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Empathic responsivity at 3 years of age in a sample of cocaine-exposed children☆

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ABSTRACT

This study examined the association between prenatal exposure to cocaine and behavioral and physiological responsivity. Participants were 216 mother–infant dyads (116 cocaine exposed-CE, 100 nonexposed-NCE) recruited at birth. Measures of heart rate (HR) and respiratory sinus arrhythmia (RSA) were obtained during baseline and during a task designed to elicit empathy (exposure to infant crying). When the effects of prenatal cocaine use were examined in the context of polydrug use, results of model testing indicated that lower gestational age, prenatal exposure to cocaine and postnatal exposure to alcohol were each associated with a reduced suppression of RSA during the empathy task. These findings provide additional support for an association between prenatal cocaine exposure and dysregulation during early childhood during affect-eliciting environmental challenges.

Introduction

Prenatal exposure to cocaine (PCE) has increasingly been linked to a risk of dysregulation beginning in infancy and continuing into childhood. A number of human studies have consistently reported significant associations between prenatal cocaine exposure and some aspects of the regulatory system including both behavioral (Karmel and Gardner, 1996; Bendersky and Lewis, 1998; Mayes et al., 1998) and autonomic regulation (Silvestri et al., 1991; Bard et al., 2000; Schuetze and Eiden, 2006; Schuetze et al., 2009). Animal models also indicate that prenatal cocaine alters offspring attention and arousal regulation (Gendle et al., 2004), disrupts emotionality and social behaviors in juvenile and adult offspring (Wood et al., 1994, 1995; Johns and Noonan, 1995; Johns et al., 1998; Wood and Spear, 1998; Overstreet et al., 2000) and increases sensitivity to environmental stressors (Sobrian et al., 1990; Spear et al., 1998). Taken together, both the human literature and studies using animal models suggest that prenatal cocaine exposure has the potential to significantly alter the regulatory system.

An increasing number of studies have found that cocaine-exposed children have particular difficulty regulating their arousal during emotional-eliciting tasks. To date, most studies with cocaine-exposed children have focused on emotional responsivity during tasks designed to elicit frustration. For instance, cocaine-exposed infants and children display higher negative affect (Bendersky and Lewis, 1998; Mayes et al., 1996), more anger (Alessandri et al., 1993), higher frustration and more disruptive behavior (Dennis et al., 2006) and disrupted patterns of physiological regulation (Eiden et al., 2009; Magnano et al., 1992; Schuetze et al., 2009, 2007). Fewer studies have examined responsivity during other types of emotional challenges. One exception found cocaine-exposed 3- to 6-year-old children showed fewer empathic reactions and had greater right frontal EEG asymmetry, a pattern related to greater negative affect, when exposed to infant crying (Jones et al., 2004).

One aspect of emotion regulation that has not received much attention to date in cocaine-exposed children is empathic responsiveness. Empathy has been defined as an affective response resulting from either the apprehension or comprehension of another's affective state (Eisenberg and Fabes, 1998; Mehrabian and Epstein, 1972) and is conceptualized as leading to either sympathy (i.e., concern for another; Eisenberg et al., 1991) or personal distress (i.e., self-focused, aversive emotional reactions; Batson, 1991). Eisenberg and colleagues have

Abbreviations: RSA, respiratory sinus arrhythmia; BRSA, baseline respiratory sinus arrhythmia; HR, heart rate; PCE, prenatal cocaine exposure; CE, cocaine exposed; NCE, noncocaine exposed; TLFB, Timeline Followback Interview; IBI, interbeat interval.

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demonstrated that individual differences in self-regulation are associated with empathy (Eisenberg et al., 1994, 2007). Individuals who have difficulty regulating arousal in response to empathy-eliciting situations are more likely to experience personal distress. Specifically, young children who experience high levels of arousal in response to the personal distress of others may focus on self-comforting behaviors rather than on prosocial behaviors directed towards others (Gill and Calkins, 2003). Thus, children who are prone to increased reactivity are expected to show less regulation in empathy-eliciting situations. More moderate and optimal arousal responses, on the other hand, are associated with sympathy. Thus, children who have the capacity to regulate emotionality are more likely to experience sympathy. Taken together, these data suggest that cocaine-exposed children may have difficulty regulating their emotional responses during empathy-eliciting situations.

One physiological regulatory system that supports self-regulation is the parasympathetic branch of the autonomic system. This system allows for quick changes in metabolic inputs and outputs from the heart and facilitates behaviors necessary for self-regulation and social exchanges. One commonly used measure of physiological responsivity to affect-eliciting tasks is respiratory sinus arrhythmia (RSA) reactivity, indexed by change in RSA in response to challenge. Change in RSA as a response to challenge reflects an ability to respond to rapidly changing environmental inputs, i.e., changes in social signals that underlie interpersonal interactions (Beauchaine, 2001) and the initiation of coping strategies to manage affective and behavioral arousal (Calkins, 1997). Among normative developmental populations, RSA change is associated with aspects of self-regulation such as executive control (Marcovitch et al., 2010) and empathy (Eisenberg et al., 1994; Fabes et al., 1993, 1994), with a decrease in RSA indicating more adaptive regulatory functioning. More specifically, as children focus their attention on this external event, RSA is expected to decrease (Calkins and Dedmon, 2000).

The purpose of the present study was to examine behavioral and physiological indices of empathy in a sample of 36-month-old cocaine exposed children. We chose to examine reactions to empathy at 36 months of age because previous research suggests that empathic responding undergoes significant development during the second year of life (Young et al., 1999). During this time, children begin to respond to distress in others with concern, focused attention and prosocial interventions. Thus, by 36-months of age, we expect to see empathic responses in children when exposed to a distressing event involving others. Based on existing studies, however, we hypothesized that prenatal exposure to cocaine would be associated with reduced behavioral and physiological responsiveness to infant crying. Specifically, we hypothesize that cocaine-exposed children would display less anxiety, an index of personal distress, and would have reduced rates of concerned verbal attention, indicating reduced sympathy, relative to nonexposed children. Furthermore, we hypothesized that exposed children would have smaller changes in RSA in response to an empathy task, indicating reduced physiological regulation, than nonexposed children.

1. Method

1.1. Participants

The sample consisted of 216 mother–child dyads participating in an ongoing longitudinal study of prenatal cocaine exposure (116 cocaine exposed or CE, 100 not cocaine exposed or NCE). An outreach worker on the project staff recruited all participants after delivery from two local area hospitals. Mothers ranged in age from 18 to 42 years ($M = 29.78$; $SD = 5.46$). The majority of mothers were African American (74%), were receiving Temporary Assistance for Needy Families (71%) at the time of their first laboratory visit (Years 2001–2004), and were single (60%). Of the 216 children, 106 (49%) were male. All families were recruited from two hospitals serving a predominantly low-income population and the two groups were matched on maternal education, maternal race/ethnicity, and infant sex. The study received approval from the institutional review boards of the hospitals as well as the primary institution at which the study was conducted. Informed written consent was obtained from all recruited participants. Participants were compensated for their time in the form of gift certificates, checks, and infant toys at each assessment, with the amount increasing over time. All assessments were conducted at age corrected for prematurity.

Maternal and child assessments were conducted at 4–8 weeks, 7, 13, 24, and 36 months of child age. Measures obtained at 4–8 weeks, 24 months and 36 months were included in the current analyses. By 36 months of child age, 46 children in the cocaine group and 4 children in the control group had been removed from parental care and placed in non-parental care. All assessments were conducted with the primary caregiver of the child at that time, although for ease of presentation the terms mother and maternal are used throughout the manuscript when referring to the primary caregiver. The primary caregiver was identified as the adult who had legal guardianship of the child and accompanied the child at all appointments.

1.2. Procedure

All mothers were screened after delivery for initial eligibility and matching criteria. Interested and eligible mothers were given detailed information about the study and asked to sign consent forms. About 2 weeks after delivery, mothers were contacted and scheduled for their first laboratory visit, which took place at the time that their infant was approximately 4–8 weeks old. Additional visits were scheduled when the infant was 7, 13, 18, and 24 months old. All visits (with the exception of the 18 month visit consisting of maternal interview only) consisted of a combination of maternal interviews, observations of mother–infant interactions, and infant assessments. In the circumstance of a change in custody arrangements, the person who had legal guardianship of the child was contacted and asked to participate. Biological mothers were interviewed at the 4–8 week assessment in addition to the foster mother in order to obtain accurate information about prenatal substance use.

Once a family was recruited into the cocaine group, the closest matching non-cocaine group family was recruited. However, a significantly higher proportion of mothers in the non-cocaine group declined participation or withdrew before formal enrollment, resulting in a smaller number of families in the control group. Of the 4800 women screened at delivery, 340 were eligible for participation in either group. Of these 340 women, 35% either declined participation or were not enrolled in the study because they expressed initial interest but later withdrew, resulting in a final sample of 220 mother–infant dyads. Mothers who participated were more likely to be between 18 and 25 years of age, ($p < .001$), and were more likely to have a high school or below high school education ($p < .001$), compared to those who were eligible but not enrolled. The participation rate was higher among eligible mothers who used cocaine (91%) than for eligible mothers who did not use cocaine during pregnancy (68%). Mothers who participated were also more likely to be in the cocaine group (with a participation rate of 91% among cocaine group eligibles) compared to those who were eligible but not enrolled. The majority of mothers in the cocaine group who were eligible but not enrolled in the study had children who were placed in non-maternal care. There were no other differences on any demographic variables between those who participated and those who were eligible but not enrolled or between mothers in the cocaine group who participated compared to those who did not.

1.3. Assessment of growth and risk status

Three measures of growth were used in this study: birth weight (gm), birth length (cm), and head circumference (cm). All measurements were taken by obstetrical nurses in the delivery room and recorded in the infant's medical chart. Research staff recorded this information