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The effects of early positive parenting and developmental delay status on child emotion dysregulation

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Abstract

Background Emotion regulation has been identified as a robust predictor of adaptive functioning across a variety of domains (Aldao *et al.* 2010). Furthermore, research examining early predictors of competence and deficits in ER suggests that factors internal to the individual (e.g. neuroregulatory reactivity, behavioural traits and cognitive ability) and external to the individual (e.g. caregiving styles and explicit ER training) contribute to the development of ER (Calkins 1994). Many studies have focused on internal sources or external sources; however, few have studied them simultaneously within one model, especially in studies examining children with developmental delays (DD). Here, we addressed this specific research gap and examined the contributions of one internal factor and one external factor on emotion dysregulation outcomes in middle childhood. Specifically, our current study used structural equation modelling (SEM) to examine prospective, predictive relationships between DD status, positive parenting at age 4 years and child emotion dysregulation at age 7 years.

Method Participants were 151 families in the Collaborative Family Study, a longitudinal study of young children with and without DD. A positive parenting factor was composed of sensitivity and scaffolding scores from mother–child interactions at home and in the research centre at child age 4 years. A child dysregulation factor was composed of a dysregulation code from mother–child interactions and a parent-report measure of ER and lability/negativity at age 7 years. Finally, we tested the hypothesis that positive parenting would mediate the relationship between DD and child dysregulation.

Results Mothers of children with DD exhibited fewer sensitive and scaffolding behaviours compared with mothers of typically developing children, and children with DD were more dysregulated on all measures of ER. SEM revealed that both DD status and early positive parenting predicted emotion dysregulation in middle childhood. Furthermore, findings provided support for our hypothesis that early positive parenting mediated the relationship between DD and dysregulation.

Conclusions This work enhances our understanding of the development of ER across childhood and how endogenous child factors (DD status) and exogenous family factors (positive parenting) affect this process. Our findings provide clear implications for early intervention programmes for children with DD. Because of the predictive relationships between (a) developmental status and ER and (b) parenting and ER, the results imply that sensitive parenting

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behaviours should be specifically targeted in parent interventions for children with DD.

Keywords behavioural phenotypes, intellectual disability, mental health, parents

Researchers have identified emotion regulation (ER) as a significant predictor of a variety of emotional, social, psychological and physical outcomes (Aldao *et al.* 2010). Furthermore, ER is considered a core aspect of many psychological disorders (Cole & Deater-Deckard 2009), and difficulties with ER have been integrated into models of psychopathology, such as major depressive disorder, bipolar disorder, anxiety disorders, eating disorders and various personality disorders (Aldao *et al.* 2010). In a longitudinal study of adolescents, for example, McLaughlin and colleagues found ER deficits to prospectively predict increases in anxiety symptoms, aggressive behaviour and eating pathology, after controlling for baseline symptoms (McLaughlin *et al.* 2011). As the evidence base for the importance of ER accumulates, developmental and clinical researchers have been investigating the developmental processes underlying ER itself.

The development of emotion regulation across childhood

Emotion regulation abilities emerge early in life. Infants have instinctive regulatory behaviours, such as gaze redirection, body re-positioning, self-soothing, distraction, problem solving and venting (Leerkes & Wong 2012), but the most adaptive form of regulation for infants is to seek regulatory assistance from a caregiver. As such, a caregiver's sensitivity, consistency and support are critical for the healthy development of ER. The strongest theoretical and empirical support for this phenomenon comes from the attachment literature; indeed, Sroufe (1997) explicitly defined attachment as 'the dyadic regulation of emotion'. Drawing from John Bowlby's theory of 'internal working models', young children develop mental representations of the caregiving relationship, as well as relationships more generally, through repeated interactions with the caregiver. Sensitive and consistent caregiving promotes the development of the expectation that emotional arousal is manageable via eliciting the support of the caregiver (or others) and/or with independent coping. Alternatively, Bowlby hypothesized that infants who experience insensitive and inconsistent caregiving are likely to develop the expectation that emotional needs will not be met by others or the self (Bowlby 1969/1980). Researchers have since found empirical support for and elaborated upon Bowlby's original theories. In terms of attachment-based group differences in ER, secure attachment in infancy has been found to be associated with lower levels of expressed distress and more frequent utilization of strategies that involve social referencing or expressing a need for caregiver involvement. Insecure attachment, on the other hand, was related to an increased likelihood to self-soothe or engage in solitary play (Braungart & Stifter 1991; Nachmias *et al.* 1996; Leerkes & Wong 2012). In an impressive longitudinal study on the effects of attachment across the lifespan, Sroufe (2005) found that attachment-based group differences in ER persist throughout childhood and have enduring implications for functioning in adulthood.

The effect of parenting on ER is a well-studied phenomenon, but other factors also contribute to the development of regulatory abilities. In a seminal paper synthesizing research on the sources of individual differences in ER, Calkins (1994) presented a model of internal and external components that contribute to ER across development. Factors internal to the individual included neuroregulatory reactivity, behavioural traits and cognitive ability. Factors external to the individual were primarily rooted in the family system, such as caregiving styles and explicit ER training. Calkins then proposed a general developmental pathway to ER, which entailed an interactive or transactional relationship between said internal and external components. Many studies have focused on internal sources (e.g. (Fox 1994; Goldin *et al.* 2008; Santucci *et al.* 2008; Stansbury & Gunnar 1994) or external sources (Morris *et al.* 2007); however, few have studied them simultaneously (Crockenberg *et al.* 2007; Kochanska *et al.* 2009; Kim & Kochanska 2012) and even fewer in a transactional manner (Yates *et al.* 2010; Otterpohl & Wild 2013; Norona & Baker 2014).

While the literature examining internal and external sources of ER within one model is currently rather limited, the results are consistent: the effects of environmental factors depend on constitutional factors, and these constitutional factors affect

environmental input. One clear example of these relationships can be found in Kim and Kochanska's (2012) study on the moderating effect of temperament on the relationship between parent–child interactions and self-regulation. While they found a negative relationship between infant negative emotionality and mother–child mutually responsive interaction, they also found that infants prone to negative emotionality were more strongly affected by the quality of maternal care, for better or for worse. That is, these infants had poorer regulatory abilities under conditions of negative, non-reciprocal parenting but excelled under conditions of mutually positive, reciprocal parent–child relationships. While Kim and Kochanska's model examined moderation, not mediation as in this current study, their results nonetheless underscore the importance of examining internal and external factors simultaneously.

As children become older, it becomes increasingly important to be an adept, independent regulator. Changes in biological, cognitive, and social systems present emotionally challenging situations, which must be successfully managed to ensure adaptive functioning. Notably, older children start to move away from parents, formerly their main ER facilitators, and toward their peers, a source of both emotional support and stress (Masten & Coatsworth 1998). Fortunately, Blandon and colleagues found in a community sample that ER increases and negative emotionality decreases over time, from age 4 to 7 years (Blandon *et al.* 2008). Yet this is not always the case, and youth who have underdeveloped ER skills are at increased risk for emotional, behavioural and psychological problems that may extend into adulthood (McLaughlin *et al.* 2011). Drawing from attachment literature and Calkins' framework described earlier, youth who have experienced less sensitive, less consistent parental responses to emotional arousal are at high risk of ER difficulties. Considering the critical role of caregiver sensitivity, the next step is to examine mechanisms through which this process unfolds and consider factors that may affect the likelihood of sensitive parenting responses.

Emotion regulation difficulties in children with developmental delay

The vast majority of research on ER has focused on individuals with typical development (TD), but the predictive power of ER makes it an especially appropriate construct to include in models for at-risk populations. Studies have identified individuals with developmental delay (DD) as particularly vulnerable to diagnosable psychiatric disorders (Einfeld & Tonge 1996; Dekker & Koot 2003; Baker *et al.* 2010) and behaviour problems more broadly (Crnic *et al.* 2004; Marquis & Baker 2014). Considering the consistent evidence that individuals with DD are poorer regulators than their TD counterparts (Wilson 1999; Berkovits & Baker 2014; Pears *et al.* 2014) and the predictive role of ER among TD samples discussed earlier, it is possible that deficits in ER may underlie some of these relationships. Few studies, however, have examined these pathways.

In order to answer questions about the role of ER in long-term outcomes in DD, we must first investigate the mechanisms that contribute to ER difficulties within this group. In a study of young boys with TD or DD, Wilson (1999) examined ER strategies during experiences of repeated social failure. Wilson found group differences in strategy use, with the DD group employing less gaze aversion, less use of new strategies and more return to solitary play than the TD group. These findings support Calkins' model that identifies cognitive ability as a constitutional factor for variation in ER development and underscore the necessity to examine the mechanisms underlying this relationship. Specifically, does DD lead to persistent difficulties in ER because it directly impairs one's ability to cognitively regulate emotional arousal, or might one's developmental status interact with environmental factors that, in turn, lead to ER impairment?

Considering the role of sensitive, positive parenting in the development of ER for children with TD, there is a clear need to examine this relationship in children with developmental risk. A number of researchers from the Collaborative Family Study a longitudinal study of families of youth with or without DD have examined parenting behaviours and have found consistent evidence for compromised parenting. Child DD predicted less positive parenting (Ellingsen *et al.* 2014ab) and more negative, intrusive parenting (Brown *et al.* 2011). Furthermore, Norona & Baker (2014) found support in this dataset for a transactional relationship between child dysregulation and maternal scaffolding in the DD, but not TD,

group. The present study, following upon this discrepancy finding, was designed to directly examine the role of developmental status in predicting parenting and ER outcomes.

This study examined prospective, predictive relationships among child DD status, positive parenting, and child emotion dysregulation across early and middle childhood. We utilized structural equation modeling (SEM) to examine latent constructs of positive parenting and child ER. These constructs were measured sequentially, with developmental status measured at age 3 years, early positive parenting at age 4 years and child emotion dysregulation at age 7 years. We anticipated group differences between children with and without DD in our various measures of positive parenting and ER, such that families in the TD group would have mothers who exhibited more positive parenting and children with less dysregulation. We also predicted that both developmental status group and early positive parenting would be significant predictors of emotion dysregulation in middle childhood. Furthermore, we predicted that the effect of developmental status on emotion dysregulation would be mediated by positive parenting.

Method

Participants

Participants were 151 families in the Collaborative Family Study, a longitudinal study of children with and without DD, with families recruited from southern California (78%) and central Pennsylvania (22%). This study was based at three universities: Pennsylvania State University, University of California, Los Angeles and University of California, Riverside. The Institutional Review Boards of the three universities approved procedures; informed consent was obtained from participating parents and assent from the children. Families were assessed annually from child ages 3 through 9 years. The present sample was composed of all families for whom data were available on the primary measures at child ages 3, 4, and 7 years. We use the term developmental delay rather than the more formal diagnosis of intellectual disability (ID) for this sample because (a) the cognitive assessment was conducted on the children when they were young, likely resulting in a less stable classification over time than with older children and (b) the groupings were based on IQ alone.

Families were recruited at child age 3 years. Families of children with DD came primarily from agencies that provide diagnostic and intervention services for this population. Children with autism were excluded from the study. Families of children with TD were recruited primarily through local preschools and day care programs. Selection criteria were that the child scored in the range of normal cognitive development and had not been born prematurely or had any known developmental disability. In recruiting participants, school and agency personnel mailed brochures describing the study to families who met the selection criteria, and interested parents contacted the research centre. All children were initially assessed in their homes with the Bayley Scales of Infant Development (Bayley 1993) to confirm their developmental status.

Table 1 shows the sample demographic characteristics at child age 3 years, by TD ($n = 95$) or DD ($n = 56$) group status. Overall, mothers' race/ethnicity was primarily Caucasian, non-Hispanic (64.9%) or Hispanic (21.2%), with others African-American (7.3%), Asian (1.3%), Native American (1.3%) or self-identified as other (1.3%), The socioeconomic status was generally high; 60.7% of families had an annual income above $50 000 (in US dollars), and mothers' average years of schooling was 3 years of college. The status groups did not differ significantly on child gender, child race/ethnicity, parent race/ethnicity, parental marital status, family income or parental age; however, mothers of TD children completed significantly more years of schooling.

Procedures

Parenting measures were obtained though behavioural coding of mother–child interactions at age 4 years during an assessment at the research centre and another in the home. Further description of the behavioural coding tasks will be provided in the Measures section. Maternal scaffolding was coded from videotapes of three parent–child interaction tasks (3 min each) of increasing difficulty at the centre. For each task, the mother was assigned three scaffolding codes (motivational, emotional and technical). These codes were averaged over the tasks to increase measurement reliability and to provide a

Table 1 Demographics by status delay group at child age 3 years

Demographic	TD	DD	x^2 or t
Child gender (% male)	52.9	62.5	$x^2(1, N = 151) = 1.39$
Child race (% Caucasian)	62.1	57.8	$x^2(1, N = 151) = 0.28$
Marital status (% married)	85.1	78.1	$x^2(1, N = 151) = 1.21$
Mother's income (% > $50 000)	65.1	54.7	$x^2(1, N = 151) = 1.67$
Mother's grade in school (SD)	15.9 (2.2)	14.4 (2.1)	$t(149) = 4.26$***
Mother's age (years) (SD)	36.0 (5.7)	34.4 (6.5)	$t(149) = 1.60$

***$P < 0.001$

DD, developmental delays; TD, typical development.

single score of scaffolding. Maternal sensitivity was coded from behaviours during centre tasks and in naturalistic observations at home. Like scaffolding, the centre sensitivity tasks were videotaped and later coded by trained coders blind to the hypotheses of the study. The home sensitivity codes were rated live, during observation of family interactions. Thus, each mother–child dyad was assigned one sensitivity score for the centre tasks and one for the home observations, and the final sensitivity score was the average of these two scores. The child ER data were obtained through live behavioural coding and parent-report measures at age 7 years. The behavioural coding tasks at age 7 years were similar to those at age 4 years, consisting of two tasks with different levels of difficulty. Each child was assigned two dysregulation codes (emotion and behaviour). The dysregulation codes were averaged over the two tasks and two types of dysregulation in order to increase measurement reliability and to provide a single score for child dysregulation.

Measures

Cognitive ability

Children's cognitive ability was evaluated with the Bayley Scales of Infant Development (Bayley 1993), which assesses the motor (fine and gross), language (receptive and expressive) and cognitive development of infants and toddlers, ages 1–42 months. We used the Bayley Scales of Infant Development-II Mental Development Index scores to classify children as having DD (IQ < 70), borderline (IQ = 70–84) or typical cognitive development (IQ > 84). Children categorized as having DD or borderline IQ were combined in analyses and referred to as developmentally delayed.

Maternal scaffolding codes

Maternal scaffolding was assessed with the Maternal Scaffolding Coding System (Maslin-Cole & Spieker 1990). Highly effective scaffolding involved a mother providing the optimal level of support and assistance necessary to allow her child to succeed beyond what the child would have been able to achieve alone. Observers rated three dimensions of scaffolding for each task: technical, motivational and emotional. *Technical scaffolding* reflected the mother's ability to structure the task in such way that it was within the child's abilities to successfully complete it with her support. Effective technical scaffolding included providing demonstrations that were well-timed and designed to be easily understood by the child, pointing out critical features of the task and filling-in substeps that were too difficult for the child, without oversimplifying. *Motivational scaffolding* assessed the mother's ability to help the child initially become engaged with the task and her ability to maintain the child's focus on, and enthusiasm for, the task. Effective motivational scaffolding included clearly stating the goal of the task for a child who needed it reiterated, frequently praising and encouraging for effort, maintaining persistence toward the end goal even if the child started to lose focus and successfully refocusing a child who had become distracted. Finally, *emotional scaffolding* captured the mother's ability to make the task a positive experience for the child that would add to the child's sense of accomplishment and effectiveness. This reflected a high degree of acceptance of and value for the child's

attempts at the task, maintenance of sensitivity toward the child's emotional state, shared positive emotions between parent and child and statements that contributed toward the child's sense of pride and efficacy. Each form of scaffolding was rated on a 5-point scale ranging from 1 (*low quality scaffolding*) to 5 (*high quality scaffolding*) (see Hoffman *et al.* 2006 for further description of this coding system).

Baker *et al.* (2007) determined the reliability of the Maternal Scaffolding Coding System and reported intraclass correlations of 0.84 for motivational, 0.87 for emotional and 0.90 for technical scaffolding, based on review of 20% of tapes. Construct validity for the scaffolding system has been generated within the current sample through its relations with parent expressiveness (Baker & Crnic 2005), parental depression and child regulation (Hoffman *et al.* 2006), child social skills (Baker *et al.* 2007) and child behaviour problems (Marquis & Baker 2014).

Maternal sensitivity codes

Parent behaviour was coded from naturalistic home observations and centre observations of families using the Parent–Child Interaction Rating Scale (Belsky *et al.* 1995). For the home observation, families were observed in the evening, for a 90-min period at age 4 years. Coders observed for 10 min, followed by a 5-min scoring period. Ratings were averaged across the six 10-min observation periods. A number of parent, child and dyadic behaviours were observed. Each of the behaviours 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 behaviour. One of the dimensions, Sensitivity, was examined in the current study. Sensitivity was defined by maternal behaviour that was child-centred and developmentally appropriate. A sensitive mother is tuned to the child and manifests awareness of the child's needs, mood, interests and capabilities and allows this awareness to guide her interaction with the child.

Prior to collecting observational data in the home, coders were trained on videotapes of home observations and attended live home observations with an experienced coder until reliability was established. Reliability was defined as a criterion of over 70% exact agreement with the primary coder and 95% agreement within one scale point. After obtaining reliability, individual observers conducted home observations. To maintain reliability within and across project sites, we designated a primary coder at each site and determined reliability regularly through videotaped and live home observations. The kappa coefficient for within-site reliability was 0.61 and 0.59 at the California and Pennsylvania sites, respectively, and kappa for across-site reliability was 0.64 (Crnic *et al.* 2005). Kappa coefficients represent a conservative reliability index, and these levels are considered acceptable (Fleiss *et al.* 1969).

Emotion dysregulation codes

Child emotion and behaviour dysregulation were coded using the Dysregulation Coding System (Hoffman *et al.* 2006). The Emotion Dysregulation subscale was adapted from the parameters presented by Cole and colleagues (1994). This scale was designed to measure the appropriateness of the type, duration and intensity of emotional expressions as well as the lability and soothability exhibited by the child. Emotion dysregulation ratings, therefore, involved emotional expressions exhibited by the children, but as Cole *et al.* (2004) suggested, ratings also captured more process-level features of the expressions and their relationship to the context rather than simply considering the valence of the emotional expression. The children were assigned scores ranging from 0 (no evidence of dysregulation) to 4 (significant dysregulation). A score of 1 reflected a low degree of emotion dysregulation and described children who (a) displayed only one or two brief emotional expressions that were inappropriate to the situation and who were able to regroup on their own or (b) displayed one or two brief instances of emotional lability and/or variability in intensity of emotional expression and usually recovered quickly from inappropriate emotional experiences. In contrast, a child receiving a score of 4 showed significant dysregulation in that he or she displayed several intense emotional expressions or displayed less intense but frequent emotional expressions for the majority of the segment, was virtually unable to regroup without the help of the parent and was very labile, showing extreme variability in the intensity of emotion and/or very slow recovery from emotional experiences.

Behaviour dysregulation was coded separately from emotion dysregulation and included instances of poor

behavioural management by the child that impeded his or her ability to complete the task. This score included expressions of overt noncompliance or defiant behaviour and instances of disruptive behaviour. Behaviour dysregulation was coded on a scale similar to that of emotion dysregulation, ranging from 0 (no evidence of dysregulation) to 4 (significant dysregulation). A score of 1 described a child who displayed only one or two brief inappropriate behaviours during the segment, with no instances of intense behaviour disruption. A score of 4 indicated that a child displayed several intense disruptive behaviours or displayed less intense, but frequent, disruptive behaviours for the majority of the segment.

Hoffman *et al.* (2006) provided a more detailed presentation of the Dysregulation Coding System and reported reliability for the overall system at an intraclass correlation of 0.90. The Emotion subscale reliability was 0.79, and the Behaviour subscale was 0.90. Construct validity for the Dysregulation System within the current sample has been supported through its relationship with maternal scaffolding and child behaviour problems (Hoffman *et al.* 2006) and child social skills (Baker *et al.* 2007).

Emotion regulation checklist

Mothers completed the Emotion Regulation Checklist (ERC) (Shields & Cicchetti 1997), which assesses the parent's perception of the child's processes central to emotionality and regulation. This measure includes 24 items that are rated on a 4-point Likert scale indicating how frequently the behaviours occur (1 = almost always to 4 = never). The Emotion Regulation subscale includes items that assess situationally appropriate emotional displays, empathy and emotional self-awareness; sample items include 'Displays appropriate negative affect in response to hostile, aggressive or intrusive play' and 'Is empathic toward others'. The Lability/Negativity subscale includes items that assess aspects such as angry reactivity, emotional intensity and dysregulated positive and negative emotions; sample items include 'Exhibits wide mood swings' and 'Is easily frustrated'. Validity has been established using correlations with observers' ratings of children's regulatory abilities and the proportion of expressed positive and negative affect (Shields & Cicchetti 1997). Shields and Cicchetti (1997) reported that internal consistency was high for both factors (Emotion Regulation subscale $a = 0.83$; Lability/Negativity subscale $a = 0.96$). Since its development, the ERC has been used in previous research on child development, for example, on associations between ER and reactive aggression (Shields & Cicchetti 1998), specific language impairments (Schwartz & Proctor 2000) and academic success (Graziano *et al.* 2007). In the present sample, the two subscales of the ERC were found to have acceptable internal consistency (Emotion Regulation subscale $a = 0.71$; Lability/Negativity subscale $a = 0.87$).

Data analytic plan

Independent samples *t*-tests were used to compare TD and DD children on measures of maternal scaffolding and sensitivity and also child dysregulation (behavioural codes and ERC). SEM was used to investigate the relationship between positive parenting in early childhood and child ER abilities in middle childhood. Developmental group status was included in the model as a predictor of both parent and child behaviours. SEM allows for specifying, estimating and testing hypothesized interrelationships among a set of substantively meaningful variables (Bentler 2006). One of the strengths of SEM is the ability to construct latent variables, which are estimated in the model using observed indicator variables. The present study constructed a latent variable of positive parenting, consisting of the sensitivity and scaffolding codes, and a latent variable of child emotion dysregulation, consisting of the dysregulation codes, the ER subscale of the ERC and the Lability/Negativity subscale of the ERC. In addition, to examine the role of positive parenting as a potential mediator in the relationship between DD status and ER, we utilized a mediation analysis within the final structural equation model.

Lastly, as we found TD/DD group differences on mother's education, we tested two alternative models: (a) with mother's education only as the only predictor of child emotion dysregulation and (b) with mother's education added as a covariate to the main model. While the first model, with mother's education only predicting child emotion dysregulation, the model was determined to have good model fit: $x^2(2, N = 151) = 1.71$, $P = ns$, comparative fit index (CFI) = 1.00, root mean square error of approximation (RMSEA) = 0.00.

However, this model only accounted for 0.7% of the variance in child emotion dysregulation. The second model, with mother's education added as a covariate to the main model, was determined to have poor model fit: $x^2(12, N = 151) = 28.92$, $P < 0.001$, CFI = 0.90, RMSEA = 0.10. Of note, neither the directionality nor the significance of the path coefficients differed between the second model and the final model. For these reasons, the final model presented does not include mother's education as a covariate.

Results

Data management

Interrelations among motivational, emotional and technical scaffolding ratings were significant, with *rs* ranging from 0.39 to 0.69, and thus, subscales were combined into a composite scaffolding score that combined scores from all of the lab tasks. The scaffolding composite demonstrated an internal consistency of 0.88 at age 4 years. A composite sensitivity score was generated from combining scores from the home and lab tasks. The association between the final scaffolding and sensitivity composites was substantial, $r = 0.48$, $P < 0.001$. A composite of overall dysregulation was similarly generated by averaging the emotional and behavioural dysregulation ratings, which were significantly correlated, with *rs* ranging from 0.42 to 0.44 within each task. The dysregulation composite demonstrated an internal consistency of 0.74 at age 7 years.

Developmental status group differences

Table 2 presents status group differences on our variables of interest. We found group differences in positive parenting at age 4 years, such that mothers of TD children exhibited significantly more scaffolding behaviour. We also found group differences in emotion dysregulation at age 7 years, such that children with DD were significantly more dysregulated than TD children on the observational codes, ERC Emotion Regulation, and ERC Lability/Negativity.

Structural equation modeling

Structural equation modelling was used to evaluate the fit of the proposed causal model of positive parenting playing a role in ER difficulties in individuals with DD. All measurement parameters previously outlined applied to this analysis.

The model presented in Fig. 1 was tested with EQS Version 6 (Bentler 2006). Table 3 shows the intercorrelations among variables entered into the model. Three criteria were employed to evaluate model fit: the chi-square test, the CFI and the RMSEA. A non-significant chi-square value indicates adequate model fit, as do CFI values above 0.90 (range = 0–1.00) and RMSEA values below 0.08. Based upon these criteria, the fit of the overall model presented in Fig. 1 appeared excellent: $x^2(6, N = 151) = 5.49$, *ns*, CFI = 1.00, RMSEA = 0.00.

Structural equation modelling allows for the simultaneous evaluation of links between measured variables and latent constructs and of associations between the constructs themselves. Maximum-likelihood was used to estimate the model parameters. The latent factor variances were fixed at 1. All indicator loadings for the latent variables and all path coefficients were statistically significant. The model in Fig. 1 revealed developmental status as a significant

Table 2 Key variables by status delay group at all time points

Child age + variable	TD	DD	*t*
Age 4, maternal scaffolding	3.6 (0.7)	3.2 (0.9)	$t(111) = 2.35$*
Age 4, maternal sensitivity	3.2 (0.7)	3.0 (0.6)	$t(149) = 1.54$
Age 7, child Emotion Regulation codes	0.8 (0.5)	1.0 (0.7)	$t(112) = -2.67$**
Age 7, ERC Emotion Regulation subscale	27.1 (3.2)	25.8 (3.2)	$t(149) = 2.53$*
Age 7, ERC Lability/Negativity subscale	25.8 (6.0)	29.3 (7.1)	$t(149) = -3.40$**

*$P < 0.05$, **$P < 0.01$.

ERC, Emotion Regulation Checklist (Shields & Cicchetti 1997); DD, developmental delays; TD, typical development.

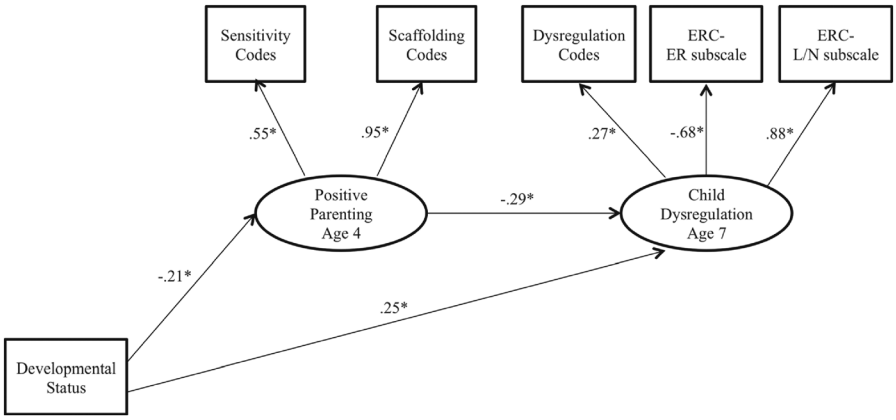

Figure 1 Maternal sensitivity as a mediator of the association between developmental status and child dysregulation. *Note*. *$P < 0.05$. ERC, Emotion Regulation Checklist; L/N, Lability/Negativity. Reported coefficients are standardized. Latent factor variances fixed at 1.

Table 3 Intercorrelations among variables entered into the model in Fig. 1

	Sensitivity	Scaffolding	ER codes	L/N sub
Scaffolding, age 4	0.52**			
ER codes, age 7	0.02	−0.04		
ERC L/N subscale, age 7	−0.16	−0.29**	0.23**	
ERC ER subscale, age 7	0.15	0.20*	−0.19*	−0.60**

*$P < 0.05$, **$P < 0.01$.
ER, emotion regulation; ERC, Emotion Regulation Checklist (Shields & Cicchetti 1997); L/N, Lability/Negativity.

predictor of maternal sensitivity at age 4 years. In addition, early positive parenting and developmental status were both significant predictors of emotion dysregulation at age 7 years. The total variance in children's emotion dysregulation accounted for by this mediation model was 18%.

Mediation testing

Next, we considered positive parenting as a mediator to determine its contribution to the relationship between DD and emotion dysregulation. Bootstrapped testing of the indirect effect is the preferred method for testing mediation, as the classic Sobel test's limitations include reduced power and assumption of normality (Hayes 2009). Unfortunately, we were unable to perform bootstrapped testing of our final structural equation model, as depicted in Fig. 1, because of a small sample size relative to the complexity of our structural equation model. Thus, we attempted to test mediation using a combination of Sobel testing and bootstrapping of a simplified version of our model. First, upon satisfying steps 1–3 of the causal steps approach, we found that the association between DD and dysregulation was reduced after controlling for positive parenting, original $\beta = 0.32$, $P < 0.05$; final $\beta = 0.22$, $P < 0.05$. We then employed the product-of-coefficients method (Sobel 1982) in order to provide a more direct test of whether the mediating variable significantly carried the effect of the predictor variable on the outcome variable. Results indicated that the indirect effect of DD through maternal sensitivity was approaching significance, providing tentative support for our hypothesis that maternal sensitivity carried the effect of DD on emotion dysregulation, Sobel = 1.64, $P = 0.10$. As one of the primary limitations of the Sobel test is reduced power, we set out to utilize

bootstrapping of our mediation model. We constructed an analogous but simplified path model version of the larger SEM, using the observed variables with the largest factor loading for each latent variable (i.e. scaffolding for positive parenting and ERC Lability/Negativity subscale for emotion dysregulation); see Fig. 2 for a diagram of this path model. Then, we applied the empirical bootstrap methodology, with 1000 bootstrap samples. As with any confidence interval method, mediation testing involves examining the bootstrap confidence interval to determine if it contains the value zero. If zero is not within the interval, then the null hypothesis of no indirect effect is rejected. Bootstrapping revealed the indirect effect of DD on emotion dysregulation through positive parenting to be significant, with an estimate of 0.66 and the confidence interval ranging from 0.1206 to 1.5504.

Discussion

We examined the predictive relationships among child DD, early positive parenting and child ER. Using these constructs, we simultaneously examined internal and external sources of individual differences in ER and considered potential interplay between them. We set out to extend previous research, which has predominantly focused on typically developing samples, early childhood and internal and external components of ER in isolation. SEM allowed us to specify, estimate and test a causal model among latent variables of parenting and ER, as these constructs are difficult, perhaps impossible, to measure directly.

First, we examined the data for status group differences on our variables of interest (positive parenting and child ER). There were significant status group differences in positive parenting in early childhood, such that mothers of DD group children exhibited less scaffolding at age 4 years. This result is consistent with previous studies that have found deficits in positive parenting in families of children with DD (Floyd & Phillippe 1993). We also found group differences in ER, such that children with DD were more dysregulated than TD children on all three of our measurements of ER, also consistent with previous research (Wilson 1999; Nader-Grosbois 2014).

Our primary analyses examined a causal model with positive parenting and child developmental status as predictors of subsequent child emotion dysregulation. To this end, we utilized SEM to create latent factors for positive parenting and child ER, with pathways from developmental status group to parenting and from status group and parenting to ER. The proposed model was determined to have excellent fit by the standardized SEM fit criteria. Furthermore, the pathways from the predictor variables to the outcome variables were statistically significant, such that developmental status was a significant predictor of positive parenting at age 4 years, and early positive parenting and developmental status were simultaneous significant predictors of ER at age 7 years. Then, in formal testing of mediation, results provided preliminary support for our hypothesis that positive parenting mediated part of the effect between developmental status and ER.

Given the research on the relationships between parenting and child ER in typically developing children and the developmental status group differences in regulation between children with and children without DD, this model fills a crucial empirical gap. No previous studies have examined parenting processes as a mediator of the effect between developmental status and ER difficulties. Perhaps the most relevant study to date, conducted by van Lieshout *et al.* (1998), examined concurrent

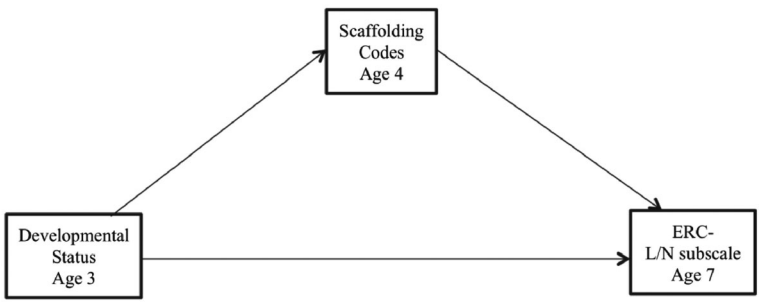

Figure 2 Simplified path model used for bootstrap testing of positive parenting as a mediator between developmental delay status and child dysregulation. *Note*. ERC, Emotion Regulation Checklist; L/N, Lability/Negativity.

relationships between family factors and personality profiles among children with genetic syndromes implicated in ID. One of the personality constructs, emotional stability, was defined as 'self-reliance, emotional balance, and being easy going', thus, not the same construct as ER, but related. For two of the genetic syndromes, Prader–Willi and Fragile-X, Van Lieshout found that parental anger was negatively associated with emotional stability. Although they examined these constructs cross-sectionally and did not formally conduct a mediation analysis, their findings are consistent with the view that parent behaviour has an impact on emotional development in children with delays.

Limitations and future directions

Certain limitations of the study should be noted. First, the positive parenting factor consisted of the observational measures of scaffolding and sensitivity. While these were assessed through careful behavioural coding, additional sources of information, such as self-report measures of parenting, may have improved the reliability and validity of the sensitivity factor. Because prediction across types of measurement can remove shared method variance and minimize potential biases, future investigators are encouraged to incorporate multiple methods of assessment. Second, while the ERC has been validated for completion by different types of adults familiar with the target child (parents, teachers and camp counselors), the ERC was administered to mothers only in this study. Obtaining scores from additional adults who interact with the children in different contexts, such as school, may provide a more comprehensive and valid ER score. Third, our prospective study provides evidence for causal pathways but does not prove causation. Experimental research would be necessary to establish causation, such as examining the effects on ER of an early intervention programme promoting sensitive parenting in young children with DD. Last, we were unable to test mediation within our full structural equation model via bootstrapping, as our sample size was small relative to the complexity of the model. The combination of direct mediation tests we employed (i.e. bootstrapped testing of a simplified version of the model and Sobel testing of the full model) suggested that positive parenting did indeed impact the relationship between DD and child emotion dysregulation. We strongly recommend for researchers with access to larger datasets with comparable measures of child IQ, positive parenting and child emotion dysregulation to replicate or build upon our findings.

Overall, the proposed mediation model fit the data very well and yielded significant, yet somewhat small effects; it accounted for 18% of the total variance in child dysregulation. This finding supports the theoretical model discussed earlier that a variety of internal and external factors contribute to individual differences in ER. As the current study examined the contribution of one internal factor (developmental status) and one external factor (positive parenting) to later emotion dysregulation, we encourage future investigators to include multiple internal and external factors within one model. Additional internal sources to be incorporated include child temperament and physiological reactivity; external sources include the emotional climate of the family, marital conflict and explicit ER training. Studies utilizing this multifaceted approach can help researchers compare and contrast the simultaneous contributions of these various proposed factors, which will, in turn, help inform prevention and intervention efforts directed at improving ER outcomes.

Implications

This work enhances understanding of the development of ER across childhood and how endogenous child factors (DD status) and exogenous family factors (positive parenting) affect this process. Our findings provide clear implications for early intervention programmes for children with ID. Because of the predictive relationships between (a) developmental status and ER and (b) parenting and ER, the results imply that sensitive parenting behaviours should be specifically targeted in parent interventions for children with DD. These findings provide empirical support for existing interventions that promote positive parenting in families of children with DD, such as Stepping Stones Triple P and Incredible Years Parent Training Program with DD modifications (McIntyre 2008). In addition, parent training should involve coaching specifically on scaffolding, a potentially difficult skill that is not included in traditional parent training protocols. As we found a relationship from age 4 to 7 years, it is

critical that these interventions happen very early, even in toddlerhood. Perhaps the most important takeaway from the present study is the dual effect of developmental status and parenting on ER. The findings suggest that the children at highest risk of dysregulation problems are those with DD and less positive parenting. Thus, it is critical for clinicians working with this population to assess parenting behaviours and intervene as necessary to promote positive parenting behaviours.

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