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To cite this article: Feihong Wang, Michael Willoughby, Roger Mills-Koonce & Martha J. Cox (2016) Infant attachment disorganization and moderation pathways to level and change in externalizing behavior during preschool ages, Attachment & Human Development, 18:6, 534-553, DOI: [10.1080/14616734.2016.1243139](https://doi.org/10.1080/14616734.2016.1243139)

To link to this article: <http://dx.doi.org/10.1080/14616734.2016.1243139>



Published online: 13 Oct 2016.



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## Infant attachment disorganization and moderation pathways to level and change in externalizing behavior during preschool ages

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### ABSTRACT

This research examined the child, parent, and family conditions under which attachment disorganization was related to both level and change in externalizing behavior during preschool among a community sample. Using the ordinary least squares regression, we found that attachment disorganization at 12 months significantly predicted children's externalizing behavior at 36 months and this prediction was not contingent on any other factors tested. For predicting changes in externalizing behavior from 36 to 60 months, we found a significant main effect of family cumulative risk and an interaction effect between attachment disorganization at 12 months and maternal sensitivity at 24 months. Specifically, high disorganization was related to a significant decrease in externalizing behavior from 36 to 60 months when maternal sensitivity at 24 months was high. Our main-effect findings replicated the significant effect of attachment disorganization and cumulative risk on externalizing behavior with preschool-aged children. Our interaction finding provided support for understanding the parenting conditions under which infant attachment disorganization may be related to change in externalizing behavior during preschool ages. Implications of the findings were discussed.

### ARTICLE HISTORY

Received 17 February 2016  
Accepted 27 September 2016

### KEYWORDS

Attachment disorganization;  
externalizing behavior;  
maternal sensitivity;  
cumulative risks; moderation  
effect

### Introduction

Attachment disorganization indicates a disruption in children's organized behavioral and attentional strategies under attachment related stress (Main & Solomon, 1990). This disruption represents a failure in children's attempt to accomplish an early milestone in development, which is the establishment of trust in people around them (Erikson, 1963) as often shown in an organized secure attachment relationship with their primary caregiver in infancy (Macfie, Fitzpatrick, Rivas, & Cox, 2008). From a developmental psychopathology perspective, this failure may undermine children's subsequent

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negotiation of developmentally salient tasks and potentiate the development of pathological outcomes in children (Cicchetti & Rogosch, 1996). Indeed, empirical evidence supports that infant and childhood attachment disorganization is a robust predictor of children's externalizing behavior and social incompetence during school years (e.g., Fearon, Bakermans-Kranenburg, van IJzendoorn, Lapsley, & Roisman, 2010; Lyons-Ruth & Jacobvitz, 2008; Madigan, Brumariu, Villani, Atkinson, Lyons-Ruth, 2016), although the magnitude of the prediction is only small to moderate (Fearon et al., 2010; Madigan et al., 2016) suggesting that the prediction may occur more likely under some conditions than others. But, a cross-level examination of the child, parent, and family conditions that moderate the association of early attachment disorganization and children's externalizing behavior during preschool ages is still lacking.

In this study, we examined the extent to which child, parent, and family factors moderated the association between attachment disorganization and both the level and change in children's externalizing behavior during preschool ages from 36 to 60 months. Using a family systems approach (Cox & Paley, 2003), we first considered a key child factor (i.e., child difficult temperament) as a potential moderator because it has been implicated in the development of behavior problems (Rothbart & Bates, 2006). Research also has suggested that difficult temperament may make children more susceptible to adverse experiences such as disorganized relationships with caregivers in setting their long-term development of competence and problems (Shaw, Owens, Vondra, Keenan, & Winslow, 1996). At the parent-child dyad level, we examined maternal sensitivity at 24 months as a possible moderator motivated by the finding that maternal sensitivity at 24 months moderated the association of secure/insecure attachment with later development of competence and problems in data from the National Institute of Child Health and Development Study of Early Child Care and Youth Development (Belsky & Fearon, 2002a). Last, we considered an index of the family risk environment to ask if cumulative risk in the first three years of children's lives moderated the association between early attachment disorganization and later externalizing behavior given the evidence of the role of cumulative demographic risks in children's development of externalizing problems (Appleyard, Egeland, van Dulmen, & Sroufe, 2005) and its correlation with the incidence of attachment disorganization in children (Cyr, Euser, Bakermans-Kranenburg, & van IJzendoorn, 2010).

### ***Child difficult temperament at 12 months***

Child temperament reflects individual differences in reactivity and regulation that are constitution based (Rothbart & Sheese, 2007), and may also be indicative of individual sensitivity to environmental influences. Many researchers were inspired by Thomas and Chess' (1977) idea of difficult child temperament that refers to negative reaction, frequent crying, and slowness in accepting changes. In the modern literature, this can be operationalized by child reactivity and regulation (Putnam & Stifter, 2008). The differential susceptibility theory (Belsky, 1997) further specifies that children of difficult temperament may be more susceptible to the presence of either favorable or unfavorable environmental factors. Accumulating studies have supported the interplay between child difficult temperament and the parenting environment as related to child outcomes (e.g., Kochanska & Kim, 2013). Other research has demonstrated the interaction between

child temperament and attachment security in predicting child outcomes (e.g., Lickenbrock et al., 2013; McElwain, Holland, Engle, & Wong, 2012; Stupica, Sherman, & Cassidy, 2011; Troxel, Trentacosta, Forbes, & Campbell, 2013). This supports the theoretical belief that temperament and attachment represent two separate domains of development contributing to children's developmental outcomes independently or through their interaction (Vaughn, Bost, & van IJendoorn, 2008). With regard to the interaction between child difficult temperament and attachment disorganization, one previous study showed that child difficult temperament at age 2, when combined with an early disorganized parent-child relationship, put children at high risk for aggressive behavior at age 5 (Shaw et al., 1996). Another study found that the co-occurrence of attachment disorganization and child difficult temperament predicted maladjustment in middle childhood, albeit in cognitive domains and ego-control (Stams, Juffer, & van IJendoorn, 2002). But, no research exists examining the possible interaction between infant attachment disorganization and child difficult temperament in predicting level and change in externalizing behavior during the preschool years. To fill this gap in the literature, we test whether the association between children's attachment disorganization and their level and change in externalizing behavior during the preschool years is stronger for children with more difficult temperament at 12 months as compared to their counterparts with less difficult temperament.

### *Maternal sensitivity at 24 months*

Given negative early experiences, later experiences with parents may attenuate, amplify, or maintain the association between early risks and later maladjustment (Sroufe, Egeland, Carlson, & Collins, 2005). Numerous studies have suggested that sensitive and nurturant parenting in the early years is related to better emotion and behavior regulation and lower externalizing behavior in children (Dozier et al., 2006; NICHD Early Child Care Research Network, 2004; Propper et al., 2008; Van Zeijl et al., 2006). Research has demonstrated that children who showed an insecure attachment with mothers at 12 months had better outcomes in the first three years of life when they experienced high maternal sensitivity at 24 months as compared to children of secure attachment who experienced low maternal sensitivity at 24 months (Belsky & Fearon, 2002a). This finding suggests the specific protective role of maternal sensitivity during the toddler years in altering the negative consequences evolving from the risk of early insecure attachment. This protective role may apply equally to children with infant attachment disorganization.

Furthermore, a meta-analysis on 15 sensitivity-based intervention studies has shown that higher maternal sensitivity in toddlerhood through intervention for mothers of disorganized infants was associated with change of children's disorganized attachment into organized ones during the toddler years (Bakermans-Kranenburg, van IJendoorn, & Juffer, 2005). Additional evidence corroborates the meta-analytic finding that negative maternal behavior was related to attachment disorganization (Gedaly & Leerkes, 2016) but enhanced maternal sensitivity was associated with change in children's disorganized attachment into organized ones around toddler ages (Forbes, Evans, Moran, & Pederson, 2007; Hoffman, Marvin, Cooper, & Powell, 2006). One randomized control trial research gave further evidence on the role of improved maternal sensitivity in reducing

attachment disorganization as well as externalizing behavior among young children from maltreating families (Moss et al., 2011). Research, however, has not examined if subsequent high maternal sensitivity at 24 months would mitigate the association between infant attachment disorganization and both level and change in externalizing behavior during the preschool years.

We were especially interested in maternal sensitivity during toddlerhood because it is both an important period in children's reorganization of infant disorganized attachment (Forbes et al., 2007; Hoffman et al., 2006), and a period when children peak in negativity (Belsky, Woodworth, & Crnic, 1996). This heightened negativity may create additional demands and challenges for parents to remain positive and sensitive to their toddlers. In addition, children with infant disorganized attachment were found as a group to experience decreases in maternal sensitivity between 6 and 36 months as compared to their secure or resistant counterparts (Mills-Koonce et al., 2007). Thus, the level of sensitivity that mothers show during the toddler years may function to either strengthen or weaken the association between infant attachment disorganization and externalizing behavior during preschool ages. Mothers with a high level of maternal sensitivity at 24 months may help reduce children's disorganization levels and facilitate re-organization of the attachment relationship during the challenging toddler years, but a low level of maternal sensitivity during this period may precipitate externalizing behavior in children with infant disorganization.

### *Cumulative risk in the first three years*

Research suggests the accumulation of multiple sociodemographic risks (e.g., single parenthood, low family income, large household size, etc.) predicts children's developmental outcomes better than singular risk indicators (Evans, 2003; Rutter, 1985; Sameroff, Seifer, Baldwin, & Baldwin, 1993). Cumulative risk models (Evans, Li, & Whipple, 2013; Rutter, 1985) have suggested that the presence of multiple or cumulative sociodemographic risks is a powerful predictor of children's externalizing behavior (e.g., Appleyard et al., 2005). Furthermore, children who experience five out of six risks between the ages of 12 and 18 months are more likely to show disorganization in the Strange Situation Paradigm (SSP; Ainsworth, Blehar, Waters, & Wall, 1978) than their peers with fewer contextual risks (Cyr et al., 2010). However, whether or not high cumulative risk versus low cumulative risk places disorganized children at increased risk for later behavioral problems is still an empirical question.

In a recent meta-analysis (Fearon et al., 2010), social economic status (SES) was considered as an approximation of a few proximal psychosocial risks and was tested as a moderator in the association between children's attachment and externalizing problems. Specifically, in this meta-analytic review, samples of qualified studies were categorized as low vs. middle/high SES samples to form a binary SES status variable. It was found that the association between attachment disorganization and externalizing behavior did not differ by SES differences in the samples. Fearon et al. (2010) acknowledged that grouping samples into either low or middle/high SES status might have reduced the power to detect SES effects on the association between attachment disorganization and externalizing behavior. Furthermore, using SES as an approximation of multiple psychosocial risks is less statistically rigorous than creating a composite of

cumulative risk based on multiple risk indicators. Therefore, it is important to further explore how cumulative risk, as a composite of multiple risk indicators, interacts with attachment disorganization in predicting externalizing behavior in children.

A few studies have examined the interaction between attachment types and count-based cumulative risk (i.e., summation of the number of risk indicators), but with inconsistent findings. For example, Belsky and Fearon (2002b) initially did not find significant differences in children's total behavioral problems at 36 months between the disorganized group and the other attachment groups in an analysis that consider different levels of cumulative risk of individual children. But, in a later publication, Fearon and Belsky (2011) did find a significant association between attachment disorganization and increases in boys' externalizing behavior in the primary school years when they experienced high level of cumulative risk.

Some researchers suggest that a mean-based cumulative risk variable is preferable to a summed number of cumulative risk because mean-based cumulative risk has been found to have stronger associations with parenting and child outcomes than the count variable of the risk indices (Burchinal, Roberts, Hooper, & Zeisel, 2000; Burchinal, Vernon-Feagans, Cox, & Key Family Life Project Investigators, 2008). Mean-based cumulative risk variables are created by taking the mean of the standardized risk indicators without forcing the continuous risk indicators into binary indicators, thus they maintain more variation in the indicator. Cumulative risk as a mean-based variable has not yet been tested in interaction with attachment disorganization levels in predicting both level and change of externalizing behavior in preschool ages. Following a similar argument of preserving variation, attachment disorganization level as a continuous variable has been used instead of the binary disorganized/not disorganized distinction (i.e., Macfie et al., 2008) because it preserves the naturally occurring variation in the continuous nine-point rating of level of disorganization (Main & Solomon, 1990). In this study, we tested whether cumulative risk as a mean-based variable interacts with attachment disorganization levels in predicting both level and change in externalizing behavior in preschool ages.

Common risk indicators for the cumulative sociodemographic risk composite in the relevant literature are single parenthood, low maternal education, low family income, child minority status, household children's size, and involuntary unemployment of the primary wage earners (Belsky & Fearon, 2002b; Burchinal et al., 2008; Cyr et al., 2010). We have selected risk indicators based on the relevant literature and principal component analysis to create a cumulative risk composite that highlights sociodemographic aspects of risks. Although attachment disorganization could be part of cumulative psychosocial risks, we focused on understanding the child, parent, and sociodemographic conditions under which the association between attachment disorganization and externalizing behavior would be strengthened or lessened. Therefore, attachment disorganization was used as a main predictor instead of a risk indicator in this study.

### *The current study*

The current study uses longitudinal data to examine how child temperament, maternal sensitivity, and family cumulative risk may moderate the association between attachment disorganization in infancy and externalizing behavior during preschool ages. Whereas several previous studies have examined the direct association between attachment

disorganization and later externalizing behavior, this study is one of the first to test moderation of risk and protective factors in this association over the preschool years.

Our first hypothesis was that the association between attachment disorganization and later level and increase in externalizing behavior would be greater among children with more difficult as compared to less difficult temperamental characteristics. Our second hypothesis was that high rather than low maternal sensitivity at 24 months would be associated with an attenuated association between high attachment disorganization and later level and increase in externalizing behavior. Our third hypothesis was that high rather than low family cumulative risk would be related to an augmented association between attachment disorganization and level and increase in externalizing behavior.

We examined externalizing behavior during preschool ages (i.e., 36 and 60 months) because difficulties in behavioral and emotional adjustment during this period often precede subsequent maladaptation (Caspi, Moffitt, Newman, & Silva, 1998; Egeland, Pianta, & Ogawa, 1996). There is evidence that 50% of preschoolers with externalizing behavior continue to display such behavior by middle childhood (Campbell & Ewing, 1990). Identifying the mechanisms responsible for behavioral difficulties in early and late preschool ages may have implications for preventing the development of later behavior problems in children.

## Method

### Participants

The participants in this study were drawn from the longitudinal Durham Child Health and Development (DCHD) study in North Carolina. In the DCHD study, 206 families from varied backgrounds were recruited through parenting classes, fliers distributed in the hospital, and phone calls using children's birth records when the children were 3 months old. The participating children were typically developing children without any problematic medical histories before or after birth. Efforts were made to achieve relatively equal representation of both African and European American families and of both poor and non-poor families. Sample size was 206, 180, 165, 182, 179, and 137 at the 3, 6, 12, 24, 36, and 60 months of assessment due to family withdrawal, relocation, or schedule unavailability. Maternal report of externalizing behavior was available at either 36 or 60 months or at both time points for 182 child participants. We used this sub-sample for analysis in the current study. No significant mean differences were found in the covariates (gender and minority) and in child difficult temperament, maternal sensitivity, and cumulative risk based on the general linear modeling group comparison procedure between the study sample and the group of children who were not in the study sample. Children in the study sample as compared to those not in the study sample had a significantly lower mean score on attachment disorganization ( $F_{(1, 205)} = 11.71, p < .001$ ), higher average family incomes ( $F_{(1, 205)} = 6.13, p < .05$ ), and higher average maternal education ( $F_{(1, 205)} = 4.27, p < .05$ ) from 3 to 36 months. Males comprised 51% of the study sample, and females comprised 49%; 56% were African American, and 44% were European American. The average ages for the study children were .58, 1.11, 2.13, 3, and

5.09 years old at 6, 12, 24, 36, and 60 months of data collection with standard deviation of .08, .12, 1.33, .05, and .31 respectively.

### *Missing data*

In this study sample, 24% had missing scores on attachment disorganization, 20% on difficult temperament, and 13% on maternal sensitivity at 24 months. Furthermore, 2% and 24.70% missed externalizing at 36 and 60 months, respectively. Eighty (44%) had complete data across all the measures over time. Sixty-three (34.31%) had missing data on one study variable, 30 (16.49%) on two study variables, 8 (4.40%) on three study variables, and 1 (.55%) on four study variables. There were four major reasons for the missing data: (a) failure to attend the Strange Situation Paradigm at 12 months and/or parent-child interaction tasks at age 24 months, (b) coding difficulties due to problems with video recordings for 12- or 24-month laboratory session, and (c) partial completion of the questionnaire on child temperament that led to their exclusion in the creation of child difficult temperament composite, and (d) failure in responding to the CBCL questionnaire. The varied reasons in missing data support missing at random (MAR) assumption for using multiple imputation in handling missing data.

### *Procedures*

When children were 6 months old, mothers responded to the demographics questionnaire. When children were 12 months old, each participating pair of mother and infant was filmed in the Strange Situation Procedure (SSP; Ainsworth et al., 1978), and mothers also responded to the Infant Behavior Questionnaire-Revised (IBQ-R; Rothbart, 1981). At 24 months, mother-child pairs were filmed for 10 min in a semi-structured puzzle task interaction. At both 36 and 60 months, mothers completed the Child Behavior Checklist 1.5–5 questionnaire (CBCL/1.5–5; Achenbach & Rescorla, 2000) about their children's behavior.

### *Measures*

#### *Covariates*

Given the gender and ethnic differences in externalizing behavior (Dodge, Coie, & Lynam, 2006; Laird, Pettit, Dodge, & Bates, 2005), gender and minority status were controlled in all the analysis. Additionally, attachment insecurity was controlled to single out its potential effect on children's externalizing behavior. Children with forced classification of B during Strange Situation Paradigm (Ainsworth et al., 1978) were coded as 0 indicating secure attachment and children with forced classification of A or C were coded as 1 indicating insecure attachment. See coding description below.

#### *Attachment disorganization*

This construct was assessed through a continuous 9-point scale of attachment disorganization (Main & Solomon, 1990) indexing the extent of disorganization based on children's behavior in the SSP at 12 months. A rating of "1" indicates no signs of attachment disorganization, and "9" indicates severe, extreme, and frequent signs of



disorganization and/or disorientation. Examples of behavioral indicators of disorganization include freezing, vigilant body posture, and apprehensive affect at the sight of the parent. Boys had significantly higher disorganization scores than girls ( $F_{(1, 147)} = 4.83$ ,  $p = .03$ ). Two coders, previously trained in addition to certified by Alan Sroufe and Elizabeth Carlson of the University of Minnesota, independently coded the procedure with 20% of the cases overlapping to estimate reliability (intraclass correlation = .90 for the continuous scores of attachment disorganization and Cohen's kappa = .85 for the classification data of attachment).

### *Child difficult temperament*

There are individual differences in both reactivity and regulation that are constitutionally based and differentially expressed as early as infancy (Putnam & Stifter, 2008; Rothbart & Derryberry, 1981). This construct was assessed using parents' responses at 12 months on the IBQ-R (Rothbart, 1981), a refinement of the original IBQ with eight new subscales assessing the broad dimensions of reactivity and regulation. In the DCHD study, parents were asked to respond to four subscales from the IBQ-R: (1) distress to limitations, (2) fear, (3) soothability, and (4) rate of recovery from distress. Parents were asked to rate on a 7-point Likert scale the extent to which their infants acted in specific ways for the past one or two weeks in multiple routine situations such as feeding, bathing, and exposure to novel places and new people. *Distress to limitations* and *fear* subscales reflect reactivity aspect of infants' temperament, and *soothability* (reversely coded) and *rate of recovery from distress* subscales reflect the regulation aspect of infants' temperament. For the present purpose, difficult temperament was assessed through a composite of these four subscales of the IBQ-R by averaging infants' scores on *distress to limitations*, *fear*, *soothability* (reversed), and *rate of recovery from distress*. Such a composite was created to capture the constitutional variation in the combination of reactivity and regulation (Hill-Soderlund & Braungart-Rieker, 2008). Higher scores on the composite indicate higher reactivity and lower regulation in the child that make them difficult to handle from the caregiver's perspective. Cronbach's  $\alpha$  was .54 for this composite in the current sample.

### *Maternal sensitivity*

This construct was a mean composite of five subscales of maternal behavior rated by trained coders based on the 24-month, semi-structured videotaped mother-child interaction in the laboratory (Cox, 1997). The mother-child interaction task was a 10-minute challenging puzzle task in which three puzzles of increasing level of difficulty were presented to the child starting with the easiest. Parents were told that the task was meant for their child to complete, although they could help if they perceived the need.

The subscales that formed the maternal sensitivity composite based on factor analysis (Mills-Koonce et al., 2007) are *sensitivity* (the level of emotional support from the mother to both the child's distress and non-distress), *positive regard for child* (the extent the parent showed positive feelings and expressions to the child), *animation* (the extent the parent showed excitement, interest, or affective and vocal energy to the child), *stimulation of development* (the extent to which the mother tried to promote the child's development), and reversed *detachment* (the extent to which the mother was uninvolved and disengaged with the child or being perfunctory to the child during the

puzzle activities). The rating for each subscale ranges from “1” (*not characteristic at all*) to “7” (*highly characteristic of the parent*). Cronbach’s  $\alpha$  for the maternal sensitivity composite was .89. Intercoder reliabilities for the individual subscales were .80 and above between coders and master coders on at least 20% of the independently scored videotapes of puzzle tasks.

### Cumulative risk

This construct was a mean composite of six standardized risk indicators from 3 to 36 months supported by the relevant literature (e.g., Burchinal et al., 2008; Cyr et al., 2010). The risk indicators included *frequency of single parenthood over time*, *maternal highest years of education over time*, *frequency of involuntary unemployment of the primary caregivers* (working less than 10 h per week) over time, *aggregated income-to-needs ratio over time*, *frequency of family on welfare over time*, and *average mean financial stress over time*. Each indicator was standardized before the formation of the composite. The six risk indices all had loadings exceeding .6 on the principal component of the construct in principal component analyses. Cronbach’s  $\alpha$  was .84. See Table 1 for further descriptive and statistical details of the risk indicators.

### Level and change in externalizing behavior

Externalizing behavior was assessed by maternal report on the CBCL/1.5–5 (Achenbach & Rescorla, 2000) when the child was 36 and 60 months of age. The CBCL includes 99 items regarding children’s behavioral or emotional problems during the previous two months with seven syndrome scales. *Level of externalizing behavior* was a mean composite of the aggressive and attention problems raw scores at 36 months. Achenbach and Rescorla (2000) indicated acceptable reliability and validity of the scores on this construct. *Change in externalizing behavior* was the difference in the mean externalizing behavior at 36 and 60 months. A negative value on this composite indicated a decrease

**Table 1.** Cumulative risk indicators.

Cumulative risk indicators	Time points	Definitions	Skewness/Kurtosis	Range
Single parenthood	3, 6, 12, 18, 24, 30, 36 months	Average frequency of single parenthood over time	.89/-.91	-.72–1.80
Maternal education	3, 6, 12, 18, 24, 30, 36 months	Average years of education over time, reversed	.10/-.60	-2.14–2.20
Involuntary unemployment of the primary wage earner	3, 6, 12, 18, 24, 30, 36 months	Average frequency of involuntary unemployment over time	1.59/1.49	-.59–2.96
Family income	3, 6, 12, 30, 36 months	Average income-to-needs ratio (2003 cutoff) overtime, reversed	-1.28/1.92	-4.46–1.29
Welfare status	3, 6, 12, 30, 36 months	Average frequency of being on welfare over time	3.44/13.22	-.34–5.94
Financial stress	3, 6, 12, 30 months	Mean item scores with one item reversed and two items rescaled on the 4-point scale with higher score reflecting higher financial stress	.18/-.66	-1.85–2.56

Each indicator is the mean of the standardized score across time points. So means of the indicators are all 0, indicating the average level for that specific indicator.

in externalizing behavior from 36 to 60 months, whereas a positive value indicated an increase from 36 to 60 months.

### **Data analysis plan**

Analyses were done in SAS 9.4. Preliminary analysis of the missing data was conducted to make sure the data were missing at random. It is recognized that multiple imputation is one of the best approaches to addressing missing data when the data is missing at random (Rubin, 1987), thus multiple imputation was used (with the proc MI command in SAS) with 30 imputed datasets to handle missing data (Yuan, 2014) in the study variables. Product terms between variables that were interactions were included in the imputation model. This ensures that the multiplied imputed data preserve any nonlinear associations between predictor and outcome variables, which were formally tested in the analysis model (Allison, 2001). Ordinary least squares regression models were estimated for each of the 30 imputed datasets with the first series of models predicting externalizing behavior at 36 months, and the second series of models predicting change in externalizing behavior from 36 to 60 months. PROC MIANALYZE in SAS 9.4 was used to generate aggregated beta estimates as well as F statistics and R squares. Each series of models started with the control model, then the main-effect model in which the block of main predictors was added to the control model, and last the interaction effect model in which the block of interaction terms was added to the main effect model. A non-significant F statistic served as a model trimming criterion to preserve the most parsimonious model. Predicting variables were grand mean centered to reduce non-essential multicollinearity (Aiken & West, 1991). Standard methods (Aiken & West, 1991) were used to probe significant interactions based on the aggregated beta coefficients across the 30 sets of estimates. Additional tests were conducted, when applicable, to test the robustness of the interaction between attachment disorganization and each of the moderators separately in a series of models that included the same set of covariates and predictors. In these longitudinal analyses, all the main predictors except for the cumulative risk composite that included the 36 month data were assessed prior to the assessment of the level and change in externalizing behavior during the preschool years to approximate the predictions in the models.

## **Results**

### **Descriptive statistics**

Univariate analysis suggested the skewness and kurtosis for the continuous predictors and the outcome variables were all within the absolute value of 1, except that attachment disorganization had a skewness of 1.49 and kurtosis of 1.23. This may reflect the fact that a substantial number (64%) of children had a disorganization score of 1. Pairwise descriptive statistics and bivariate correlations of the study variables were presented in Table 2. Infant attachment disorganization was significantly and positively correlated with externalizing behavior at 36 months ( $r = .25, p = .004$ ) but not significantly correlated with change in externalizing behavior from 36 to 60 months. Neither child difficult temperament nor maternal sensitivity was related to level of externalizing

**Table 2.** Descriptive statistics and bivariate correlations.

Variables	1	2	3	4	5	6	7	8	9
1. Gender	1								
2. Minority	.09	1							
3. Insecurity	-.13	.11	1						
4. Disorganization	-.18*	-.02	.27**	1					
5. Temperament	.19*	.35***	-.07	.02	1				
6. Sensitivity	.02	-.4***	-.08	-.05	-.26**	1			
7. Cumulative risk	-.01	.43***	.04	.14	.34***	-.47***	1		
8. Externalizing behavior at 36 M	-.14	-.03	.06	.25**	.15	-.10	.14+	1	
9. Changes in externalizing behavior	.18*	.03	-.02	-.08	.01	.01	.18*	-.55***	1
N.	182	182	139	139	146	159	182	178	133
Mean	.49	.55	.35	2.17	3.05	4.48	-.17	10.45	-1.97
S.D.	.50	.50	.48	1.85	.57	1.26	4.47	7.97	6.15
Min.	0	0	0	1	1.55	1	-9.24	0	-19
Max.	1	1	1	8	4.87	7	13.12	35	16

N = 182. 0 = white, male. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

behavior at 36 months or change in externalizing behavior from 36 to 60 months. Cumulative risk was positively correlated with change in externalizing behavior from 36 to 60 months ( $r = .18$ ,  $p = .04$ ). Externalizing behavior at 36 months was negatively correlated with change in externalizing behavior from 36 to 60 months ( $r = -.55$ ,  $p < .0001$ ). Also, the mean change in externalizing behavior is  $-1.97$ , indicating that on average, externalizing behavior is lower at 60 months than at 36 months by about one fourth standard deviation of the externalizing behavior at 36 months.

### Predicting externalizing behavior at 36 months

The first set of regression models predicted externalizing behavior at 36 months. Because the initial model that included all the main effects and three hypothesized two-way interactions did not yield any significant interaction effects, we used the main effect model as our final model. In the main effect model ( $F_{(7, 7689.5)} = 2.55$ ,  $p = .01$ ), attachment disorganization was uniquely and positively associated with externalizing behavior ( $b = .82$ ,  $p = .04$ ). The total set of predictors explained 11% of the variation in externalizing behavior at 36 months. See Table 3 for a summary of the estimates.

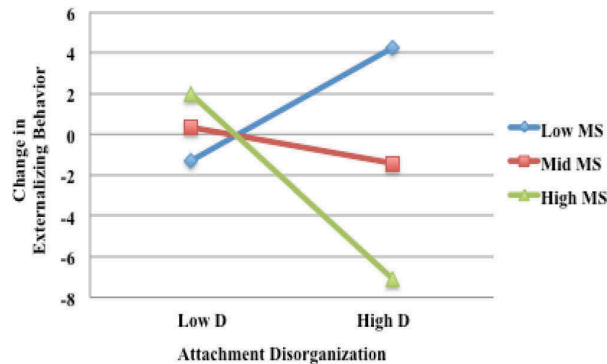
### Predicting change in externalizing behavior from 36 to 60 months

The second set of regression models predicted change in externalizing behavior from 36 to 60 months. In the final model ( $F_{(10, 1094.6)} = 1.97$ ,  $p = .03$ ,  $R^2 = .22$ ), there was a significant main effect for cumulative risk ( $b = .35$ ,  $p = .01$ ) such that higher cumulative risk was associated with greater *increases* in externalizing behavior, and a significant interaction between attachment disorganization and maternal sensitivity ( $b = -.83$ ,  $p = .04$ ). As depicted in Figure 1, the disorganization X sensitivity interaction indicated that higher attachment disorganization was associated with more *decreases* ( $b = -1.29$ ,  $p = .04$ ) in externalizing behavior from 36 to 60 months when maternal sensitivity at 24 months was high (1 SD above the mean). When maternal sensitivity was at the mean level or at the low level (1 SD below the mean), attachment disorganization was not significantly associated with change in externalizing behavior ( $b = -.25$ ,  $p = .48$ ,

**Table 3.** Predicting externalizing behavior during preschool ages.

	Predicting Externalizing Behavior Level at 36 Months <sup>a</sup>		Predicting Changes in Externalizing Behavior from 36 to 60 Months <sup>b</sup>	
	Beta (95% CI)	SE	Beta (95% CI)	SE
Gender	-1.79 (-4.19-.60)	1.22	1.35 (-.76-3.45)	1.07
Minority	-2.24 (-5.04-.56)	1.43	.06 (-2.32-2.44)	1.21
Insecurity	.41 (-2.38-3.20)	1.42	-.72(-3.20 - 1.76)	1.26
Disorganization (D)	.82* (.05-1.59)	.39	-.25 (-.95-.45)	.35
Temperament (T)	2.13 (-.28-4.55)	1.23	-.06 (-2.12-2.01)	1.05
Maternal sensitivity (MS)	-.53 (-1.71-.65)	.60	.24 (-.92-1.39)	.58
Cumulative risk (CR)	.14 (-.18-.46)	.16	.35* (.07-.63)	.14
D X T			.77 (-.59-2.14)	.69
D X MS			-.83*(-1.63 - .04)	.40
D X CR			-.20 (-.42-.02)	.11
	$F_{(7, 7689.5)} = 2.55, p < .05$ $R^2 = 11\%, p < .05$		$F_{(10, 1094.6)} = 1.97, p < .05$ $R^2 = 23\%, p < .05$	

\*  $p < .05$ .  $F$  statistics based on aggregated results out of 30 imputed datasets.



**Figure 1.** Interaction between attachment disorganization and maternal sensitivity (MS) in predicting changes in externalizing behavior from 36 to 60 months.

The outcome is the *change* in externalizing behavior.  $b = -1.29, p = .04$  for high maternal sensitivity slope.  $b = -.25, p = .48$  for middle maternal sensitivity slope.  $b = .79, p = .20$ , for low maternal sensitivity slope.

and  $b = .79, p = .20$  respectively). The temperament X disorganization and the risk X disorganization terms were not significant at the .05 level. In our series of models that test the robustness of the interaction findings, we found that the effect of disorganization X maternal sensitivity was only significant when the other two interaction variables were present as reported here. See Table 3 for a summary of the estimates and Figure 1 for the plot of the interaction between attachment disorganization and maternal sensitivity.

## Discussion

This study aimed to add to the literature on the sequelae of attachment disorganization by considering moderation pathways in the linkage between attachment disorganization and externalizing behavior during preschool ages. In predicting externalizing behavior at

36 months, we found a significant main effect of infant attachment disorganization, supporting other studies that suggest that attachment disorganization creates risk for later behavior problems in children (Fearson et al., 2010). This finding adds to the research literature on the linkages between infant and child attachment disorganization and children's externalizing behavior (Fearon et al., 2010; Lyons-Ruth & Jacobvitz, 2008; Madigan et al., 2016; Madigan, Moran, Schuengel, Pederson, & Otten, 2007). This finding indicates that the negative effect of infant attachment disorganization on externalizing behavior shows up as early as 36 months of child age.

In predicting the change in externalizing behavior from 36 to 60 months, we found attachment disorganization was not a significant predictor. Instead, cumulative risk in the first three years was a significant predictor of increases in externalizing behavior consistent with other literature (e.g., Appleyard et al., 2005). Because attachment disorganization was assessed at 12 months whereas cumulative risk was based on the indicators assessed from 6 to 36 months, it could be that the cumulative risk variable was simply better measured and more proximal to the outcome, and thus the effect of the early relational risk was not apparent. Alternatively, by late preschool ages, as the environment of the child expands to include more experiences outside the home and with other adults, children's externalizing behavior may be more influenced by proximal sociodemographic disadvantages as implied in the cumulative risk variable than by early relationship risks.

However, we were primarily interested in illuminating the conditions under which children may show differential changes in externalizing symptoms over the preschool years after experiencing disorganized attachment with their mothers as infants. Contrary to our expectations, attachment disorganization did not interact with child difficult temperament, maternal sensitivity at 24 months and cumulative risk in the first three years in predicting externalizing behavior at 36 months. This may suggest that very early intervention may profitably focus directly on reducing disorganized attachment relationship between the caregiver and the child in the first year if the goal is to prevent externalizing behavior at 36 months. Indeed, researchers have demonstrated success in reducing the incidence of disorganized attachment by improving maternal sensitivity in a pre-post intervention study (Hoffman et al., 2006), and a randomized clinical trial (Moss et al., 2011).

More importantly, we found that maternal sensitivity at 24 months moderated the association of attachment disorganization levels at 12 months and change in externalizing behavior from 36 to 60 months. When maternal sensitivity was high at 24 months, higher attachment disorganization was associated with a decrease in externalizing behavior from 36 to 60 months. When maternal sensitivity was low or average at 24 months, there was a non-significant association between infant attachment disorganization and change in externalizing behavior from 36 to 60 months. This finding suggests that high level of sensitive care from parents at toddlerhood, as a proximal supportive factor, may help facilitate re-organization of the attachment relationship for children with high attachment disorganization in the first year. This finding is consistent with the meta-analysis of sensitivity-based intervention studies (e.g., Bakermans-Kranenburg et al., 2005) and other empirical studies (e.g., Forbes et al., 2007; Hoffman et al., 2006; Moss et al., 2011). The support of a sensitive mother for a child who has experienced high attachment disorganization may contribute to

the child's enhanced behavioral and attentional control and foster regulation of behavior (Belsky, Fearon, & Bell, 2007) and decreases in externalizing behavior. Thus, for children who show disorganization in attachment relationships at the end of the first year, intervention efforts focusing on high sensitivity and responsiveness in maternal caregiving during toddlerhood may be an important avenue to reduce externalizing behavior during the preschool ages. While this study focused on the measure of maternal sensitivity at 24 months, future studies may further examine to what extent the change in maternal sensitivity from infancy to toddlerhood might moderate the association between infant attachment disorganization and later externalizing behavior.

It is noted that the disorganization X maternal sensitivity effect was significant with the presence of the interactions between disorganization X temperament and disorganization X cumulative risk. It could be that the unique effect of disorganization X maternal sensitivity was able to stand out only when the potential effect of disorganization X temperament and disorganization X cumulative risk were accounted for. It is also noted that frightened/frightening (FR; Main & Hesse, 1990) and disrupted parenting (Lyons-Ruth, Bronfman, & Parsons, 1999), two major parenting precursors of attachment disorganization could potentially precipitate children's externalizing behavior. Future research may also be directed at examining the moderating role of FR and disrupted maternal behavior in the association between infant disorganization and level and change in children's externalizing behavior.

We did not find that child difficult temperament and cumulative risk were significant moderators in the association between attachment disorganization and change in externalizing behavior during the preschool ages. Regarding the disorganization X child difficult temperament variable, it may be that maternal report of child difficult temperament is not the best measurement approach, and that observational measures of children's reactivity and regulation would have yielded a more robust index of difficult temperament such that a moderation effect would have emerged. Furthermore, the internal consistency of the child difficult temperament scores is relatively low. Testing this interaction effect in another sample with bigger sample size and higher internal consistency in the composite score of child difficult temperament is needed.

Regarding the cumulative risk variable, its significant main effect instead of a moderating effect may suggest an alternative avenue for intervention to decrease children's externalizing behavior independent of early attachment disorganization levels. Nevertheless, the null finding in its interaction with attachment disorganization as assessed in a precise mean-based manner is consistent with the null finding from the meta-analysis by Fearon et al. (2010) where the cumulative risk was assessed based on high versus low socioeconomic status. Neither this empirical study nor the meta-analysis yielded evidence for a diathesis stress model of attachment disorganization in which children with higher levels of disorganization are at heightened risk for externalizing behavior if they also experience higher levels of socioeconomic adversity. Still, we suggest further research to test the potential interaction between attachment disorganization and cumulative risk in samples where the range of cumulative risks may be larger to help explore a potential interaction effect.

### *Limitations and strengths*

This study was limited by the moderately sized community sample such that the representation of clinically relevant symptomatology in the sample may be limited. Second, this study focused on moderation pathways in the association between attachment disorganization and children's externalizing behavior during preschool ages. Given this focus, we limited our exploration of interaction terms only to those involving attachment disorganization. Third, our measure of child difficult temperament was based on maternal report reflecting subjective perceptions of child temperament by mothers. This reporter bias of mothers of diverse demographic background, coupled with our relative small sample size, might have compromised the internal consistency of the scores in child difficult temperament composite (Charter, 2003; Green, Chen, Helms, & Henze, 2011). Future research may pursue other approaches in assessing child temperament that are more objective such as the use of observational or physiological measures (Karp, Serbin, Stack, & Schwartzman, 2004). Efforts should also be made to collect child temperament data with larger sample sizes to enhance the internal consistency of the data. Also, we only had two time points to measure change because of our focus on the preschool period. More time points of assessment of externalizing behavior would have allowed estimates of the trajectories of externalizing behavior within one model that includes both the initial point and change in children's externalizing behavior. Lastly, we had substantial missing data in our study sample for some of the key predictors. A small group of children who were relatively more at risk with higher average attachment disorganization score and lower average family income and maternal education than those in the study sample were lost to the analysis due to their missing data on externalizing behavior at both 36 and 60 months. Therefore, our findings may have yielded a conservative estimate of the association of attachment disorganization and later externalizing behavior as well as the relevant conditions that moderate such an association. Although we have taken advantage of multiple imputation procedures to offset the limitation of missing data, we acknowledge the need to replicate our findings in other samples with more complete data and more diverse ranges of attachment disorganization levels, family income and maternal education.

Nevertheless, our study adds to the literature by suggesting attachment disorganization as a significant predictor of externalizing behavior as early as 36 months in an ethnically diverse sample at both higher and lower income levels. Many attachment studies involve mostly middle class white samples, so that the use of this sample adds significantly to the literature regarding the linkages between early attachment disorganization and later behavioral difficulties in children. We also add to the literature on cumulative risk with this ethnically and socioeconomically diverse sample as it relates to the increase in externalizing behavior from 36 to 60 months. More importantly, while the literature on attachment disorganization has focused mostly on the main effect prediction of attachment disorganization on child outcomes mostly at school ages, our study is one of the first to examine the conditions under which infant attachment disorganization predicts externalizing behavior during preschool ages. The only other study (Goldberg, Gotowiec, & Simmons, 1995) that has examined this topic focused on the different medical conditions in preschoolers in understanding the association between infant-mother attachment and behavior problems. Our study suggests that high maternal sensitivity at 24 months is especially crucial for children with high attachment disorganization in attenuating the link between infant



attachment disorganization and increases in externalizing behavior from the early to the late preschool years.

Our finding is also relevant to a recent discussion in *Attachment and Human Development* on the appropriateness of using observed disorganized attachment behaviors as part of risk assessment for maltreatment and custody decisions (Granqvist, 2016; Shemmings, 2016; Steele, 2016) and on the possibility of alternative non-parental factors that contribute to attachment disorganization (Granqvist et al., 2016). Our finding suggests that even when children have developed high attachment disorganization behavior in the first year regardless of reasons, they are not doomed. When supported and nurtured by a high level of maternal sensitivity in toddlerhood, children with higher disorganized attachment actually respond with more decreases in externalizing behavior from the early to the later preschool years. Therefore, intervention for children with infant attachment disorganization may need to focus on supporting parents to be sensitive and responsive to their children's needs and teaching parents effective strategies to facilitate children's behavior organization. Removing these disorganized children from their own parents may not be optimal for both the child (for losing the dear contact with the parent) and the parent (for losing the opportunity to parent better).

### Acknowledgements

This work was supported by The North Carolina Child Development Research Collaborative, which was funded by the National Science Foundation through Children's Research Initiative Grant [NSF-BCS-0126475]. Additional support for the first author in preparation for this work came from the Postdoctoral Research Training Fellowships in Early Intervention and Early Learning in Special Education at the University of Florida funded by the Institute of Educational Sciences [R324B120002]. The authors would like to thank the parents who participated in the Durham Child Health and Development study and the research assistants for their valuable help in collecting these data.

### Disclosure statement

No potential conflict of interest was reported by the authors.

### Funding

This study was supported by The North Carolina Child Development Research Collaborative, which was funded by the National Science Foundation through Children's Research Initiative Grant [NSF-BCS-0126475]. Additional support for the first author in preparation for this manuscript came from the Postdoctoral Research Training Fellowships in Early Intervention and Early Learning in Special Education at the University of Florida funded by the Institute of Educational Sciences [R324B120002].

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