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Mother-Child Interaction and Resilience in Children with Early Developmental Risk

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Abstract

Although prenatal and genetic factors make strong contributions to the emergence of intellectual disability (ID), children's early environment may have the potential to alter developmental trajectories and to foster resilience in children with early risk. The present study examined mother-child interaction and the promotion of competence in 50 children with early developmental delays. Three related but distinct aspects of mother-child interaction were considered: maternal technical scaffolding, maternal positive-sensitivity, and mother-child dyadic pleasure. Children were classified as exhibiting undifferentiated delays at age three based upon performance on developmental assessments and the absence of known genetic syndromes. Mother-child interaction was assessed at age four through observational ratings of structured laboratory tasks and through naturalistic home observations. ID was identified at age five using the dual criteria of clinically significant delays in cognitive functioning and adaptive behavior. Maternal technical scaffolding and dyadic pleasure each uniquely predicted reduced likelihood of later ID, beyond the contributions of children's early developmental level and behavioral functioning. Follow-up analyses suggested that mother-child interaction was primarily important to resilience in the area of adaptive behavior, with scaffolding and dyadic pleasure differentially associated with particular sub-domains. Implications for theories of intellectual disability and for family-based early intervention and prevention efforts are discussed.

Keywords

developmental delay; intellectual disability; mother-child interaction; responsiveness; risk

Once conceptualized as primarily genetically driven and static, intelligence has been increasingly viewed as mutable and influenced by environmental factors, particularly during early sensitive periods (Devlin, Daniels, & Roeder, 1997; Nelson et al., 2007). The importance of the social context to children's cognitive development is underscored by the deleterious effects of environmental deprivation (e.g., Smyke et al., 2007) and the potential to improve developmental outcomes by enhancing the caregiving environment (e.g.,

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Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Landry, Smith, & Swank, 2006; Ramey & Ramey, 1999; Smyke et al., 2007; Zigler, 1995). Although investigations have demonstrated associations between positive parenting behaviors and continuous measures of children's cognitive functioning, less attention has been devoted to understanding clinically significant change. The current study focused upon the contributions of child characteristics and mother-child interaction to the prediction of formal intellectual disability (ID) among children with identified early developmental delays.

Resilience is generally conceptualized as positive adaptation in the context of adversity (Luthar, 2006). When applied specifically to children at risk for intellectual disability, we have operationalized resilience as the achievement of developmental gains such that a child does not meet the diagnostic threshold for ID, despite exhibiting significant early developmental delays. Intellectual disability is defined by significant deficits in cognitive functioning *and* impairment in adaptive behavior, the skills required for independent functioning in everyday life (e.g., communication, self-care, safety awareness, and socialization; American Psychiatric Association, 2000). According to current diagnostic criteria (APA, 2000), it is therefore possible for children with developmental delays to demonstrate sufficient advances to score above the diagnostic threshold in cognitive functioning or adaptive domains—or both. Of the potential environmental factors likely to facilitate such developmental growth, few are as salient or consistent as parental influence.

The construct of maternal *responsiveness* has garnered attention in the research literature as an aspect of parenting central to promoting children's adaptive cognitive, language, and social-emotional outcomes. Responsiveness can be conceptualized as a multidimensional construct that includes contingent reactions, emotional support, encouragement of joint attention, and provision of developmentally-appropriate structuring and language input (Bornstein et al., 1992; Landry, Smith, Swank, & Guttentag, 2008). The potential causal role of maternal responsiveness in facilitating children's cognitive development has been suggested by well-controlled longitudinal studies and experimental designs (e.g., Landry et al., 2006). Beneficial effects have also been demonstrated for children with developmental risk (see Warren & Brady, 2007 for a review), a population whose increased vulnerability may render parenting especially influential in fostering positive adaptation (J. Baker, Fenning, Crnic, Baker, & Blacher, 2007; Crnic & Greenberg, 1987).

Although responsiveness is sometimes regarded as a unitary construct, evidence suggests that components of responsiveness may function somewhat independently (Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008; Landry et al., 2006). A distinction between structuring and affective features of responsiveness has been delineated in the literature (e.g., J. Baker, Messinger, Lyons, & Grantz, 2010). This approach is particularly germane to the study of intellectual disability given the potential for various forms of parenting to influence cognitive functioning and adaptive behavior differentially. The present study examined two core aspects of maternal responsiveness: maternal *technical scaffolding* and *positive-sensitivity*. In addition, we examined *mother-child dyadic pleasure*, a broader measure of relationship quality.

Maternal Scaffolding

The notion that children's cognitive development is supported and enhanced through scaffolded interactions with knowledgeable caregivers draws upon early developmental theories (e.g., Vygotsky, 1978). From this perspective, a parent fosters development by sensitively guiding and extending a child's skills beyond his or her independent capacities. A number of studies reveal the importance of stimulation, particularly the quality and style of maternal teaching, to cognitive development in children at risk due to a variety of contextual and developmental factors (e.g., Barocas et al., 1991; Landry et al., 2006). For children with identified developmental delays, effective maternal scaffolding appears to predict language development (Warren & Brady, 2007), increased independence in everyday activities (Hauser-Cram et al., 1999), improved problem solving (Hauser-Cram, 1996), as well as generalized social-emotional adaptation (J. Baker et al., 2007; Hauser-Cram et al., 1999). Indeed, Baker and colleagues (2007) found that maternal scaffolding predicted later social skills for children with early delays more strongly than did key child characteristics, including relative developmental level and early emotion regulation.

Technical scaffolding, which encompasses sensitive structuring and developmentally appropriate teaching, may be especially important when considering implications for the emergence of intellectual disability. A parent who exhibits a high degree of technical scaffolding is one who successfully enables a child to understand and complete a difficult task by providing well-timed practical support, clear instructions and feedback, and opportunities for independent learning. By fostering a child's own problem-solving skills, maternal technical scaffolding may directly promote resilience in cognitive functioning and adaptive behavior.

Maternal Positive-Sensitivity

Substantial research supports associations between maternal sensitivity and a host of positive child outcomes including secure attachment, cognitive and language growth, as well as social and emotional competence (e.g., Baumwell, Tamis-LeMonda, & Bornstein, 1997; De Wolff & van IJzendoorn, 1997; Kochanska, Forman, & Coy, 1999; Landry, Smith, Miller-Loncar, & Swank, 1997; NICHD Early Child Care Research Network, 1999). The construct of maternal *positive-sensitivity* used in the present study incorporated traditional definitions of sensitivity, including warmth and contingent responsiveness, while also drawing upon evidence linking positive affect and learning.

It has been suggested that one's own positive affect may enhance problem solving (e.g., Isen, Daubman, & Nowicki, 1987), promote intrinsic motivation (Isen & Reeve, 2005), and facilitate self-regulation (Aspinwall, 1998). Mothers provide an important model of emotional expression for their children (e.g., Halberstadt & Eaton, 2002; Malatesta, Grigoryev, Lamb, Albin, & Culver, 1986), and maternal expressiveness also helps to establish the tenor of collaborative mother-child interaction. Mothers who express positive affect themselves are more likely to have children who also display and benefit from the experience of positive emotion (Eisenberg, Cumberland, & Spinrad, 1998). Although discrete measures of maternal positive affect have been studied less frequently in relation to

children's cognitive functioning, some evidence of direct associations exists. Kirsh and colleagues (1995) found that maternal positive affect was associated with children's concurrent cognitive functioning even after considering children's earlier developmental level and maternal characteristics such as education. Thus, mothers who combine positive affect with sensitive support may be more likely to invoke an affective style conducive to developmental gains in the context of learning tasks and everyday activities (Barocas et al., 1991; Hubbs-Tait, Culp, Culp, & Miller, 2002; Kirsh et al., 1995).

Mother-Child Dyadic Pleasure

Parent-child exchanges are nested within the broader context of the parent-child relationship. In seeking to understand core markers of relationship quality, emphasis has been placed on the level of synchrony in dyadic encounters. Dyadic synchrony, which encompasses mutuality and reciprocity in parent-child interaction, is believed to provide a foundation for positive development by facilitating exploration, communication, secure attachment, and self-control (Feldman, Greenbaum, & Yirmiya, 1999; Harrist & Waugh, 2002; Isabella & Belsky, 1991; Legerstee, Markova, & Fisher, 2007; Lindsey, Cremeens, Colwell, & Caldera, 2009). Synchrony in parent-child exchanges has also been linked to children's cognitive development (Poehlmann & Fiese, 2001) and broad social outcomes (Criss, Shaw, & Ingoldsby, 2003; Harrist, Pettit, Dodge, & Bates, 1994). Definitions of synchrony often include shared affect as a central characteristic. Studies specifically focused on parent-child affective attunement highlight the role of mutual positive affect in fostering young children's communicative and regulatory skills (Feldman et al., 1999; Kochanska & Aksan, 1995; Legerstee et al., 2007; Lindsey et al., 2009). Furthermore, mother-child positive affective relationship quality during the preschool years has been linked prospectively to cognitive growth and social competence (Estrada, Arsenio, Hess, & Holloway, 1987) whereas mutual negativity may underlie detrimental family processes (Granic & Patterson, 2006). The current investigation focused upon synchronicity of mother-child positive affect and reciprocal enjoyment in the form of *dyadic pleasure*.

Differentiating the Mother-Child Interaction Constructs

The present study focused on three mother-child interaction constructs often encompassed in prior research by broad parenting factors. However, consideration of the way in which specific aspects of mother-child interaction predict children's subsequent intellectual disability status affords unique opportunities to develop finely tuned intervention strategies. Toward this end, the constructs included in the present investigation share aspects of positive parent-child interaction, but also reflect important differences in content that were anticipated to be meaningful to children's developmental trajectories. The construct of maternal technical scaffolding was conceptualized as representing a dynamic teaching process dependent upon a mother's ability to identify and effectively implement appropriate strategies to promote her child's attainment of new skills. Maternal positive-sensitivity reflected a greater focus on a mother's broad parenting abilities as related to her expression and maintenance of child-directed positive affect and her contingent responsiveness to her child's needs. Maternal positive-sensitivity did not include an emphasis on teaching or upon child reciprocity. Lastly, mother-child dyadic pleasure was considered to be a specific

feature of synchronous mother-child interaction thought to reflect underlying positive relationship quality.

The Current Study

Children with developmental vulnerabilities may be especially malleable to environmental influence (e.g., Crnic & Greenberg, 1987). Although children with delays might be more vulnerable to the negative ramifications of adversity, they may also reap greater benefit from the positive effects of a simulating and supportive caregiving environment (J. Baker et al., 2007). The present investigation addressed this supposition by examining the role of mother-child interaction in promoting competence in young children at high risk for subsequent intellectual disability.

A number of studies have explored predictors and correlates of change in continuous measures of cognitive functioning in children at risk for developmental delays due to known environmental factors such as poverty or defined biological vulnerabilities like low birth weight (Landry et al. 2006; see also Ramey & Ramey, 1999 for a review). To our knowledge, this is the first study to investigate mother-child factors in the prediction of formal *intellectual disability*, and the first to do so by examining predictors of resilience in children already exhibiting deviant developmental trajectories.

Study Aims and Hypotheses

The primary goal of the current study was to examine patterns of mother-child interaction associated with intellectual disability at age 5 among children at risk for this disorder based upon developmental delays at age 3 (Aim 1). Higher levels of maternal technical scaffolding, maternal positive-sensitivity, and mother-child dyadic pleasure were expected to predict decreased likelihood of subsequent intellectual disability diagnosis. It was further hypothesized that technical scaffolding might be an especially powerful predictor of beneficial outcomes given direct implications for teaching concrete skills.

Associations between aspects of mother-child interaction and the manner in which children did or did not meet criteria for intellectual disability based upon the diagnostic components of intellectual functioning and adaptive behavior were considered (Aim 2). Exploratory analyses were also conducted to clarify the nature of relations between mother-child interaction and specific features of adaptive behavior (Aim 3).

In addition, child characteristics thought to be important in understanding subsequent functioning, including early developmental level and behavior problems, were considered. Among children with developmental delays, initial level of cognitive processing is one of the most significant correlates of improvement in cognitive functioning, with research suggesting that higher initial developmental functioning is linked with greater cognitive progress over time (Bernheimer & Keogh, 1988). An inverse association between behavioral difficulties and cognitive and adaptive functioning has similarly been documented in the literature (Clark, Prior, & Kinsella, 2002; Sonuga-Barke, Lamparelli, Stevenson, Thompson, & Henry, 2004), although not universally (Heller, Baker, Henker & Hinshaw, 1996; Sonuga-Barke et al., 2004). Thus, higher levels of developmental functioning and lower levels of

behavior problems at age three were expected to predict lower probability of an intellectual disability diagnosis at age five. However, given the study focus on mother-child interaction, children's early developmental functioning and behavior problems were primarily considered at the level of control variables.

Method

Participants

The current sample was drawn from a multi-site longitudinal investigation of child and family contributions to developmental outcomes in children with and without early delays (J. Baker et al., 2007; B. Baker et al., 2003). Exclusionary criteria for the larger study at intake (age 3 years) included autism and the presence of severe motor difficulties. Families were recruited primarily from community agencies serving children with delays and from preschools. Three quarters of the families resided in southern California and one quarter lived in central Pennsylvania.

Of the original longitudinal sample of 238 families, 93 children were identified as exhibiting early developmental delays at age 3 based upon a standardized assessment of developmental functioning. The present study focused on the 60 families of children exhibiting undifferentiated developmental delays (delays of an unknown etiology). Children excluded from participation included those with known genetic conditions, cerebral palsy, and other co-existing conditions associated with developmental delay. Initial developmental delay was established based upon the child's Mental Development Index score (MDI < 76) from the age 3 assessment with the Bayley Scales of Infant Development, Second Edition (BSID-II; Bayley, 1993). Eighty-three percent of the original families completed the follow-up intellectual disability assessment two years later (age 5), resulting in a final sample of 50 families for the present study (33 boys, 17 girls). No relevant demographic or study variable of interest differentiated those families who completed the age 5 assessment from those who did not, including maternal age, education, race/ethnicity, marital status, and family income, as well as child race/ethnicity, developmental functioning, and behavior problems at age 3. All families included in the present study provided complete data at child ages 3, 4, and 5.

The 50 participating families represented relatively diverse racial and ethnic backgrounds, with 58% of mothers identifying their children as Caucasian (non-Hispanic), 24% as Hispanic, 4% as African American, and 14% as “Mixed/Other.” On average, mothers had completed some postsecondary education at the time of the initial age 3 assessment (grade level completed: $M = 13.9$, $SD = 2.35$), with 96% having completed high school or an equivalent degree. The majority of mothers were married (80%). Average family income fell within the $25,001 to $50,000 range.

Procedures

All study procedures were approved by the Institutional Review Boards of the three participating universities. At ages 3 and 5, the families participated in laboratory visits that each included a developmental evaluation administered by a trained graduate student or staff member. Parents completed questionnaires, including a measure of children's behavior

problems, at the time of the laboratory visits. Observations of mother-child interaction were conducted at age 4 in the context of a home visit and a separate laboratory assessment.

The one-hour home observation was scheduled in the late afternoon or evening, which permitted observation of maternal positive-sensitivity and mother-child dyadic pleasure during family interactions around dinnertime. Upon the arrival of a trained observer at the family's home, families were instructed to act as they normally would, which resulted in observation of a range of activities including free play, cooking, and sports.

During the laboratory visit, maternal scaffolding was coded in the context of five structured mother-child interaction tasks. Tasks included a clean-up (3 minutes), an “easy” problem-solving task (2 minutes), a “medium” problem-solving task (3 minutes), a “difficult” problem-solving task (5 minutes), and a delay-of-gratification task (5 minutes). Mothers were instructed to allow their child to first try each task independently and then to provide whatever assistance the mother deemed necessary to enable successful task completion (see J. Baker et al., 2007 and Crnic, Gaze, & Hoffmann, 2005, for additional task details and procedural information).

Child Predictors at Age 3 Years

Early child developmental functioning—Children's early developmental functioning was measured with the Bayley Scales of Infant Development, Second Edition (Bayley, 1993). The BSID-II provides a comprehensive assessment of developmental functioning for children ages 1 to 42 months. For purposes of the present study, only items from the Mental Development Index (M = 100, SD = 15) were administered. Children with a Mental Development Index score of 75 or below were identified as exhibiting early developmental delays.

Early child behavior problems—Children's early behavior problems were measured with the Child Behavior Checklist for ages 1½ - 5 (CBCL; Achenbach, 2000). The CBCL is a widely used parent report instrument designed to assess problem behaviors in young children. Parents were asked to rate ninety-nine items as either *‘not true’* (0), *‘somewhat or sometimes true’* (1), or *‘very true or often true’* (2), now or within the past 2 months. The present study utilized the broadband total problems score, which was converted to a T-score (M = 50, SD = 10).

Mother-Child Interaction Predictors at Age 4

Maternal technical scaffolding—Maternal scaffolding was measured during laboratory tasks according to the Maternal Scaffolding Coding System (Hoffman, Crnic, & Baker, 2006). The current investigation focused specifically on *technical scaffolding*, a measure of the mother's ability to structure an activity to facilitate her child's successful task completion. Effective technical scaffolding included providing demonstrations that were well paced and designed to be easily understood by the child, pointing out critical features of the task, and filling in difficult sub-steps without oversimplifying. Observers rated the quality of maternal technical scaffolding during each task on a 5-point scale from 1 (*low-quality scaffolding*) to 5 (*high-quality scaffolding*). Ratings of maternal scaffolding

behaviors were averaged across tasks to produce a technical scaffolding composite. Reliability was acceptable for technical scaffolding ratings (*ICC* = .90).

Maternal positive-sensitivity and mother-child dyadic pleasure—The naturalistic, home-based family observation was rated using the Parent-Child Interaction Rating System (PCIRS; Fenning, Baker, Baker, & Crnic, 2007; Park, Belsky, Putnam, & Crnic, 1997). Mothers' *positive-sensitivity* reflected a composite of two parent codes: maternal *positive affect* and *sensitivity.* Positive affect included the verbal and behavioral expression of positive regard or affect, warmth, and affection. Sensitivity was defined by maternal behavior that was child-centered, developmentally appropriate, and responsive to the child's needs. These variables were highly related, $r = .71$, $p < .001$, and were averaged to represent maternal positive-sensitivity.

Dyadic pleasure measured the degree to which the mother and child appeared to be enjoying one another as reflected in energy level, shared positive affect (e.g., facial expressions, cheerfulness, and positive tone), and content of the conversation between them. Each coding dimension was rated on a 5-point Likert scale (1 = *not at all characteristic,* 5 = *highly or predominantly characteristic*) that considered both the frequency and intensity of the expressed affect or behavior.

Total observation/recording time was 60 minutes divided into four, 10-minute observation periods. Five-minute recording sessions separated each formal observation epoch. Ratings were averaged across the four observation periods. Reliability for the system with the current sample was adequate, $\kappa > .60$ (Crnic et al., 2005; Fenning et al., 2007).

Intellectual Disability Status at Age 5

Intellectual disability (ID) at age 5 was determined through standardized assessments of intellectual functioning and adaptive behavior. Children were identified with intellectual disability at age 5 if they received standard scores less than 76 on the overall composites of both the Stanford-Binet Intelligence Scale-IV (SB-IV; Thorndike, Hagen, & Sattler, 1986) and the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984). An upper limit of 75 was selected in accordance with current definitions provided by the American Association on Intellectual and Developmental Disabilities (AAIDD) and the American Psychiatric Association (APA, 2000), which allow for consideration of measurement error in establishing a level of performance that equates with clinically significant impairment.

Stanford-Binet Intelligence Scale-IV

(SB-IV; Thorndike et al., 1986)—The SB-IV composite score yields a mean of 100 and a standard deviation of 16. The SB-IV has sound psychometric properties, including high internal consistency for the composite score ($r = .95$ to .99 across ages) and strong test-retest stability ($r = .91$ for 5-year-olds; Thorndike et al., 1986; Sattler, 2001).

Vineland Adaptive Behavior Scales (VABS; Sparrow et al., 1984)—The VABS measures adaptive behavior through a semi-structured interview designed to assess the level

of independence with which an individual regularly performs everyday activities required for personal and social competence. Mothers were interviewed regarding their children's communication (e.g., receptive and expressive language), daily living skills (e.g., personal care, domestic chores, and safety), socialization skills (e.g., interpersonal relationships, play skills, adaptability, and self-regulation), and motor skills (fine and gross motor). These four scores were combined to generate the Adaptive Behavior Composite (M = 100, SD = 15).

Results

Data Analysis Plan

A hierarchical binomial logistic regression was conducted to examine whether mother-child interaction factors at age 4 predicted eventual intellectual disability (ID) status at age 5, above and beyond early child factors at age 3 (Aim 1). Aim 2 focused on disaggregating the effects observed in Aim 1. Path analysis was employed to examine associations between predictor variables and the individual components of ID (intellectual functioning and adaptive behavior). Aim 3 explored associations between predictors and ID components on a sub-scale level to examine relations with specific aspects of adaptive behavior.

Descriptive Data

Of the 50 children with early developmental delays of unknown origin at age 3, 22 (44%) met criteria for intellectual disability at age 5. Of the 28 children who did *not* meet criteria for ID, 8 exhibited intelligence levels within the ID range but adaptive behavior scores within the normal range. Seven children scored below the adequate range on adaptive behavior but within the normal range of intellectual functioning. Table 1 presents descriptive data by intellectual disability outcome status at age 5. Demographic variables did not significantly differentiate children with early delays who later met criteria for intellectual disability from those who did not. Consequently, demographic factors were not entered as covariates. All mother-child interaction variables were standardized for use in analyses. The dyadic pleasure variable exhibited some positive skew and it was therefore normalized using a log transformation.

Aim 1: Prediction of Intellectual Disability Status at Age 5

Correlations between all study variables appear in Table 2. A hierarchical binomial logistic regression was performed to predict age 5 ID diagnostic status from early child characteristics (developmental functioning and reported behavior problems at age 3), and mother-child interaction variables (technical scaffolding, positive-sensitivity, and dyadic pleasure). Child characteristics were entered on Step 1, followed by mother-child interaction variables on Step 2. As seen in Table 3, results revealed that early child developmental and behavioral functioning were important predictors of subsequent ID status. Higher Bayley scores were linked to reduced likelihood of ID diagnosis, whereas more behavior problems were associated with greater odds of subsequent ID. After accounting for the effects of early child characteristics, mother-child interaction variables remained important predictors of ID outcome. Specifically, better technical scaffolding and greater dyadic pleasure were each associated with significantly reduced odds of ID diagnosis.

Aim 2: Prediction to the Components of ID

A path analysis was performed using Mplus (Muthen & Muthen, 2006) in order to examine how aspects of mother-child interaction may have influenced the way in which children did or did not meet ID criteria at age 5. Cognitive and adaptive behavior composite scores served as the dependent variables and were dichotomized according to the diagnostic threshold for intellectual disability (score ≤ 75 / score ≥ 76). Path analysis was conducted using logit estimation, with the dependent variables specified as categorical. The two child factors (early developmental functioning and behavior problems) and the three mother-child variables (technical scaffolding, maternal positive-sensitivity, and dyadic pleasure) were entered as predictors of impairment in both intellectual functioning and adaptive behavior. Consistent with the observed bivariate correlations shown in Table 2, predictor variables were correlated in the model as follows: technical scaffolding with early developmental functioning, technical scaffolding with positive-sensitivity, positive-sensitivity with dyadic pleasure, and early child developmental functioning with behavior problems. Given our interest in testing individual pathways rather than a comprehensive model, overall model fit was not assessed.

Estimates and odds ratios are presented in Table 4. Findings revealed evidence of differential prediction to components of ID. Early developmental functioning and behavior problems were significantly linked to whether or not children passed the diagnostic threshold for intellectual impairment. Adaptive behavior was predicted significantly by maternal technical scaffolding and dyadic pleasure, in addition to children's early developmental functioning.

Aim 3: Exploratory Analyses of Mother-Child Interaction and Adaptive Behavior

In order to understand associations between predictor variables and the overall adaptive behavior composite, follow-up analyses were conducted to examine relations with each of the four individual adaptive behavior subscales. Associations between the mother-child interaction variables and scores on the Vineland subscales (dichotomized by score ≤ 75 / score ≥ 76) were examined using point biserial partial correlations, controlling for early child developmental functioning and behavior problems. Higher technical scaffolding ratings were associated with significantly greater independent child functioning in the areas of socialization (pr = .35, $p < .05$) and motor skills (pr = .30, $p < .05$). Higher dyadic pleasure was linked at the level of a trend with more independent behavior in all domains of the Vineland with the exception of motor skills (pr= .12, ns), including communication (pr = .28, $p < .10$), daily living skills (pr = .28, $p < .10$) and socialization (pr = .25, $p < .10$).

Discussion

Resilience research aims to identify those processes important to facilitating positive adaptation in the context of risk. Findings from the present study suggest that mother-child interaction may play a critical role in promoting competence for children with early developmental delays. Specifically, high levels of early technical scaffolding and mother-child dyadic pleasure were associated with reduced likelihood of later intellectual disability diagnosis, even after considering the notable contributions of early child developmental and

behavioral functioning. Interestingly, mother-child interaction appeared to predict children's subsequent ID diagnosis primarily through an association with adaptive behavior. These findings strongly suggest that mother-child interaction may be important to promoting resilience in children at high risk for developmental problems.

Prior research has predominantly examined variation in cognitive outcomes among children with early risk due to prenatal/perinatal factors or sociodemographic disadvantage, with an emphasis on the predictive power of global constructs such as maternal responsiveness (for reviews see Ramey & Ramey, 1999 and Warren & Brady, 2007). The present study extended the clinical relevance of this work by focusing on the prediction of formal ID diagnosis among children already exhibiting deviant developmental trajectories and by examining the differential contribution of multiple dimensions of mother-child interaction. Evidence that some, but not all, components of mother-child interaction were associated with subsequent diagnosis reveals a level of specificity in the influence of dyadic processes that may be obscured by consideration of broad parenting composites. Beyond contributing to developmental science, understanding which aspects of parent-child interaction appear most important to reducing likelihood of intellectual disability diagnosis may also facilitate the development of more focused intervention efforts.

Evidence that the scaffolding component of maternal responsiveness and the reciprocal quality of positive affect may be most important for predicting later ID outcomes yields direct implications for family-based programs. Mothers who received the highest scores on technical scaffolding were those who made activities accessible to their children by breaking down tasks, using effective shaping techniques, and balancing assistance with opportunities for independent problem solving. In turn, their children were significantly more successful in mastering everyday skills. These findings suggest that mothers' ability to provide high quality technical scaffolding in the context of structured, goal-directed tasks may generalize to the kind of sensitive teaching needed to facilitate children's adaptive behaviors in everyday situations. By enhancing maternal technical scaffolding during structured activities and coaching mothers to translate these skills to everyday tasks, prevention and intervention programs could bridge across settings to optimize children's functioning.

Results also revealed that mother-child dyadic pleasure predicted reduced likelihood of later ID. Mutual positive affect may provide a foundation for developmental gains by increasing child engagement and intrinsic motivation to learn and by directly enhancing the problem solving process (e.g., Isen et al., 1987; Isen & Reeve, 2005). Finding ways to infuse everyday tasks with enjoyment and to turn mastery of skills into playful activities may foster greater child participation and effort, and might ultimately produce more positive change over time. Overall, findings suggest that a high level of technical support provided in the context of an affectively positive relationship may offer an optimal learning environment for children with early developmental risk.

The results from the current study thus highlight the potential to augment family-focused prevention and intervention by incorporating a focus on maternal scaffolding and dyadic pleasure into treatment protocols. Integrating traditional skills-based parent training (e.g., B. Baker, 1996) with developmental approaches that emphasize the sensitive implementation of

these parenting skills and dyadic relationship enhancement (e.g., child-directed interaction; Bagner & Eyberg, 2007; Landry et al., 2008) may be particularly likely to maximize positive developmental outcomes for children at risk for ID.

It was somewhat surprising that general maternal positive-sensitivity did not contribute independently to children's later ID status. However, correlations between maternal positive-sensitivity and child outcomes were in the expected direction and, given the nature of the observed effect sizes, it is possible that findings would be significant with more power to detect differences. Present results also do not preclude the likelihood that maternal positive-sensitivity remains important for other core aspects of children's successful adaptation (e.g., social-emotional functioning).

Interestingly, mother-child interaction predicted adaptive behavior outcomes, but was not significantly associated with whether children met the intellectual functioning criterion for ID. As discussed, most studies have examined children's intellectual functioning on a continuum; thus, it remains possible that mother-child interaction may relate to change in children's cognitive abilities over time when using an alternate analytical approach. For example, mother-child interaction may predict improvement in children's cognitive functioning, but such gains may not necessarily allow a child to surpass the diagnostic threshold for intellectual disability.

Summary and Future Directions

The present investigation revealed associations between data drawn from multiple sources, including parent interviews and questionnaires, direct child evaluation, and observation of family process in both structured and naturalistic settings. The longitudinal design afforded the opportunity to follow children with early developmental delays over time to assess subsequent clinical ID diagnosis. An additional strength of the study included examination of three related, but distinct facets of mother-child interaction. By identifying the dyadic processes that were most predictive of children's later ID status, findings afford considerable insight into critical targets for prevention and intervention programs.

The current focus on the preschool years offered a unique perspective on a period characterized by transition from a high degree of plasticity in early development to increasing stability in cognitive functioning (Cicchetti & Curtis, 2006). Evidence that particular features of mother-child interaction may be protective suggests important implications for intervention programs, particularly those that target school readiness. Given the diversity of the present sample, findings also reveal the potential benefits of extending family-based intervention to a rather heterogeneous population of children with early developmental delays. In addition, findings indicating differential prediction from aspects of mother-child interaction to child functioning further underscore the importance of observing families across contexts, as different environments and varying task demands may elicit distinct patterns of behavior. To evaluate parental scaffolding, for instance, it may be important to stress the dyad by providing a challenging goal-oriented task. Conversely, it may be most informative to assess dyadic pleasure in free play settings or other naturalistic contexts. Future studies would benefit from further examination of patterns of parent-child

interaction over time in order to assess how the family context adapts to children's changing needs in ways that continue to promote positive outcomes.

Despite the strengths of this study, there are some limitations. The investigation employed a moderately sized sample of children with early developmental delays and it is important to replicate findings with a larger group. In addition, although the factors that contributed to observed patterns of mother-child interaction were not a focus in the present study, future investigations would benefit from repeated measures of children's adaptive behavior and mother-child interaction in order to examine potential bidirectional effects.

Future studies also would be enhanced by measurement of maternal IQ. The present study included maternal education and family income as potentially important sociodemographic indicators and found that neither related to children's ID outcome within this risk sample. All analyses also controlled for the influence of children's early developmental functioning. However, measured IQ takes on greater heritable properties and more stability as children transition into middle childhood. Inclusion of maternal IQ would allow for direct evaluation of associations between maternal intellectual functioning and mother-child interaction.

It would also be important to evaluate the potential influence of other family characteristics, including parent mental health and stress as well as child factors such as temperament and emotion regulation. The current measure of mother-child dyadic pleasure was conceptualized as an indictor of positive relationship quality; inclusion of other underlying relationship factors, such as attachment, would further enhance understanding of possible explanatory mechanisms (e.g., Poehlmann & Fiese, 2001). Consideration of the broader family context, particularly the role of fathers and siblings, is also central to understanding possible family effects. Lastly, conducting additional longitudinal investigations to assess family processes in middle childhood and beyond would enable examination of the extent to which the identified features of mother-child interaction continue to predict children's successful long-term adaptation.

Taken together, present findings suggest that mother-child interaction may have the potential to influence children's developmental trajectories by fostering critical competencies during the preschool period. However, some children in our study who did not meet criteria for an intellectual disability diagnosis at age 5 due to adequate adaptive behavior nonetheless exhibited significant cognitive delays. Although these children were resilient in some respects, they remain at risk for learning difficulties and are likely to benefit substantially from continued supports. As the field of prevention science continues to advance our ability to foster resilience in children at risk for ID, policies must ensure that children exhibiting ongoing delays remain eligible for necessary supports, despite the absence of a clinical ID diagnosis. In this way, we can strive to maximize potential for all children at risk.

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Table 1

Descriptive Data for Early Child Characteristics, Mother-Child Interaction Variables, and Later Diagnostic Measures by Eventual Intellectual Disability (ID) Status.

Variable	ID at Age 5 (n = 22)	Not ID at Age 5 (n = 28)	Difference between Groups (*t* statistic)
Age 3			
Early Developmental Level	54.6 (8.1)	66.8 (6.7)	5.79***
Behavior Problems	60.8 (9.5)	52.4 (8.7)	−3.27**
Age 4			
Technical Scaffolding	2.5 (.87)	3.3 (.67)	3.52**
Positive-Sensitivity	2.4 (.66)	2.6 (.73)	1.17
Dyadic Pleasure	1.3 (.28)	1.7 (.52)	3.34**
Age 5			
SB-IV Composite Score	58.9 (11.9)	78.7 (16.0)	4.84***
VABS Composite Score	60.1 (8.7)	83.6 (13.0)	7.27***

Note. Stanford Binet = SB-IV; Vineland Scales = VABS

* $p < .05$.

** $p < .01$

*** $p < .001$.

Table 2

Correlations among Child Characteristics, Mother-Child Interaction, and Diagnostic Variables.

Variable	1	2	3	4	5	6	7
1. Age 3 Developmental Level	--						
2. Age 3 Behavior Problems	−.30*	--					
3. Age 4 Technical Scaffolding	.37**	−.24†	--				
4. Age 4 Positive-Sensitivity	.11	−.08	.33*	--			
5. Age 4 Dyadic Pleasure	.24†	−.03	.27†	.43**	--		
6. Age 5 Cognitive Threshold (Low = 1)	−.63***	.47**	−.33*	−.10	−.05	--	
7. Age 5 Adaptive Beh. Threshold (Low = 1)	−.47**	.31*	−.43**	−.14	−.48***	.38**	--
8. Age 5 Intellectual Disability Status (ID = 1)	−.64***	.43**	−.45**	−.17	−.42**	.72***	.75***

† $p < .10$

* $p < .05$.

** $p < .01$

*** $p < .001$.

Table 3

Logistic Regression Predicting ID Status at Age 5.

Early Predictor	*B*	*SE B*	*OR*	95% CI
Age 3 Child Variables				
Developmental Level	−2.15	.67	.037**	(.32, .43)
Behavior Problems	.94	.45	2.55*	(1.06, 6.13)
Age 4 Parent-Child Variables				
Technical Scaffolding	−1.96	.94	.14*	(.02, .89)
Positive Sensitivity	1.50	1.10	4.49	(.52, 38.99)
Dyadic Pleasure	−2.41	1.04	.09*	(.01, .68)

Note. Odds ratios (OR) were obtained from a logistic regression, with child variable scores reported from Step 1 and parent-child variables from Step 2.

†$p < .10$

*$p < .05$.

**$p < .01$

Table 4

Path Analysis Predicting Threshold for Impairment in Components of ID Diagnosis.

	Intellectual Functioning Impairment (SB-IV)			Adaptive Behavior Impairment (VABS)		
Early Predictor	**B**	**SE B**	**OR**	**B**	**SE B**	**OR**
Age 3 Child Variables						
Developmental Level	−2.44	.76	.09**	−1.14	.43	.32**
Behavior Problems	1.04	.44	2.81*	.45	.34	1.56
Age 4 Mother-Child Variables						
Technical Scaffolding	−.86	.68	.42	−1.14	.56	.32*
Positive Sensitivity	.14	.60	1.15	.96	.53	2.61†
Dyadic Pleasure	.62	.66	1.86	−1.77	.62	.17**

Note. Stanford-Binet Intelligence Scale-IV = SB-IV; Vineland Scales = VABS.

† $p < .10$

* $p < .05$.

** $p < .01$.