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What Are the Odds: Predicting the Likelihood of a Negative Episode in a Sample of Toddlers with ASD

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Introduction

There is growing evidence that individuals with autism spectrum disorder (ASD) have challenges in their emotion regulation capabilities (Berkovits et al. 2017; Mazefsky et al. 2013; Nuske et al. 2017a; Samson et al. 2014), where emotion regulation (ER) is defined as the process of modulating emotional reactions in the service of accomplishing social adaptation or achieving a goal (Thompson, 1994; Eisenberg & Spinrad, 2004). Emotion dysregulation, the inability to regulate emotions effectively or appropriately (Samson et al., 2014), may manifest in negativity and problematic behaviors, such as irritability, poor anger control, and temper tantrums (Prizant and Laurent 2011) which can interfere with interpersonal interactions and goal-oriented activities. Poor ER abilities, in combination with the core social-communications deficits that characterize ASD, may compound social-communication impairments and moderate response to intervention among children with autism (Berkovitz et al., 2017; Jahromi et al., 2013).

Emotion Regulation in Young Typically Developing Children

In typical development (TD), children show evidence of ER as early as 5 months of age when they display early forms of passive emotion regulation strategies such as orienting to their caregiver or assistance seeking as a means to reduce negativity (Stifter and Braungart, 1995). By preschool, TD children begin to shift from using predominantly other-directed strategies (i.e: orienting to the caregiver) to self-directed strategies (i.e.: using positive self-talk) in an attempt to modulate negative emotions (Kopp, 1982). During this time, children also shift from passive to more active forms of emotion regulation, such as cognitive reappraisal, as a result of a growing sense of autonomy and cognitive development (Kopp, 1982; Thompson & Goodman, 2010; Zimmer-Gembeck & Skinner, 2011). The ability to successfully regulate emotions has been shown to be a strong predictor of more successful peer interactions, less peer rejection, better mental health outcomes and better academic achievement in TD children (Denham, 2006; Hamre & Pianta, 2005; Ladd, et al, 2006; Fredericks, Blumenfeld & Paris, 2004), emphasizing its important role in childhood development.

Emotion Regulation in Young Children with ASD

There is ample literature to suggest that emotion regulation deficits are common among young children on the spectrum (Hirschler-Guttenberg et al., 2015; Jahromi et al., 2013;

Nuske et al., 2017a) and related to core deficits of ASD (Mazefsky et al., 2013), as well as other associated characteristics, such as executive dysfunction and sensory differences (Jahromi, et al., 2013; Samson et al., 2014). A recent study by Nuske and colleagues (2017a) found that preschoolers with ASD used other-directed strategies more frequently than their TD peers, leading the authors to speculate that these differences are indicative of a delay in ER abilities, rather than a deficit. These differences in ER among children with ASD are also reflected in findings of higher rates of negative emotionality (Konstantereas et al., 2006; Samson et al., 2014; Zwaigenbaum et al., 2015) and less successful employment of ER strategies (Jahromi, et al., 2012; Samson et al. 2015). Children with ASD also use more maladaptive ER strategies overall (Rieffe et al., 2011; Samson et al., 2015; Mazefsky et al., 2014; Samson et al., 2015; Samson et al., 2012), contrasting with TD children who use more adaptive strategies that are associated with positive future outcomes (Cai et al., 2018).

Similar to what is seen among TD children, ER abilities in children with ASD are associated with a range of future outcomes including social functioning (Cappadocia et al. 2012; Chamberlain et al. 2007), mental health (Mazefsky et al., 2014) and school readiness (Ashburner et al., 2008). These impairments in ER may be especially detrimental for children on the spectrum who experience core deficits in social-communication that already predispose them to challenges in social-functioning (Berkovitz et al., 2017).

The Role of The Caregiver

Caregivers of children with and without developmental disabilities are instrumental in facilitating the development of emotion regulation during early childhood (Kopp, 1982). Not only is the ability to regulate emotions developed through transactional interactions with caregivers over time, but caregivers also contribute to their children's in vivo regulation of negative emotions through co-regulation (Kopp, 1982; Hirschler-Guttenberg et al., 2015), where caregiver co-regulation refers to active emotional and motivational scaffolding strategies that are used with the explicit intent to assist the child in modulating their emotions (Gulsrud et al., 2010). Caregivers of children with ASD have been found to use a wide range of strategies to help their child co-regulate their emotions (Hirschler-Guttenberg et al., 2015; Valentovich et al., 2018), but appear to use comparatively more physical and active helping strategies (Gulsrud et al., 2010; Hirschler-Guttenberg et al., 2015; Ting & Weiss, 2017) and less cognitively sophisticated strategies in comparison to typically developing peers (i.e: cognitive reframing; Nuske et al., 2017). An association between caregiver co-regulation and decreased negativity has been found using a sample of toddlers with ASD (Gulsrud et al., 2010), but little is known regarding how specific caregiver co-regulation strategies impact the likelihood of children's dysregulation from moment to moment.

More broadly, caregivers' overall responsiveness during formative caregiver-child interactions may also impact their child's emotion regulation (Kopp, 1982; Mahoney & Perales, 2003). Responsiveness refers to attending to verbal and nonverbal bids from children in a way that is timely, contingent and appropriate. Examples of this could include responding to a child's question or offering assistance when requested. Caregiver responsiveness precludes behaviors that may be considered directive, such as commanding

the child's attention towards the adult's interest or directing the child's actions according to the caregiver's agenda (Bornstein et al., 2008; Shire et al., 2016). Responsive parenting in the context of behavioral intervention has been linked to improvements in social behavior and language attainment among children with ASD (Shire et al., 2016; Siller et al., Sigman, 2012); although little is known regarding the impact of caregiver responsiveness on emotion regulation in this population.

The Current Study

Children with ASD have difficulty maintaining reciprocal and high-quality social interactions with their caregivers (Adamson et al., 2009). While social communication delays clearly contribute to this difficulty, poor emotion regulation and negativity can magnify these deficits and quickly derail positive caregiver-child interactions (Hirschler-Guttenberg et al., 2014). Given that emotion regulation is largely formed through transactional caregiver-child interactions, mismatched caregiver-child interactions could in turn impact children's emotion regulation development (Kopp, 1982). Thus, it is important to understand what caregiver and child behaviors may help reduce the frequency of negativity so that high quality interactions can be maintained. Although correlates of emotion regulation and the role of the caregiver in co-regulating their child has been previously explored, no studies to date have attempted to explore how caregiver behaviors are predictive of the likelihood of children's expressed negativity over the course of a challenging task. The purpose of this study is two-fold: 1) to provide a fine-grained description of caregiver and child behaviors during a clinic-based caregiver-child interactions and 2) to evaluate the likelihood of an immediate negative episode following specific child emotion regulation strategies, caregiver co-regulation strategies and caregiver responsiveness will be evaluated. It is hypothesized that caregiver use of co-regulation strategies and responsiveness will contribute to a decreased likelihood of a child exhibiting a negative episode in the following interval, and that children's use of emotion regulation strategies will have limited success in decreasing negativity, based on previous findings showing that children with ASD have exhibit difficulties in regulating negative emotions (Berkovits et al. 2017; Mazefsky et al. 2013; Nuske et al. 2017a; Samson et al. 2014).

Methods

Participants

This study includes a sample of toddlers with ASD and their caregivers who participated in a randomized controlled efficacy trial of a parent-mediated social-communication intervention. Participants were originally recruited from a 10-week outpatient early intervention (EI) program, consisting of a combination of behavioral, speech, and occupational therapies for 30 hours a week. Children were included if they were younger than 36 months, had a clinical diagnosis of ASD confirmed by an independent assessment using the Autism Diagnostic Interview-Revised (ADI-R; Lord, Storoschuk, et al.,, 1993) and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000), had no significant physical disabilities, and both the caregiver and child were available for treatment and follow-up assessments. A total of 86 caregiver-child dyads enrolled in the study from

January 2007 to September 2012, 71 of whom were included in this study. For participant demographics, please see Table 1.

Procedures

Of the 86 toddlers with ASD (mean age = 31.2 months), 71 completed a frustration task with their caregiver upon entry to the study. Participants were excluded from analysis if the task was not completed (i.e. missing). The task used was similar to the "Locked Box" task from Laboratory Temperament Assessment Battery (Lab-TAB) battery, developed for use with typically developing preschoolers (Goldsmith et al., 1999). During this task, toddlers were given a locked toy box and a ring of keys and encouraged by caregiver to open the box. In order to ensure that the task was developmentally appropriate for toddlers with developmental delays, a developmentally appropriate toy box was used. The box used for this task resembled a small house with 4 doors, each door having a keyhole of a different shape (square, circle, triangle etc.). In order to open the box, children had to match the shapes and turn the key. Although caregivers were present during the task, they were asked not to assist their child in opening the box unless their child sought assistance. No instructions were given to caregivers regarding how to otherwise interact with their child. Interactions were videotaped and later coded in 10-second intervals for four factors related to the caregiver-child co-regulation process: child negativity, child emotion regulation strategies, caregiver co-regulation strategies and caregiver responsiveness.

Coded Measures

All child and caregiver variables were coded in 10-second intervals, culminating in a total of 18 intervals during the 3-minute task. For each interval, a primary code was given per variable in order to reflect the behavior represented in the majority of the interval. In the event of a tie, the latter behavior was chosen as the primary code. For child negativity, a binary variable, children were either designated as exhibiting or not exhibiting negativity during the given interval. In order to accurately capture dyadic behaviors, caregiver and child variables were coded independently of one another, such that no variable was reliant on the presence of another variable. Examples of this include coding children's and caregiver's use of regulation strategy regardless of whether negativity was coded in the same interval, and coding caregivers' use of physical comfort regardless of whether or not children exhibited comfort-seeking.

Child negativity.—Child negativity was coded based on an existing protocol used in a study of toddlers with ASD and their mothers (Gulsrud et al., 2010), using a binary variable indicating the presence of exhibited negativity. This code indicates whether or not children exhibited negative facial expression, such as furrowed brows and downturned mouths, or body negativity, such as foot stamping during a given interval.

Children's emotion regulation strategies.—Children's emotional regulation strategies codes were from existing protocol to indicate the presence of the following strategies: symbolic self-soothing, physical self-soothing, repetitive or idiosyncratic behaviors, tension release, avoidance, distraction, caregiver orientation, other-directed comfort seeking, and other-directed assistance seeking (see Table 2 for definitions; Gulsrud et al., 2010).

Caregiver co-regulation strategies.—The presence of the following caregiver regulation strategies was coded: active game-like engagement, redirection of attention, reassurance, following or physical comfort (see Table 3 for definitions; adapted from Gulsrud et al., 2010). The choice was made to eliminate "prompting/helping" from the original coding protocol in order to parse the emotional and motivational types of co-regulation from task-related helping behaviors. Instead, caregiver prompting/helping behaviors were captured by the "caregiver responsiveness" codes described below.

Caregiver responsiveness.—Caregiver's interactions with their children were coded based on the responsiveness items from the Maternal Behavior Rating Scale (MBRS; Mahoney, Powell & Finger, 1986) to indicate whether caregivers were: responsive, proactive, directive or non-responsive to their child's bid (see Table. 4 for definitions). This code is used to capture caregivers' helping behaviors and reflect how caregivers responded to children's bids for assistance during the task. Children's bids may include both verbal bids for their caregivers' attention (e.g: child asking their caregiver to "open") or nonverbal bids for their caregivers' attentions (e.g: reaching for caregiver or orienting to caregiver without vocalization).

Coding Procedures

A team of four undergraduate coders were trained to reliability (Cohen's Kappa's above 80% for all variables of interest) by the first author over a one-month period using a set of practice videos. Reliability was re-assessed over the course of the coding period, culminating in a total of 24% of videos (17 videos out of 71) that were double coded. Reliability was calculated for each variable of interest using Cohen's K and are as follows: children's negativity (k = .70, 95% CI [.59-.81]), children's emotion regulation strategies (k = 0.75, 95% CI [.69-.81]), caregiver responsiveness (k = .70 95% CI[.61-.80]) and caregiver's co-regulation strategies (k = 0.61 95% CI .53-.69]).

Data Analysis

This study reports on variables coded from videos collected at entry into the study. Descriptive information for each child and caregiver strategy was calculated as the percentage of total intervals in which the strategy was used as the primary strategy. A mixed effect logistic regression was used to examine the effect of specific child regulation strategies, caregiver co-regulation strategies and caregiver responsiveness on the presence or absence of negativity in the subsequent interval; a binary dependent variable (coded as present=1/not-present=0). Given that developmental age has been found to contribute to children's development of self-regulation (Kopp, 1982), the decision was made to control for children's developmental level by including Mullen Scales of Early Learning (MSEL) Developmental Quotient (DQ) in the model as a continuous covariate. The presence of negativity in the previous interval was included as a categorical covariate to control for the presence of sequential periods of negativity. The mixed effect model allows for the inclusion of subject level intercepts to account for the nested structure of the data (intervals nested within children), the random intercept was the only random effect included. To address the primary aim, the three covariates, child regulation strategies, caregiver co-regulation strategies, and caregiver responsiveness were included as categorical variables with each

level of the variable representing a specific strategy. The contrast (reference group) within each variable was always the absence of the strategy (i.e.: 0). This allowed for the effect of specific strategies on children's likelihood of having a negative episode to be determined. For example, whether the presence of a strategy in interval two makes a negative episode in interval three more or less likely. The model was fit using the glmer function within the lme4 package (Bates et al., 2015) in R (R Core Team, 2019). All data are reported in odds ratios, the upper and lower bounds of the 95% confidence interval are reported. 95% confidence intervals that do not cross a value of "1" are considered to be robust.

Community Involvement Statement

Given that the current study is a secondary data analysis of existing data collected as part of a larger randomized controlled efficacy trial of a parent-mediated social communication intervention, community members were not involved in the design and implementation of the current study.

Results

Descriptives and Preliminary Analyses

Descriptive statistics were run to ensure that the data met all the necessary assumptions for a mixed effects binary logistic regression. Variance inflation factors for all variables were less than 1.75 indicating little to no multicollinearity. The child emotion regulation strategies of symbolic self-soothing, physical self-soothing were used by only 7% and 5.6% of children and overall were not observed at a high enough frequency to accurately estimate the influence of these behaviors. To improve model convergence they were excluded from the subsequent analysis. This led to seven child emotion regulation strategies; repetitive behaviors, tension release, avoidance, distraction, maternal orientation, comfort seeking and assistance seeking.

Due to the low frequency of caregivers' use of co-regulation regulation strategies, occurring on average in 11.4% (SD=14.2%) of intervals across participants and only 33.8% of caregiver using any co-regulation strategy, the variable was collapsed into a binary variable representing either the presence or absence of a strategy in the interval. Caregiver's were responsive on average in 17.2% (SD=18.2%) of intervals, non-responsive in 7.7% (SD= 15.4%) and directive and proactive in 2.8% (SD=6.9%) and 3.3% (SD=8.6%) of intervals respectively. 70.4% of caregiver were responsive at least once while only 40.8% were non-responsive at least once.

On average children experienced a negative episode in 22.1% of intervals (SD=26.4%). The most common emotion regulation strategies used by the children were distraction, which children used on average in 20.4% of intervals (SD=26.6%) with 61.9% of children exhibiting the strategy at least once, and tension release which children used on average in 11.6% of intervals (SD=17.9) with 52.1% exhibiting the strategy at least once. (See Table 5 for full details on children's emotion regulation strategies, caregiver's responsiveness and use of co-regulation strategies).

Primary Analysis: Predictors of Child Negative Episode

Negativity.—The presence of negativity in the previous interval was related to an increase in the likelihood of a subsequent negative episode (OR=1.82, [1.12, 2.95]).

Children's Emotion Regulation Strategies—Tension release was a robust predictor of a subsequent negative episode, with the presence of tension release making a negative episode 2.28 times more likely, 95% CI [1.12, 4.65]. No other variables were related to increased or decreased likelihood of a subsequent negative episode All estimates are reported in Table 6.

Caregiver Co-Regulation Strategies and Responsiveness.—Caregiver's unresponsiveness to their child's bid led to a 4.86 times increase in the likelihood of a negative episode 95% CI [2.31, 10.24]. Additionally, the presence of proactive behaviors from the caregiver led to a 4.52 times increase, 95% CI [1.46, 14.02] and the presence of caregiver responsiveness led to a 2.25 times increase in the likelihood of a negative episode, 95% CI [1.24, 4.08]. The presence of caregiver co-regulation strategies (presence of any strategy) did not lead to either an increased or decreased likelihood of a subsequent negative episode (OR= 0.54, 95% CI [0.27, 1.09].

Discussion

This study offers further insight into the ways that caregivers and their toddlers with ASD navigate emotion regulation during a challenging task, as well as the way that caregiver and child behaviors are related to the likelihood of dysregulation during caregiver-child interactions in this population. First, children in this sample used a range of strategies during the task in an attempt to regulate their emotions, with only tension release predicting change in the likelihood of a subsequent negative episode. Second, findings of this study underscore the importance of *how* caregivers respond to children's bids for assistance during challenging interactions. Although no significant findings emerged regarding the impact of caregivers' use of co-regulation strategies on children's subsequent expression of negativity, significant findings emerged regarding caregivers' responsiveness to children's bids as a significant predictor of change in the likelihood of subsequent dysregulation.

Children's use of tension release (high-energy behaviors such as running back and forth) was the only strategy that predicted a change in likelihood of a negative episode, with tension release predicting an increased likelihood that children would display negativity in the subsequent interval. Although the role of high energy behaviors has not been established in the literature, this finding may be interpreted in several ways. For example, the presence of tension release itself may be an expression of children's dysregulation, or it may signal upcoming child dysregulation. Further exploration into the function of high energy and repetitive behavior is needed to understand the function of this behavior in children with ASD.

Also highlighted is the importance of how caregivers interact with their children in the context of challenging tasks. Surprisingly, caregivers' use of emotional co-regulation strategies was not found to significantly predict the likelihood of toddlers' upcoming

negativity in this sample. It is unclear as to whether this finding is a result of the low incidence of caregivers' use of co-regulation strategies during this task. This finding may also be explained by the nature of the task, for which caregivers were given instruction to abstain from offering assistance to their children unless specifically requested by the child. These instructions may have affected caregivers' use of co-regulation strategies, accounting for the lack of a significant finding for caregivers' use of co-regulation strategies. In order to further parse how caregivers' co-regulatory behaviors predict the likelihood of subsequent negativity, further exploration of these constructs during naturalistic interactions are needed.

Conversely, the way that caregivers responded to bids from their child did emerge as a significant predictor of subsequent negative episodes. Three of the four categories of caregiver responsiveness (caregiver responsiveness, caregiver proactiveness and caregiver unresponsiveness) emerged as significant predictors of an *increase* in children's subsequent negativity. When interpreting these seemingly contradictory findings, it is essential to consider that caregivers' responsiveness is wholly contingent on whether or not children made a bid. As such, there exists a confound between children's bids and caregiver responsiveness, which should be considered in the interpretation of the findings regarding caregivers' responsiveness. That said, one possible explanation for this phenomenon is that caregivers are responding to perceived negativity from their child, which is maintained through to the following interval. Additionally, given the confound between children's bids and caregiver responsiveness, it is possible that it is the act of the child making a bid towards their caregiver that may be partially responsible for the relationship seen between different types of caregivers' responsiveness and children's negativity. Lastly, it is also important to note that the finding regarding caregiver responsiveness behaviors are based on comparison with a reference group of the absence of caregiver assistance, as well as the absence of child indicators for need for assistance (ie., behavioral indicators, verbal bids and nonverbal bids).

With this in mind, perhaps the most important findings to emerge from the analysis of caregivers' responsiveness is that two caregiver behaviors, caregivers' unresponsiveness to children's bids and caregiver proactiveness, emerged as a robust predictors of a greater likelihood of an upcoming negative episode. The finding that caregivers' unresponsiveness to children's bids predicts a higher likelihood of a negative episode is not surprising, given the breadth of literature supporting the importance of caregiver responsiveness to facilitating children's emotion regulation. Caregiver proactiveness, or caregivers' responding to behavioral indicators of children's need for assistance, was also a significant predictor of the likelihood of children's upcoming negativity. Since this code captures caregivers' response to a perceived need for assistance from their child, it is possible that the finding that this finding can be attributed to caregivers detecting early indicators of dysregulation, which then predicted continued dysregulation. These results may suggest that caregivers are effective at detecting their children's need for assistance and are making active attempts to assist their children and deescalate children's emotional dysregulation. These findings are commensurate with previous literature identifying caregiver responsiveness as an important contributor to children's emotion regulation (Kopp, 1982; Mahoney & Perales, 2003), and indicate a need for a more thorough exploration of the way caregiver behaviors impact children's likelihood of dysregulation in real time.

Limitations

Findings should be interpreted with caution due to several limitations. First, data was collected using a contrived task designed to elicit frustration from children. Prior to beginning the task, caregivers were instructed by researchers to not intervene to help their child unless their child requests their help, whether verbally or nonverbally. The unfamiliar setting, and circumstances and instructions given to caregivers may have affected the way that they interacted with their children. This may explain the low incidence of co-regulation strategies used by caregivers in this sample. The interpretation of these findings is also complicated by the fact that caregiver and child behaviors were coded as mutually exclusive variables which, although necessitated by the limitations of the data, does not allow for a transactional understanding of how caregivers and their children with ASD negotiate the process of emotion co-regulation. Although these findings shed light on the nature of caregiver and children's co-regulatory behaviors during a contrived laboratory-based task, further work is needed to understand the transactional nature of caregiver-child co-regulation during naturalistic interactions.

This study is also limited by the size of the sample. Although 71 participants were included in this analysis, with a total of 1278 intervals across children, the nested structure of the data limited analytical power. Given the nature of the data, the choice was made to assign a predominant code per interval for each caregiver and child variable, which does not account for the intricate ways in which emotion regulation strategies interact nor does it fully capture the transactional nature of caregiver-child co-regulation. This indicates a need for a study of caregiver-child co-regulation using a larger sample, as well as using a task that provides more intervals per participant. This would build upon the current study by allowing for more detailed analysis of how strategies are used and combined by caregivers and children and how strategy use predicts the likelihood of subsequent negativity and changes in the intensity of negativity. Finally, the lack of a TD comparison group makes it difficult to make claims regarding whether the behaviors seen among participants of this study are typical for the population, and how these behaviors compare to those seen in TD children.

Conclusions

This study contributes to the literature on caregiver-child co-regulation in young children with ASD by exploring how caregiver and child behaviors impact the likelihood of changes in children's expressed negativity over the course of a challenging task. The findings of this study align with previous work that shows that toddlers with ASD use other-directed and avoidance type strategies most often (Jahromi, Meek & Ober-Reynolds, 2012; Konstantareas & Stewart, 2006) and expands upon this work by exploring the relationship between strategy use and the likelihood of subsequent negativity. These findings emphasize that toddlers with ASD are capable of employing emotion regulation strategies and begin to shed light on how certain behaviors may be predictive of changes in children's emotional states. Additionally, these findings underscore the important role played by caregivers in helping manage dysregulation in their child with ASD. Although caregivers' use of emotional co-regulation strategies did not predict a decrease in children's likelihood of negativity, the way that caregivers responded to their children during the task was a salient predictor of children's

likelihood of negativity. Specifically, caregivers' unresponsiveness to their children and caregivers' proactiveness both predicted increases in the likelihood of an upcoming negative episodes, which indicates the importance of caregivers' responsive behaviors not only for future outcomes (Shire et al., 2016), but during moment-to-moment caregiver interactions. These findings are promising given the move towards caregiver-mediated interventions that incorporate caregiver responsiveness as an element of fostering social-communication in this population (i.e: JASPER; Kasari et al., 2015), which appear to have a positive impact on children's emotion regulation over time (Gulsrud et al., 2010). Future research is needed to understand how caregiver and child behaviors interact to modulate children's negative emotions in real time, as well as to understand the effect of caregiver-mediated intervention on caregiver-child co-regulation, both in real time and longitudinally.

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Table 1:

Participants' Demographics (n=71)

	Mean/Count
Chronological Age (months)	31.48 (3.20)
Gender (%)	
Female	12
Race/Ethnicity (%)	
African American	2
Caucasian	46
Hispanic	6
Asian/Pacific Islander	6
Other	11
Mullen DQ	66.35 (18.78)
ADOS Severity	6.45 (1.86)
Reynell Receptive Language	−1.94 (1.25)
Reynell Expressive Language	−2.35 (0.91)
Caregiver's Age (years)	35.41 (6.55)
Caregiver Education	
High School Graduate	3
Some College	10
Special Training	2
College Graduate	30
Graduate School	26

Table 2:

Children's Emotion Regulation Strategies

Behavior	Definition
Symbolic Self-Soothing	Self-directed behaviors that include statements or activities indicating the use of cognitive/symbolic strategies to deal with frustration. Examples include positive self-talk (It's okay, I can do it!) and reappraisal ("It's not that hard").
Physical Self-Soothing	Bodily-directed behaviors such as thumb-sucking or playing with hair.
Repetitive/ Idiosyncratic Behavior	Child engages in repetitive behavior with no apparent instrumental focus. Examples include hand-flapping or echolalic vocalizations.
Tension Release	Child engages in high-energy behavior with no apparent instrumental focus. Examples include running, kicking legs and screaming.
Avoidance	Child engages in behaviors with the intended goal of distancing themselves from the task. This could include turning one's body away from the task (without an alternative focus) or trying to leave the room.
Distraction	Child focuses attention away from task, and towards another focus. Can attend to his/herself, another object in the room, or another place in the room. This can be distinguished from avoidance by the presence of an alternate focus of attention.
Caregiver Orientation	Child looks to caregiver without making bid for comfort or assistance. If gaze is paired with a bid for comfort (e.g: reaching out to be held) or assistance (e.g: "open?"), this behavior would be coded as comfort-seeking or assistance-seeking respectively.
Comfort Seeking	Comfort-seeking behavior such as wanting to be held, touching parent's hair or clothing, or reclining on parent's lap.
Assistance Seeking	Verbal or nonverbal behaviors meant to elicit help from another person. Examples to include asking for help ("I need help!") or nonverbally communicating the need for assistance (giving the keys to the parent while referencing the toy).

Table 3:

Caregiver Co- Regulation Strategies

Behavior	Definition
Active Game-Like Engagement	Caregiver actively plays with the child or engages in game-like activity (e.g., singing a song or tickling the child.)
Redirection of Attention	Caregiver distracts the child or directs the child's attention away from negative stimulus (e.g., drawing the child's attention to an item of interest.)
Reassurance	Caregiver reassures or encourages child surrounding frustrating or negative activity (e.g., "You can do it!")
Following	Caregiver's reflection, extension or elaboration upon child's distress or preoccupation (e.g., "I know you want to leave.")
Physical Comfort	Caregiver initiates behaviors to physically comfort their child (e.g. hugging, stroking hair, placing in lap).

Table 4:

Caregiver Responsiveness

Behavior	Definition
Responsive	Caregiver makes a contingent response to the child's verbal or nonverbal bid, regardless of whether task-related or not. This code can be used whether or not the caregiver's response was successful in achieving resolution of the problem. Example: A child is having difficulty manipulating the toy keys and asks for help, caregiver responds by adjusting the child's grip.
Proactive	Caregiver responds to their child's behavioral indications of needing assistance without a verbal or nonverbal bid from the child – this does not include instances in which a caregiver attempts to redirect their child when fixated. Example: A child is having difficulty manipulating the toy keys and is becoming visibly upset, the caregiver responds by adjusting the child's grip.
Directive	Caregiver guides the child's actions unsolicited, not in response to social bids or behavioral indications of the need for assistance. This includes instances in which caregiver attempts to redirect the child within the task if the child is fixated on repetitive behaviors. Example: Child is attending to the keys by visually inspecting and rotating them to view the shapes, the caregiver attempts to redirect the child by reminding them of the task.
Non-responsive	Caregiver does not respond to the child's verbal or nonverbal bid. Example: A child is having difficulty manipulating the toy keys and verbally asks the caregiver for assistance, the caregiver makes no response.

Table 5.

Percentage of Intervals with Behavior Present

	Mean of Percent of Intervals with Present (SD)	Range of Percent of Intervals with Present	Percentage of Children who Exhibit
Child Negativity	22.1% (26.4%)	0-94%	63.4%
Child Emotion Regulation Strategies			
No Strategy	27.7% (25.2%)	0-83%	77.4%
Symbolic Self-Soothing	1.5% (7.5%)	0-50%	7.0%
Physical Self Soothing	1.3% (6.2%)	0-38%	5.6%
Repetitive/Idiosyncratic Behavior	8.6% (16.7%)	0-63%	32.4%
Tension Release	11.6% (17.9%)	0-78%	52.1%
Avoidance	6.0% (11.2%)	0-64%	39.4%
Distraction	20.4% (26.6%)	0-100%	61.9%
Maternal Orientation	7.3% (11.8%)	0-65%	52.1%
Other Directed-Comfort Seeking	6.4% (11.8%)	0-67%	42.2%
Other Directed-Assistance Seeking	9.1% (13.5%)	0-61%	48%
Parental Responsiveness			
Responsive	17.2% (18.2%)	0-72%	70.4%
Proactive	3.3% (8.6%)	0-55%	22.5%
Directive	2.8% (6.9%)	0-33%	21.1%
Non-Responsive	7.7% (15.4%)	0-83%	40.8%

Table 6.

Predictors of a negative episode

	β	SE(β)	p	OR	Lower Limit	Upper Limit
Intercept	−1.75	0.62	.005	0.17	0.05	0.59
Child Strategies [*]						
Repetitive Behaviors	−0.96	0.60	0.11	0.38	0.12	1.25
Tension Release	0.83	0.36	.02	2.28	1.12	4.65
Avoidance	−0.23	0.50	0.64	0.79	0.30	2.11
Distraction	−0.50	0.36	0.17	0.61	0.30	1.24
Maternal Orientation	0.21	0.45	0.64	1.23	0.51	2.98
Comfort Seeking	−0.11	0.44	0.81	0.90	0.38	2.15
Assistance Seeking	0.21	0.38	0.57	1.23	0.59	2.57
Parent Responsiveness [**]						
Parental Responsiveness	0.81	0.30	.007	2.25	1.24	4.08
Proactive Behaviors	1.51	0.58	.008	4.52	1.46	14.02
Directive Behaviors	−0.03	0.68	.96	0.96	0.26	3.63
Parental Non-Responsiveness	1.58	0.38	<.001	4.86	2.31	10.24
Parent Strategies						
Parent ER Strategies	−0.61	0.35	0.08	0.54	0.27	1.09
Control Variables						
Mullen DQ	−0.01	0.01	0.41	0.99	0.97	1.01
Presence of Negativity	0.60	0.25	.02	1.82	1.12	2.95

[*] Reference group is no child strategy present

[**] Reference group is the absence of any child bids or indicators of need and absence of any caregiver assistance.