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Differentiating Preschool Children with Conduct Problems and Callous-Unemotional Behaviors through Emotion Regulation and Executive Functioning.

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Abstract

Objective: Callous-unemotional (CU) traits are important characteristics for identifying severe patterns of conduct problems (CP). The current study focused on a) identifying subgroups of young children displaying a combination of CP and CU *behaviors* and b) examining the extent to which executive functioning (EF) and emotion regulation (ER) are associated with CU behaviors.

Method: Participants included 249 preschoolers (N = 249, 78% boys, M_{age} = 4.95 years; 81% Latino/Hispanic) referred to treatment due to externalizing behavior problems. CU behaviors and CP were measured via a combination of teacher/parent rating scales. A multi-method approach was used to measure EF and ER including parent/teacher rating scales, neuropsychological, and observational tasks.

Results: Poorer ER as rated by parents/teachers and observed was associated with greater levels of CU behaviors. Latent profile analyses identified three subgroups of children displaying a) low CU/low CP, b) moderate CU/moderate CP, and c) high CU/high CP. Children in the high CU/high CP group were rated as having significantly poorer rated ER compared to all other groups and poorer observed ER compared to the low CU/low CP group. Exploratory analyses found that children in the high CU/high CP group displayed marginally lower levels of rated ER but significantly better EF performance on standardized neuropsychological tasks compared to children in a low CU/high CP group.

Conclusions: Children with higher levels of reported CU behaviors and CP display poorer ER yet may display relatively *better* EF performance compared to children with lower levels of CU behaviors and CP.

Keywords

callous-unemotional traits; conduct problems; preschool; self-regulation; emotion regulation; executive functioning

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Children with externalizing behavior problems (EBP) such as those with attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder, and conduct disorder

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represent the most common referrals to mental health clinics with prevalence rates between 5 to 11% (Perou et al., 2013; Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014). Prevalence of such EBP is even higher in preschool populations ranging from 7 to 25% (Egger & Angold, 2006; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009). Given the negative outcomes associated with early EBP (Coolahan, Fantuzzo, Mendez, & McDermott, 2000; Hoza, 2007; Lee, Humphreys, Flory, Liu, & Glass, 2011; Moffitt, Caspi, Harrington, & Milne, 2002; Molina et al., 2013; Molina & Pelham, 2003; Ros & Graziano, 2017), identifying which subgroup of children are at the greatest risk for a highly stable and persistent course of EBP (and associated conduct problems; CP) remains an important avenue for research. The current study focuses on the importance of callous-unemotional traits (CU), which refer to low levels of guilt, empathy, and caring for others (Frick, Ray, Thornton, & Kahn, 2013).

As reviewed by Frick and colleagues (2013), CU traits are important characteristics for identifying the most pervasive, severe, and aggressive patterns of antisocial behavior. While significantly less research has examined CU traits in young children, emerging works suggests that CU *behaviors*, a more developmentally appropriate way to refer to the CU construct in early childhood (Waller & Hyde, 2017), can be reliably identified in children as young as age three (Ezpeleta, Osa, Granero, Penelo, & Domènech, 2013) and are separate from general symptoms of EBP (Willoughby, Waschbusch, Moore, & Propper, 2011). Consistent with emerging neuroscience-related work attempting to understand the underlying processes involved in the development of such CU behaviors (Marsh et al., 2008), the current study focuses on examining the extent to which self-regulation processes relate to CU behaviors and can help to differentiate young children displaying varying levels of CP and CU behaviors.

Self-Regulation and CP

Broadly speaking, self-regulation refers to the skills and processes associated with the direction, planning, and control of attention/cognition, emotion, and behavior/action that are necessary for optimal adaptive functioning (Calkins, 2007; Ponitz et al., 2008). A review by Ursache, Blair, and Raver (2012) identified two domains of self-regulation as particularly relevant for studying young children's adaptive functioning: executive functioning (EF) and emotion regulation (ER). EF is a construct that unites cognitive flexibility, working memory, and inhibitory control for the purposes of planning and executing goal-directed activity (Blair, Zelazo, & Greenberg, 2005; Miyake et al., 2000; Pennington & Ozonoff, 1996). ER refers to effectively responding to emotional reactivity in a flexible manner, which can entail facilitating a reduction in the intensity of emotional arousal, but also includes the ability to generate and sustain emotions when contextually required (Bunford, Evans, & Wymbs, 2015; Calkins, 2007; Gross, 2011).

Children with EBP and associated CP are more likely to exhibit EF and ER difficulties compared to typically developing children (Barkley, 2010; Calkins, 2007; Campbell, 2002; Nigg, 2006; Skirrow, McLoughlin, Kuntsi, & Asherson, 2009). Deficits in self-regulation have been established as risk factors for the development of CP (Waschbusch, 2002). Additionally, while ER difficulties with negative emotion (Frick & Morris, 2004) and cognitive inhibition (Hobson, Scott, & Rubia, 2011) are associated with CP, it is important to acknowledge the heterogeneity in the early emergence of CP. Theoretical work by Frick & Morris (2004) suggests that ADHD behaviors and oppositionality represent more "hot" pathways towards early CP in terms of experiencing greater emotion dysregulation and poor inhibitory control and impulsivity. On the other hand, CU behaviors may be a "colder" pathway towards early CP in terms of emotional hyporesponsivity and moral/conscience deficits. As documented by Waller et al. (2015), while dimensions of ADHD behaviors, oppositionality, and CU behaviors can be distinguished during the preschool period, there is very little empirical work examining ER and EF as they relate to CU behaviors.

CU behaviors and ER

Early self-regulation difficulties within the emotional domain represent a distinct developmental pathway to CP, as both children with ADHD, as well as those displaying oppositionality, have been documented as having significant ER difficulties (Graziano & Garcia, 2016; Waller et al., 2015). On the other hand, as reviewed by Frick and Morris (2004), there are certain theoretical limitations to ER models of CP as it pertains to CU behaviors. For example, CP represents a wide range of behaviors, some of which are more likely to occur in the context of high emotional arousal (e.g., "overt" acts of aggression), while others may be more "covert" (e.g., lying) and are more likely to occur in the absence of emotional arousal. However, it is important to note that most prior work differentiating the link between ER and various types of CP was conducted with typically developing samples as part of temperament research (e.g., Frick & Morris, 2004) or with older children and adolescents (Frick & White, 2008). One of the few studies conducted with preschoolers found that CU behaviors were not associated with anger/frustration but rather with a lack of empathy and lower moral regulation (Waller et al., 2015). As pointed out recently by Dadds et al. (2016), relatively little is known about ER in children with high levels of CU behaviors, and it remains unclear within a clinically referred sample, the extent to which ER can differentiate children exhibiting early manifestations of CP with varying levels of CU behaviors.

CU behaviors and EF

Meta-analyses have documented significant deficits in EF, as measured by various neuropsychological tasks, among individuals with CP both in adult and adolescent samples (Morgan & Lilienfeld, 2000; Ogilvie, Stewart, Chan, & Shum, 2011). Significantly fewer studies have examined the specific link between EF and CU behaviors. Meta-analyses examining the CU traits/psychopathy domain within older adolescents and adults indicated that greater CU traits/psychopathy was associated with less EF deficits (Morgan & Lilienfeld, 2000; Ogilvie et al., 2011). However, the link between EF and CU behaviors in young children remains unclear. More recently within preschool samples, Ezpeleta et al. (2013) found that at the age of 3, CU behaviors correlated positively with EF deficits, as measured by teacher report on the Behavior Rating Inventory of Executive Function (BRIEF; Ezpeleta et al., 2013). Similarly, Waller et al. (2015; 2017) found CU behaviors in 3-year old children to be negatively correlated with effortful control performance.

EF and CU behaviors may also have an interactive effect in contributing towards later CP. For example, within an older sample of children and adolescents, the combination of high CU behaviors *and* high EF predicted higher risk for future violence (Baskin-Sommers et al., 2015; Munoz et al., 2008). On the other hand, Wall et al. (2016) found in a sample of elementary age children (mean age = 9.38) that higher CU behaviors in the absence of high levels of CP was associated with better EF. Borrowing from the adult psychopathy literature, individuals with significant levels of psychopathic traits (which would include CU behaviors) with better EF engage in better impulsive control and therefore are less likely to engage in antisocial acts (Gao & Raine, 2010). Once again, however, very little work has examined EF and CU behaviors in preschoolers as it relates to early CP. One of the few studies, to our knowledge, found that a combination of high levels of CU behaviors *and* poor EF constitutes the highest risk for predicting future aggression (Waller et al., 2017). Thus, more work is needed examining the link between CU behaviors and EF during the preschool period, especially as it relates to varying levels of CP. Additionally, no study to date has utilized a multi-method approach towards measuring EF (e.g., examining both parent report and performance-based measures) when examining CU behaviors and early CP.

Goals of the Current Study

In summary, significant work has established that children with EBP and associated CP experience significant self-regulation deficits across both EF and ER (Barkley, 2010; Graziano & Garcia, 2016). On the other hand, significantly less work has examined the underlying self-regulation processes involved in young children displaying CU behaviors. From a theoretical perspective, it is important to validate the extent to which preschool children displaying high levels of CP and CU behaviors represent a subgroup of children with EBP who are fundamentally different in terms of their underlying processes from those displaying pure CP. For example, the "colder" pathway to CP that is theorized to be linked to CU behaviors may be more tied to EF deficits, but not necessarily ER deficits that may be more pronounced in emotionally reactive children (such as those with high levels of CP but low levels of CU behaviors). Examining these subgroup differences during the preschool period is particularly important given that the most research on CU behaviors have been with older children and adolescents (Frick & White, 2008), and given the rapid developments of self-regulation during this period that are responsive to intervention (Bell & Wolfe, 2004; Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Blair & Diamond, 2008; Carlson & Wang, 2007; Graziano & Hart, 2016).

Hence, the goal of this study was to a) identify subgroups of clinically referred young children displaying a combination of CP and CU behaviors and b) examine the extent to which self-regulation processes, specifically EF and ER, are associated with CU behaviors and can differentiate such subgroups. Based on a prior latent profile analysis with older youth (Fanti, Demetriou, & Kimonis, 2013), we expected to find 5 subgroups of children displaying a combination of CP and CU behaviors such as a high CP/high CU group, a high CP/low CU group, moderate CP/moderate CU, low CP/high CU, and low CP/low CU. Based on prior work within the preschool period (Ezpeleta et al., 2013; Waller et al., 2015; 2017), we expected that EF deficits would be associated with greater levels of CU behaviors and be more prominent within a group of children displaying high levels of both CP and CU behaviors ("cold" pathway) compared to children displaying a more pure "hot" CP pathway (Frick & Morris, 2004). Children displaying a more "hot" CP profile were expected to have greater EF and ER deficits compared to children with low levels of CP/CU.

Method

Participants and Recruitment

The study took place in a large urban southeastern city in the U.S. with a large Hispanic/Latino population. Children and their caregivers were recruited from local preschools and mental health agencies via brochures, radio and newspaper ads, and open houses/parent workshops. Participants were required to (a) have an externalizing problems composite *t*-score of 60 or above on the parent (M = 64.87, SD = 12.32) or teacher (M = 66.75, SD = 13.23) Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004), (b) be enrolled in preschool during the previous year, (c) have an estimated IQ of 70 or higher (M = 91.64, SD = 14.90), and (d) be able to attend an 8-week summer program prior to the start of the kindergarten year. Sixty-eight families were screened out due to not meeting the above criteria.

The final sample consisted of 249 preschoolers (M_{age} = 4.96, SD = 0.51, & 78% male) whose parents provided informed consent to participate in the research. In terms of ethnic and racial makeup, 81% of the children were identified by parents as Hispanic/Latino White, 12% were identified as Non-Hispanic/Latino White, 4% were identified as Non-Hispanic/Latino Black, and 3% were identified as Hispanic/Latino Black. Sixty-three percent of children came from an intact family household. The socioeconomic status of the current sample was low- to middle-class (Hollingshead score: M = 43.13, SD = 12.82). Questionnaires, offered in the parents' preferred language, were completed primarily by mothers (93%). Rates of EBP diagnoses were derived from a combination of parent structured interview (Computerized-Diagnostic Interview Schedule for Children [Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000] or the Kiddie Disruptive Behavior Schedule; KDBS; [Keenan et al., 2007]) and parent and teacher ratings of symptoms and impairment (Disruptive Behavior Disorders Rating Scale [Pelham, Gnagy, Greenslade, & Milich, 1992] and Impairment Rating Scale [Fabiano et al., 2006]). Forty-three percent of children met DSM-5 criteria for both ADHD and Oppositional Defiant Disorder or Conduct Disorder, an additional 32% met criteria for ADHD alone, 14% met criteria for Oppositional Defiant Disorder or Conduct Disorder alone, and 11% did not meet any diagnosis. According to parent report at intake, only 11 children were on any psychotropic medication. Our results were the same with and without the inclusion of these 11 children and their data were retained in the final analyses.

Study Design and Procedure

This study was approved by the university's Institutional Review Board. All families participated in a pre-treatment assessment scheduled prior to the start of a summer treatment program. For this study, we were interested in a) identifying subgroups of clinically referred young children displaying a combination of CP and CU behaviors and b) examining the extent to which self-regulation processes, specifically EF and ER, are associated with CU behaviors and can differentiate such subgroups. As part of the pretreatment assessment, a laboratory visit lasting approximately two hours was conducted in which children completed several EF tasks as well as participated in two frustration tasks designed to measure ER. Parents also completed various questionnaires regarding their children's emotional, behavioral, and cognitive functioning. Similar questionnaires were also obtained from children's preschool teachers.

Measures

CP.—Parents and teachers completed the *Disruptive Behavior Disorders Rating Scale* (DBD; Pelham, Gnagy, Greenslade, & Milich, 1992) which assess for symptoms of ADHD, Oppositional Defiant Disorder, and Conduct Disorder. Each symptom of ADHD, Oppositional Defiant Disorder, and Conduct Disorder is rated on a 4-point scale with respect to the frequency of occurrence (not at all, just a little, pretty much, or very much). For the purposes of this study, we obtained an average score for the Oppositional Defiant Disorder and Conduct Disorder symptoms (α's = .71 - .88) as a measure of CP, given their significant correlations (*r*s = .51 - .65, *ps* <.001). Consistent with prior work using the "and/or" algorithm (Piacentini, Cohen, & Cohen, 1992; Bird, Gould, & Staghezza, 1992), and to maximize our ability to detect the most impaired children, the highest score among parent and teacher reports was used.

Callous-unemotional Behaviors.—Parents (α = .83) and teachers (α = .72) completed an abbreviated version of the *Inventory of Callous-Unemotional Traits* (ICU; Frick, 2004) consisting of 12 items identified by Hawes et al. (2014) as showing psychometric properties similar to those of the full ICU. Once again, the highest score among parent and teacher reports was used. The items were rated on a four-point Likert scale ranging from 0 (*not at all*) to 3 (*very much*), and a CU composite was created by averaging these 12 items.

Measures of Executive Function

Behavioral Rating Scale.—Parents and teachers filled out the *BRIEF-P* (Gioia, Espy, & Isquith, 2003). The BRIEF-P contains 63 items rated on a three-point Likert scale (*never*, *sometimes*, and *often*), which yield three overlapping indexes: Inhibitory Self-Control (Inhibit and Emotional Control), Flexibility (Shift and Emotional Control), and Emergent Metacognition (Working Memory and Plan/Organize), along with an overall Global Executive composite. To lessen the overlap between BRIEF items and DBD symptomology, the present study only examined the Emergent Metacognition composite (α = .99). The highest *t*-score among parent and teacher reports was used with higher scores indicating *poorer* EF.

Standardized assessment.—Children completed the *Head-Toes-Knees-Shoulders Task* (HTKS; (Ponitz et al., 2008). The HTKS is a direct, brief behavioral self-regulation measure used to assess multiple aspects of EF in preschoolers and kindergarteners including inhibitory control, working memory, and cognitive flexibility (McClelland & Cameron, 2012; Ponitz, McClelland, Matthews, & Morrison, 2009). The HTKS has two parts with 10 trials each. During the first part of the task, children are presented with a set of rules (i.e., head and toes), such that the child is required to do the opposite/different move from what is stated aloud. For example, when the examiner says, "touch your head" the correct behavioral response would require the child to touch their toes. For the second part, a new set of rules is added, shoulders and knees. The child receives 0 points for an incorrect response, 2 points for an immediate correct response, and 1 point for self-corrections with a total possible score of 40, with higher scores indicating better EF.

Children were also individually administered four subtests from the *Automated Working Memory Assessment* (AWMA; Alloway, 2007), a computer-based assessment of working memory skills for children ages four and up, including: (a) Word Recall (auditory short-term memory); (b) Listening Recall (auditory working memory); (c) Dot Matrix (visuo-spatial short-term memory); and (d) Mister X (visuo-spatial working memory). Raw scores are converted to standard scores using gender and age norms. To reduce the number of analyses and given the high correlations among the four AWMA tests (r's .66-.80, $p < .001$), an average standardized score was calculated and aggregated with HTKS given their moderate correlation ($r = .55$, $p < .001$) to form the EF Composite. The EF composite was used in subsequent analyses with higher scores indicating *better* EF performance.

Measures of ER

Behavioral Rating.—Parents and teachers completed the *ER Checklist* (Shields & Cicchetti, 1997). The ER Checklist is a 24-item questionnaire that uses a 4-point Likert scale (1 = *almost always* to 4 = *never*) and yields two subscales: the Negativity/Lability scale (15 items), which represents negative affect and mood lability (α's = .83 - .86), and the ER scale (8 items), which assesses processes key to adaptive regulation (α's =.70 – 74). For the present study, the emotion regulation scale and the reversed negativity/lability scale were standardized and averaged into a composite. The highest ER composite score between parents and teachers was used in subsequent analyses with higher scores indicating *better* ER.

Standardized Assessment.—Children were videotaped participating in two frustration tasks (*I'm not sharing* 4 min and *impossibly perfect circles* 3.5 min) adapted from the *Laboratory Temperament Assessment Battery* (LAB-TAB; Goldsmith & Rothbart, 1993) designed to elicit emotional distress and regulation. Unfortunately due to data corruption, which occurred during a migration of data storage systems, only a subset of the sample ($n = 146$) had usable videos that were coded for global regulation. Regulation, defined as the child's ability to maintain a calm state while using various strategies (e.g., distraction, self-soothing, and help seeking), was globally coded on a scale from 0 (*dysregulated/no control of distress*) to 4 (*child seemed to completely regulate distress during most of the task*). The reliability and validity of these frustration tasks and global regulation code have been demonstrated in previous studies across populations (Calkins, Graziano, & Keane, 2007; Zimmermann & Stansbury, 2003). The reliability Kappas for global regulation codes in this study were all above .80. To maximize our ability to detect ER impairment, the most severe rating of dysregulation between the two tasks was used.

Data Analysis Plan

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS 25.0) and Mplus (Version 8.2). For the measures used, there was minimal missing data for parent report or the EF tasks (< 2%) as well as teacher report (8%). ER coding data was only available on a subsample of 146 children, with data missing completely at random (Little's MCAR test: χ^2 (38) = 45.10, p = .20). There were no significant differences between children with complete versus partial data in terms of any demographic variables or any outcomes examined in the current study.

Preliminary analyses focused on identifying CU/CP subgroups in the data using latent profile analysis (LPA) conducted with the highest scores for CP and CU measures. Models with two to five classes were estimated and compared in order to determine the optimal number of groups. Nested model comparisons were made using: 1) bootstrapped likelihood ratio difference tests where k class models that are significantly different (p < .05) from k-1 models are preferred (Geiser, 2013), 2) Bayesian information criterion (BIC) and Akaike information criterion (AIC), where smaller values are preferred (Nylund, Asparouhov, & Muthen, 2007), and 3) consideration of entropy values, where values approaching 1 indicate strong delineation of class membership (Celeux & Soromenho, 1996). We then examined associations between the demographic variables and our study's dependent variables. For our main analyses, we conducted a regression to examine the extent to which the self-regulation measures uniquely related to CU behaviors. Multivariate analyses were then conducted with CU/CP group membership predicting the four dependent variables: parent/teacher rated ER (measured via the ER checklist), observed ER (measured by the global code across the two frustration tasks), parent/teacher rated EF problems (measured via the emergent metacognitive composite on the BRIEF), and EF performance (measured via the AWMA and HTKS composite). Follow-up ANCOVAs were conducted for each dependent variable. Bias-corrected Hedge's g effect sizes with confidence intervals, which can be interpreted similarly to the traditional Cohen's d (Durlak, 2009), were computed for comparisons among the groups.

Results

Preliminary Analyses

Comparisons of the results from an LPA of our CU parent/teacher composite (ICU total) and CP parent/teacher composite (DBD rating scale) indicated that a 3-class solution was most appropriate, fitting better (p <.001) than a previous model with two groups (see Table 2). While the 4-class solution showed improved fit based on model comparisons, the number of children comprising membership in that group (n = 2) was not considered meaningful. There was no improvement found by adding a fifth class, p = .25. The three retained groups differed significantly among each other on both the CP, F(2, 248) = 678.98, p <.001, and CU measures, F(2,244) = 35.26, p < .001, and bootstrapped Games-Howell post-hoc comparisons with 2000 replicates revealed significant differences between each group, ps <.001. Group 1 had the lowest CP (M = 0.49, SD = 0.22) and CU (M = 0.97, SD = 0.38) scores, group 2 exhibited moderate levels of both CP (M = 1.20, SD = 0.20) and CU (M = 1.18, SD = 0.38) scores, and group 3 had the highest scores on both CP (M = 2.01, SD

= 0.26) and CU (*M* = 1.66, *SD* = 0.54) measures. Based on these scores, the groups were labeled as follows: 1) Group 1 = low CU/low CP, group 2 = mod CU/mod CP, and group 3 = high CU/high CP.

Further preliminary analyses indicated a significant difference, *p* = .02, in terms of child IQ between group 1 (*M* = 90.00, *SD* = 15.27) and group 3 (*M* = 87.21, *SD* = 15.87). Given the comorbidity between ADHD and internalizing symptoms and its potential influence on EF (Schatz & Rostain, 2006), the internalizing subscale *t*-score on the BASC-2 (*M* = 56.16, *SD* = 13.26) was also examined as a potential covariate. Indeed, a significant difference ($p <.001$) was found in the internalizing subscale of the BASC-2 between group 1 (*M* = 52.61, *SD* = 10.57) and group 2 (*M* = 60.70, *SD* = 15.10), as well as a significant difference (*p* = .01) between group 1 and group 3 (*M* = 59.39, *SD* = 14.34). No other group differences for demographic variables (e.g., sex, SES) were identified. Correlational analyses with demographic and dependent variables were conducted using maximum likelihood (ML) and bootstrapped with 2000 replicates. In terms of our self-regulation variables, SES was positively associated with IQ, *r* = .16, *p* = .01, negatively associated with CP, *r* = −.15, *p* = .04, and CU behaviors, *r* = −.19, *p* = .01. Age was positively associated with EF task performance, *r* = .39, $p < .001$, and negatively associated with global observed ER, *r* = −.20, *p* = .01. Thus, children from higher SES families obtained higher IQ scores and were less likely to engage in CP and CU behaviors as rated by parents/teachers. The internalizing subscale was also positively associated with EF task performance (*r* = .13, *p* = .03) and CP (*r* = .27, $p < .001$). No other significant associations between demographic and any of our study variables emerged. All subsequent analyses controlled for SES, child age, IQ, and internalizing scores. See Table 1 for further descriptive statistics as well as correlations among variables.

Self-Regulation and CU traits

A regression model was estimated using ML with 2000 bootstrapped replicates to examine the extent to which the self-regulation measures uniquely related to CU behaviors. As seen in Table 3, after accounting for SES, child age, internalizing problems, and child IQ, significant associations emerged between the self-regulation measures and CU behaviors, $\chi^2(7) = 43.41$, $p <.001$, $R^2 = .18$. Parent/teacher rated ER significantly predicted CU behaviors, β = −.26, $p < .001$, such that higher levels of ER were associated with lower levels of CU behaviors. Observed ER was also significantly associated with parent/teacher rated CU behaviors, such that children who were better regulated were rated as having lower levels of CU behaviors, β = −.16, *p* = .05. Better EF task performance was marginally associated with higher levels of CU behaviors, β = .15, *p* = .08. There was no significant association detected between CU behaviors and parent-rated EF problems (*p* = .77).

Differentiating CU/CP Groups

Linear models with 2000 bootstrapped replicates using ML to account for missing data were fit to examine the extent to which CU/CP group membership was differentiated via the self-regulation measures, while accounting for SES, age, internalizing problems, and child IQ (see Figure 1). Overall class membership was a significant predictor of self-regulation measures, $F(2, 794) = 4.04$, *p* = .02. Considering bootstrapped fixed effects estimates, children in the high CU/high CP group displayed overall lower levels of self-regulation compared to children in the low CU/low CP group, $b = -0.32$, $SE = 0.13$, $p = .01$. There was no significant difference between children in the moderate CU/moderate CP group and the low CU/low CP group, $p = .73$. Children in the high CU/high CP group also displayed overall lower levels of self-regulation compared to children in the medium CU/medium CP group, $b = -0.30$, $SE = 0.12$, $p = .02$. Analysis of individual models revealed that there was a significant effect of group membership on observed ER, $b = -0.28$, $SE = 0.13$, $p = .03$, and parent/teacher rated ER, $b = -0.47$, $SE = 0.09$, $p < .001$. There was no significant effect on EF performance on standardized neuropsychological tasks ($p = .11$) or on parent/teacher rated EF problems ($p = .26$.).

As seen in Table 4, pairwise comparisons indicated that children in the high CU/high CP group had significantly poorer parent/teacher rated ER compared to both other groups (effect size Hedge's g ranged from −.62 to −1.08). Children in the moderate CU/moderate CP group also had significantly poorer parent/teacher-rated ER compared to the low CU/low CP group ($g = -0.47$). Additionally, children in the high CU/high CP group displayed poorer observed ER compared to children in the low CU/low CP group, $g = -.61$. Interestingly, children in the moderate CU/moderate CP group had moderately significantly higher levels of parent/teacher rated EF problems compared to children in the low CU/low CP group, $g = 0.25$. However, confidence intervals crossed zero and the result was considered untenable.

Exploratory Comparisons.—As the first LPA did not indicate the existence of a group of children with high CP but low CU traits, a second LPA was conducted on a subsample ($n = 153$) of only children diagnosed with Oppositional Defiant Disorder or Conduct Disorder (with and without ADHD). However, only a 2-class solution was found to appropriately fit the data ($p = .004$) while models with three to five classes showed no improvement (ps = .22 to .29). The two groups differed significantly between each other on both CP ($p < .001$) and CU measures ($p < .001$). But, children in each group had either both low CP ($M = 0.93$, $SD = 0.35$) and low CU ($M = 1.09$, $SD = 0.44$) or high CP ($M = 1.99$, $SD = 0.25$) and high CU ($M = 1.54$, $SD = 0.50$). Thus, in order to compare children with high levels of CP and high CU to children with high levels of CP but with low CU, two groups were created following procedures outlined by Frick et al. (2003) and Platje et al. (2018): 1) children scoring at or above the upper quartile on CP *and* CU behaviors (high CP/high CU; $n = 28$), and 2) children scoring at or above the upper quartile on CP *and* below the mean on CU traits (high CP/low CU; $n = 18$). Considering bootstrapped fixed effects estimates, no differences emerged between children in the high CP/high CU and those in the high CP/low CU in terms of observed ER or parent/teacher rated EF problems. However, children in the high CP/high CU group displayed marginally lower levels of parent/teacher rated ER compared to children in the high CP/low CU group, $b = -0.56$, $SE = 0.29$, $p = .098$, $g = -0.59$. Children in the high CP/high CU group showed *better* EF performance on standardized neuropsychological tasks compared to children in the high CP/low CU group, $b = 0.52$, $SE = 0.21$, $p = .026$, $g = 0.79$.

Additionally, comparisons were made between children in the high CP/high CU group to children who did not meet criteria for any diagnosis (no-Dx; $n = 26$). Considering bootstrapped fixed effects estimates, children in the high CP/high CU group displayed lower levels of observed ER compared to children in the no-Dx group, $b = -0.83$, $SE = 0.39$, $p = .046$, $g = -0.67$. Children in the high CP/high CU group also showed lower levels of parent/teacher reported ER compared to children in the no-Dx group, $b = -0.71$, $SE = 0.29$, $p = .02$, $g = -0.77$. Finally, no differences were found for either parent/teacher rated EF problems or EF performance between children in the high CP/high CU group and children in the no-Dx group.

Discussion

This is one of the first studies to our knowledge to examine the extent to which self-regulation processes relate to CU behaviors and can help to differentiate young children with EBP displaying early manifestations of CP both with and without CU behaviors. A multi-method approach was used to measure EF and ER including rating scales along with neuropsychological and observational tasks. Our dimensional analyses indicated that even after accounting for global levels of internalizing symptoms and IQ, better ER, across both parent/teacher ratings and observation, was associated with *lower* levels of CU behaviors. At a group level, and counter to the latent profile analyses results of Fanti and colleagues (2013), we only found three groups marked by high, moderate, and low levels of CP and CU behaviors. Children in the high CP/high CU group were rated as having significantly poorer ER by parents/teachers compared to children in all other groups, as well as poorer observed ER compared to children in the low CU/low CP group. To directly compare children with high CP/high CU to those with high CP/low CU, an exploratory set of analyses were conducted in which we created these two groups following procedures by Frick et al., (2003). This set of exploratory analyses indicated that children in the high CP/high CU group displayed marginally lower levels of parent/teacher rated ER but significantly *better* EF performance on standardized neuropsychological tasks compared to children in the high CP/low CU group. The implications of our findings are discussed in further detail below.

The few preschool studies examining EF and CU behaviors found that CU behaviors positively correlated with greater EF deficits either as reported by teachers (Ezpeleta et al., 2013) or as measured by task performance (Waller et al., 2015; 2017). Counter to the aforementioned studies, the current study found no association between CU behaviors and EF problems as rated by parents/teachers on the BRIEF. In fact, our exploratory analyses suggested a positive link between CU behaviors and EF as children classified in the high CP/high CU group had *better* EF performance on standardized neuropsychological tasks compared to those classified in the high CP/low CU group. However, further discussion of these results are considered premature given the exploratory nature; instead, we recommend that future work consider these findings as stepping stone to a more in-depth exploration of how young children's EF development may relate to the development of CU behaviors in both community and high-risk samples. Additionally, it is important to note that our EF performance composite cannot tease apart the specific domains of EF in which children with higher levels of CU traits may be outperforming children with lower levels of CU traits. Given that inhibitory control, working memory, and cognitive flexibility appear to be more reliably differentiated in later childhood (Anderson & Reidy, 2012; Blair et al., 2005), it will be important for future work to examine the association between these different facets of EF and CU traits in older elementary age children.

Within the ER domain, prior theoretical and empirical work with older samples suggested that children with CP and high levels of CU behaviors might not necessarily have emotionally based regulation deficits that typically contribute to more impulsive acts of aggression (Frick & Morris, 2004). Rather, such a subgroup of children with CP may in fact have more of a "cold" lack of emotional arousal/reactivity that contribute to more planful/covert acts of aggression and a more fearless interpersonal style (Frick & White, 2008; Viding, Fontaine, & McCrory, 2012). Our findings within a clinically elevated sample of preschoolers with EBP are somewhat counter to the notion that ER deficits are not as prominent among children with CP and higher levels of CU behaviors. Specifically, we found that poorer ER as rated by parents/teachers was associated with higher levels of CU behaviors. However, when examining the ER Checklist, it is apparent that a significant number of the items seem to be measuring more of a child's general affect (e.g., "seems sad or listless," "displays flat affect," "displays appropriate negative affect," "is a cheerful child.") versus a child's ability to control their emotions upon being upset or overly excited. Our results may be capturing parents and teachers' perception that this subgroup of children have a flatter and generally more negative emotional affect. Indeed, other studies have documented that children and adolescents with higher levels of CU behaviors appear angry and emotionally dysregulated (Ciucci, Baroncelli, Golmaryami, & Frick, 2015; Hubbard et al., 2002; Muñoz et al., 2008), and thus would be rated by parents and teachers as showing problems in ER.

An association was found between observed ER (across our two frustration tasks) and CU behaviors. It is important to note that without a typically developing control group comparison we cannot be certain the extent to which our observed measures capture the severity of emotion dysregulation present in our EBP sample. Nevertheless, observed emotion dysregulation (regardless of how severe that may have been compared to a typically developing sample) was associated with higher levels of CU behaviors. It is important to note once again that we were not able to identify a group of high CP/low CU with the LPA analysis and our exploratory analysis creating the high CP/high CU and high CP/low CU groups following Frick et al., (2003) procedures yielded no significant differences in observed ER between groups and only a marginal difference in terms of parent/teacher rated ER. Of note, children in the high CP/high CU group did exhibit poorer ER (both observed and reported by parents/teachers) compared to children in the no diagnosis group. Thus, our findings could be interpreted as capturing the "hot" deficits seen in an early CP group characterized primarily by ADHD symptoms. However, since this study is the first, to our knowledge, to link observed ER dysfunction and CU behaviors, it raises questions in terms of the validity of a "cold" path towards early CP model as it relates to CU behaviors. More studies are clearly needed that incorporate observed and more objective measures in combination with parent/teacher reports to disentangle the multiple aspects of emotion dysregulation that may be involved in early CU behaviors and that contribute to longer term CP.

Some limitations to the current study need to be addressed. First, although findings were statistically significant with moderate to large effect sizes, the cross-sectional aspect of this study precludes us from determining whether EF and ER processes can indeed contribute to children's expression of CU behaviors. Alternatively, children's early CU behaviors may contribute to the development of a flatter emotional style, while engaging in more covert and planful acts of aggression could further reinforce their EF skills. As it relates to our observation of ER, collecting psychophysiological measures (e.g., respiratory sinus arrhythmia and pre-ejection period) during these tasks would further our understanding on whether children with high levels of CU behaviors are very good at regulating their visible emotions while "under the skin" may still be reactive or simply do not require regulation due to a lack of physiological reactivity. Additionally, our clinical sample may have lacked variability in CP (since almost all had a diagnosis of ADHD and/or Oppositional Defiant Disorder or Conduct Disorder) to capture further groups of children with high CP/low CU. Lastly, another limitation of the current study is the homogeneity of the sample, which was largely Hispanic/Latino (81%) due to the study's geographical location. The homogeneity of the sample limits the generalizability of these findings. However, this limitation is also a strength as Latino children represent the fastest growing group in the U.S., but are understudied in child psychopathology research (La Greca, Silverman, & Lochman, 2009).

In sum, our findings suggest that preschool children with EBP who are reported as having higher levels of CU behaviors and CP display poorer ER (both as reported by parents/ teachers and observed), compared to children with lower levels of CU behaviors and CP. Future studies need to carefully consider the context and type of observation task used when trying to assess the emotional reactivity and regulation abilities of children with high levels of CU behaviors. Given our mixed findings as it relates to the link between EF and CU behaviors, it will be important to continue to explore how children's cognitive development relate to the emergence of CU behaviors. Finally, it will be important for future studies to longitudinally track the EF and ER abilities of preschool children with EBP identified as having high levels of CP with varying levels of CU behaviors to determine (a) the extent to which this self-regulation profile persists, (b) the extent to which this profile is affected by various socialization variables (e.g., peers, parenting), and (c) perhaps most importantly, the extent to which early intervention can ameliorate the expression of such CU behaviors by targeting some of these self-regulation processes, especially those that appear more impaired (i.e., reactivity, emotional processing).

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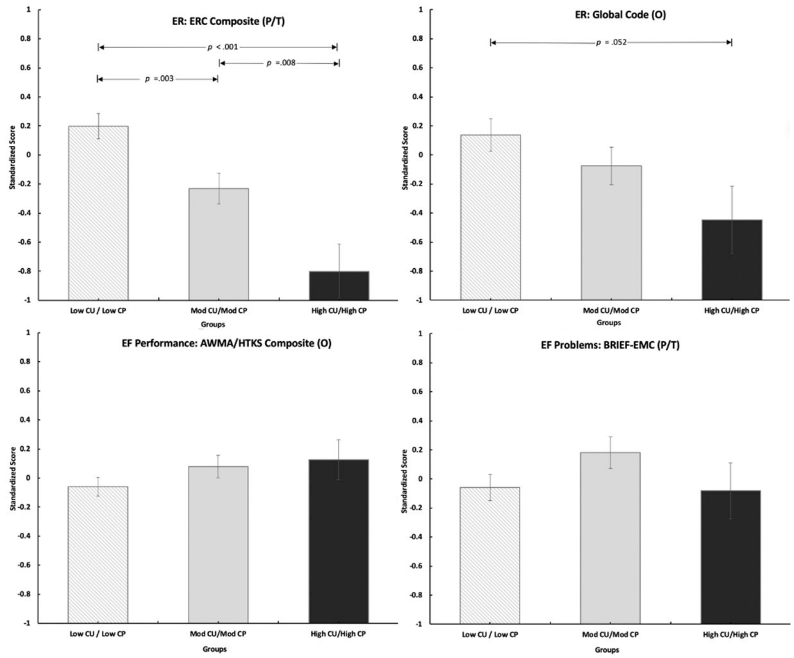

Figure 1.

Estimated marginal means for standardized scores on outcome measures. Error bars represent standard error controlling for socioeconomic status, child age, internalizing problems, and child IQ. ER = Emotion Regulation, ERC = Emotion Regulation Checklist, EF = Executive Functioning, BRIEF = Behavior Rating Inventory of Executive Function-Preschool Version, EMC = Emergent Metacognitive Composite, AWMA = Automated Working Memory Assessment, HTKS = Head-toes knees-shoulders task, P/T = parent/teacher report, O = observational/standardized assessment. Data for ER: Global code (O) available from a smaller subsample (n = 146).

Table 1.

Descriptive Statistics and Correlations between Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. CU Traits: Mean item score ICU (P/T)	1.12	.45	--					
2. CP: Mean ODD/CD item score DBD (P/T)	.90	.55	.40***	--				
3. ER: Lab-TAB-Global Regulation Code (O)	2.18	.99	−.14*	−.12	--			
4. ER- ERC Z-score Composite (P/T)	−.39	.95	−.35***	−.51***	.17**	--		
5. EF Performance: AWMA/HTKS Z-score Composite (O)	.00	.88	.16*	.23***	.09	−.11	--	
6. EF Problems: BRIEF-EMC t-score (P/T)	75.36	13.15	.06	−.03	−.14*	−.14*	−.24***	--

Note. All analyses controlled for SES and child age;

+ $p < .10$.

* $p < .05$.

** $p < .01$,

*** $p < .001$. CU = Callous-unemotional traits, ICU = Inventory of Callous-Unemotional Traits, CP = Conduct Problems, ODD/CD = Oppositional Defiant Disorder/Conduct Disorder, DBD = Disruptive Behavior Rating Scale, ER = Emotion Regulation, ERC = Emotion Regulation Checklist, EF = Executive Functioning, AWMA = Automated Working Memory Assessment, HTKS = Head-toes knees-shoulders task, BRIEF = Behavior Rating Inventory of Executive Function-Preschool Version, EMC = Emergent Metacognitive Composite. P/T = parent/teacher report, O = observational/standardized assessment. Data for ER-Lab-TAB Global Regulation code (O) available from a smaller subsample (*n* = 146).

Table 2.

Model Comparisons for Latent Profile Analysis

Classes	Class counts (*n*)	Bootstrapped -2LL	AIC	BIC	Entropy
2	1 = 205 2 = 44	p <.001	655.64	680.26	.79
3	1 = 135 2 = 86 3 = 28	p <.001	634.78	669.96	.82
4	1 = 134 2 = 87 3 = 26 4 = 2	p = .01	627.91	673.64	.86
5	1 = 110 2 = 56 3 = 55 4 = 2 5 = 26	p = .25	627.68	683.23	.79

Note. −2LL = 2 Times the log likelihood difference, AIC = Akaike information criterion, BIC = Bayesian information criterion. Class counts based on their most likely latent class membership.

Table 3.

Self-regulation Model for Predicting CU traits

Predictor	**β**	***SE***	**95% BCI**	**Model R^2**	**Δ R^2**
Step 1.					
Child Age (P)	−.12	0.08	−0.29, 0.05	.04	.04
Socioeconomic Status (P)	−.15[+]	0.003	−0.01, 0.001		
Child IQ (O)	−.01	0.002	−0.01, 0.01		
Internalizing Problems: BASC-2 (P)	.07	0.003	−0.003, 0.01		
Step 2.					
ER-ERC Z-Score Composite (P/T)	**−.38*****	0.04	−0.26, −0.11	.24	.20
ER-Lab-TAB-Global Regulation Code (O)	**−.17***	0.04	−0.14, −0.01		
EF Problems: BRIEF-EMC t-score (P/T)	.01	0.04	−0.07, 0.07		
EF Performance: AWMA/HTKS Z-score (O)	.13	0.05	−0.04, 0.16		

Note. Standardized scores reported.

[+] $p \leq .10$,

[*] $p \leq .05$.

[**] $p \leq .01$,

[***] $p \leq .001$. BCI = Bootstrapped Confidence Intervals, CU = Callous-unemotional traits, ER = Emotion Regulation, ERC = Emotion Regulation Checklist, EF = Executive Functioning, BRIEF = Behavior Rating Inventory of Executive Function-Preschool Version, EMC = Emergent Metacognitive Composite, AWMA = Automated Working Memory Assessment, HTKS = Head-toes knees-shoulders task, P/T = parent/teacher report, O = observational/standardized assessment. Data for ER-Lab-TAB Global Regulation code (O) available from a smaller subsample (n = 146).

Table 4.

Group Comparisons of Estimated Marginal Means

Measure	Group	*M* (*SD*)	Effect Sizes for Group Differences Hedges *g* [95% CI]		
			Low CU/Low CP	**Mod CU/Mod CP**	**High CU/High CP**
ER: ERC Composite (P/T)	Low CU/Low CP	0.20 (0.92)	-	−0.47[−0.76,−0.17]**	−1.08[−1.54,−0.62]***
	Mod CU/Mod CP	−0.23 (0.93)	-	-	−0.62[−1.08,−0.15]**
	High CU/High CP	−0.80 (0.91)	-	-	-
ER: Global code (O)	Low CU/Low CP	0.14 (0.96)	-	−0.23[−0.57,0.13]	−0.61[−1.15,−0.08]*
	Mod CU/Mod CP	−0.08 (0.97)	-	-	−0.38[−0.93,0.17]
	High CU/High CP	−0.45 (0.96)	-	-	-
EF Problems:	Low CU/Low CP	0.20 (0.92)	-	0.25[−0.04,0.54]+	−0.03[−0.47,0.42]
BRIEF-EMC (P/T)	Mod CU/Mod CP	−0.23 (0.93)	-	-	−0.27[−0.73,0.19]
	High CU/High CP	−0.80 (0.91)	-	-	-
EF Performance:	Low CU/Low CP	0.20 (0.92)	-	0.21[−0.09,0.50]	0.28[−0.17,0.72]
AWMA/HTKS Composite (O)	Mod CU/Mod CP	−0.23 (0.93)	-	-	0.08[−0.39,0.53]
	High CU/High CP	−0.80 (0.91)	-	-	-

Note. ***$p < .001$, ** $p<.01$, *$p < .05$, +$p<.10$. Means and *SD*s are marginal estimates of standardized scores, controlling for socioeconomic status, child age, internalizing problems, and child IQ. Data for ER: Global code (O) available from a smaller subsample ($n = 146$). Mod = Moderate. ER = Emotion Regulation, ERC = Emotion Regulation Checklist, EF = Executive Functioning, BRIEF = Behavior Rating Inventory of Executive Function-Preschool Version, EMC = Emergent Metacognitive Composite, AWMA = Automated Working Memory Assessment, HTKS = Head-toes knees-shoulders task, P/T = parent/teacher report, O = observational/standardized assessment. Data for ER-Lab-TAB Global Regulation code (O) available from a smaller subsample ($n = 146$).