descriptive statistics were conducted for the raw cortisol values by day, as well as the descriptives of each of the composite parameters and main independent variables in the models. Next, simple correlations among the main constructs of interest (interparental discord, parental involvement, and parental depression) and the dependent variable (children's AUC) were calculated. Then, hierarchical regression analyses were conducted according to the following steps. Effects of interparental discord and child negative affectivity on children's average cortisol (AUC) were calculated along with their interaction. Next, other variables representing family functioning (parental involvement and depression) were added to the model to observe whether associations between interparental, child temperament, and child cortisol were dependent. Given that natural log transformations of the dependant variables were used, an inverse natural log transformation (100 (e^{β}-1)) should be used to obtain interpretable estimates of the β coefficients; after this transformation, they represent the percentage change in the dependant variable (cortisol level) for each one unit change in each independent variable. To assess the extent to which collinearity among the independent variables may have affected the parameter estimates, collinearity diagnostics (Variance Inflation Factor -VIF) were examined to avoid instability of the regression model and estimates (Neter et al., 1996; Allison, 1977; 1999).

Results

Descriptive Statistics

Table 1 presents descriptive statistics on the primary independent variables and sample characteristics, along with children's cortisol measures and sampling times. Untransformed values are presented here for ease of interpretation; natural logarithmic transformed values were used in all analyses.

Multivariate Analyses Predicting Average Cortisol Levels (AUC)

When predicting average cortisol levels across the day (AUC) on interparental discord, child negative affectivity, and their interaction, results indicated no significant interaction between exposure to interparental discord and child temperament on child AUC cortisol levels. As such, a subsequent regression model predicting children's average cortisol levels (AUC) were performed without the interaction term in the model. Model 1 presented in Table 2, presents a significant main effect of interparental discord on children's average cortisol levels (AUC) (β = .179, p = .003); for every 1 SD higher interparental discord, children's average levels of cortisol are higher by approximately 14.1% compared to children whose parents report interparental discord at the mean level. There is also a main effect for child NA (β = .181, p = .043), suggesting that children with higher levels of negative affectivity have significantly higher average levels of cortisol compared to children with low levels of negative affectivity. As illustrated in Model 2, associations between interparental discord children's average cortisol levels are independent of parental involvement and parent depression. Parental involvement (β = .007, p = .864) and depression (β = .008, p = .877) were not significantly associated with children's average levels of cortisol across the day when interparental discord and child negative affectivity are in the model, but the significant effect of interparental discord remains (β = .173, p = .010). Even after parental involvement and depression are entered in the model, 1 SD higher interparental discord is associated with 16 % higher average cortisol levels for children with high and low levels of negative affectivity. As is apparent, children with varying levels of negative affectivity appear to be similarly affected by living in homes with higher levels of interparental discord.

Discussion

This study examines associations between interparental discord, child negative affectivity, and children's cortisol levels in a sample of children and families, of whom a substantial portion are experiencing family instability due to interparental discord and anticipated (or pending) changes in family structure. This investigation finds that high levels of interparental discord (i.e., low level of marital adjustment, frequent use of a psychological aggression during interparental disagreements, and infrequent use of negotiation to solve disagreements), is associated with children's higher average cortisol levels (AUC), and this appears to be the case regardless of child levels of negative affectivity. It is important to note that these effects are independent of parental involvement and depression. While results are preliminary and data collection effort ongoing, the findings are of interest for the following reasons.

Interparental Discord and Elevated Levels of Cortisol

Our findings suggest that the nature of the conflict resolution style employed during interparental disagreements (calmly discussing disagreements versus being verbally and/or psychologically abusive) and the level of marital adjustment have important associations with children's stress hormone levels. As such, our work expands on previous work (Pendry & Adam, 2007) partly replicating findings, but doing so with a larger sample of children, better measurement, and a greater age-range of children in early childhood. In addition, by adding an examination of the role of negative affectivity, this investigation expands existing work by exploring whether certain risk and resilience factors may help explain why some children are negatively affected by exposure to discord, while others are not, or less so. These findings suggest that negative affectivity appears not to be a risk factor that may aggravate negative effects of exposure to interpersonal discord on children's physiological arousal as indicated by cortisol levels..

Alternative Explanations of Children's Cortisol Levels

We must consider the possibility that associations between family functioning and children's cortisol levels may be due to genetic factors. It is conceivable that children with higher cortisol levels have one or both parents who also exhibit elevated cortisol levels, which are in turn related to personality or behavioral traits that make interparental conflict more likely. Similarly, children who have higher levels of negative affectivity may also have parents who exhibit similar personality traits that may contribute to creating higher-discord environments. It is, however, beyond the scope of this paper to conclusively rule out genetic contributions to the reported associations.

Limitations and Future Directions

Given the preliminary nature of the results as well as the correlational nature of these data, no firm causal inferences can be made. Future research would benefit from taking a longitudinal approach that combines measures of family functioning over a longer time frame in relation to repeated measures of children's cortisol levels in high and low discord homes or those experiencing various levels of family instability. In addition, the current analyses do not take into consideration a myriad of other measures of family, couple and individual functioning, as well as child functioning collected as part of this data collection effort. In addition, the current sample is incomplete, which restricts the limits of statistical power needed to conduct more causally sensitive analyses. One component of the proposed analyses includes investigating whether children's cortisol levels significantly mediate association between interparental discord and child outcomes in various domains of functioning. These analyses have not been completed at this time. In addition, the link between family instability and the presence of interparental conflict needs to be examined explicitly once the entire sample is complete. These caveats aside, the current study suggests that a detailed examination of family processes and child characteristics may help us understand the role of individual differences in children's HPA axis functioning in possibly explaining maladjustment in the context of family instability.

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Table 1

Means and Standard Deviations for Parent Marital Functioning, Maternal Parenting Characteristics, Maternal Emotional Functioning, Child Cortisol Levels and Sampling Times

Variables	Mean	Minimum	Maximum	SD
Child Age	5.80	3.25	7.99	1.32
Mother Age	37.90	28.00	50.00	5.55
Father Age	38.80	27.00	54.00	6.48
Child Negative Affectivity				
Anger/Frustration	4.99			0.82
Discomfort	4.51			0.68
Fear	3.72			0.82
Sadness	4.16			0.72
Shyness	3.22			1.18
Soothability	4.30			0.62
Parental Involvment				
Maternal	2.91	0.33	3.82	0.68
Paternal	2.48	1.00	3.33	0.49
Depressive Symptomatology (IDD)				
Maternal	10.44	0.00	33.00	6.98
Paternal	9.58	0.00	30.00	6.72
Marital Adjustment (DAS)				
Maternal	85.08	7.00	102.00	15.97
Paternal	88.31	59.00	101.00	7.95
Mother Negotiation (CTS-2)	14.00	36.00	24.18	6.63
Mother Psych Aggression (CTS-2)	0.00	15.00	4.95	4.39
Mother Physical (CTS-2)	0.00	3.00	0.09	0.49
Father Negotiation (CTS-2)	8.00	36.00	23.39	6.54
Father Psych Aggression CTS-2)	0.00	3.00	0.10	0.49
Father Physical (CTS-2)	1.00	2.00	1.02	0.77
Day 1 sampling times				
Wake up	6.08	8.67	7.37	0.70
Response to wake up	6.00	9.25	7.89	0.76
Afternoon	12.05	19.52	15.67	1.47
Bedtime	18.75	22.35	20.46	0.79
Total time awake	10.92	15.25	13.09	1.07
Day 2 sampling times				
Wake up	6.00	9.33	7.48	0.84
Response to wake up	6.50	9.87	8.08	0.88
Afternoon	12.00	19.75	15.89	1.55
Bedtime	18.87	22.50	20.44	0.69
Total time awake	11.00	15.25	12.95	0.91
Cortisol Levels				
Wake up across day 1 and 2	0.13	0.44	0.11	0.09
Afternoon across day 1 and 2	0.01	0.37	0.09	0.06
Bedtime across day 1 and 2	0.01	0.24	0.07	0.05
Mean AUC across day 1 and 2	0.12	0.56	0.33	0.14

Note: Sampling times are expressed on a 24-hour scale with 1 hour equal to 1 unit on the scale.
Note: Cortisol values are averaged over two days and reflect untransformed values, in μg/dl.

Table 2

Linear Regression Analyses for Interparental Discord, Parental Involvement and Parental Depression Predicting Children's Average Cortisol Levels (N = 86)

Variable	*B*	*SE*	*p-value*
Model 1, (R^2 = .181)			
Constant	1.229	.073	
Interparental Discord	.179	.052	.003
Negative affectivity	.181	.093	.043
Model 2, (R^2 = .343)			
Constant	1.229	.073	
Interparental Discord	.173	.071	.010
Negative affectivity	.195	.094	.042
Parental Involvement	.007	.068	.864
Parental Depression	.008	.068	.877

Note: Dependent variable is average cortisol values, natural log transformed.

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