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Towards an understanding of the role of the environment in the development of early callous behavior

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Abstract

Key to understanding the long-term impact of social inequalities is identifying early behaviors that may signal higher risk for later poor psychosocial outcomes, such as psychopathology. A set of early-emerging characteristics that may signal risk for later externalizing psychopathology is Callous-Unemotional (CU) behavior. CU behavior predict severe and chronic trajectories of externalizing behaviors in youth. However, much research on CU behavior has focused on late childhood and adolescence, with little attention paid to early childhood when preventative interventions may be most effective. In this paper, we summarize our recent work showing that: (1) CU behavior can be identified in early childhood using items from common behavior checklists; (2) CU behavior predicts worse outcomes across early childhood; (3) CU behavior exhibits a distinct nomological network from other early externalizing behaviors; and (4)

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malleable environmental factors, particularly parenting, may play a role in the development of early CU behaviors. We discuss the challenges of studying contextual contributors to the development of CU behavior in terms of gene-environment correlations and present initial results from work examining CU behavior in an adoption study in which gene-environment correlations are examined in early childhood. We find that parenting is a predictor of early CU behavior even in a sample in which parents are not genetically related to the children.

Keywords

adoption; antisocial behavior; callous-unemotional behavior; gene-environment correlation; parenting

Overview

Social and economic inequalities across a wide array of outcomes from school performance to violence have been shown to emerge very early in childhood (Campbell, 1995). In particular, early childhood externalizing behaviors can lead to long term trajectories of antisocial behavior (AB), including aggression, substance use, and theft, which put children at risk for criminality and incarceration later in life (Shaw & Gross, 2008). Beyond AB, the greater use of health and education services by children with early-starting externalizing behaviors, as well as the effects of crime more broadly, represents a significant cost to society (Scott, Knapp, Henderson, & Maughan, 2001). In the current paper, we summarize recent findings from our program of research that has focused on identifying young children who may be at most risk for chronic and severe AB later in life and that has examined how environmental experiences, including parenting and other contextual risk factors, predict these early behaviors. We identify limitations of this approach given that little work in this area has used genetically-informed research. Finally, we describe an approach to examine gene-environment interplay using an adoption design with initial results examining early CU behaviors in an adoption study.

What is Callous Unemotional (CU) behavior?

Early-starting behavior problems assessed from age 2 onwards represent the primary reason for youth referrals to clinicians (Kazdin, 1995). However, identification and effective treatment is made difficult by significant heterogeneity in the patterns of externalizing behavior that children show (Frick, Ray, Thornton, & Kahn, 2014; Hyde, Waller, & Burt, 2014). Moreover, because many children with early behavior problems will normatively desist from these behaviors, research is needed to identify those who are most likely to *persist* in their behaviors and thus be targeted by early preventive interventions. A growing body of literature has addressed the issue of heterogeneity within early emerging AB by subgrouping children based on whether they demonstrate Callous Unemotional (CU) behavior, consisting of low empathy, callous behavior towards others, and low interpersonal emotion (Frick, O'Brien, Wootton, & McBurnett, 1994). Children with high CU behavior typically show more severe and persistent AB trajectories relative to their low CU behavior peers (Frick et al., 2014). Thus, theoretically, assessments of CU behavior in early childhood could be helpful to target prevention and treatment efforts for those youth most likely to persist in their AB over the life course (Waller, Gardner, & Hyde, 2013). Further, CU behavior has been added as a specifier to the DSM-5 diagnosis of Conduct Disorder, termed 'Limited Prosocial Emotions' adding to the clinical importance of understanding the early emergence of these behaviors, particularly as they may require different treatments.

Why examine CU behavior in early childhood?

Until recently, previous studies that have examined CU behavior have typically focused on samples assessed in late childhood (i.e., ages 7–12) or adolescence (i.e., ages 13–18). However, there are several reasons why an examination of CU behavior beginning in early childhood (i.e., ages 2–6) is important: Developmental studies have demonstrated that behavior problems that emerge as early as age 2 to 3 years predict stable and aggressive behavior across childhood and into adolescence, at least among a subset of youth (Campbell, 1995; Shaw, Gilliom, Ingoldsby, & Nagin, 2003). Further, past research examining the treatment of childhood behavior problems suggests that interventions implemented prior to school age, when behavior is potentially more malleable, may be particularly efficacious (Olds, Robinson, Song, Little, & Hill, 2005). By intervening early, we may reduce the likelihood that children will go on to develop more severe forms of AB. However, a remaining question is whether the construct of CU behavior is developmentally meaningful and appropriate to measure at this young age. In support of this notion, a significant body of evidence indicates that CU behavior may meaningfully exist in preschool children because individual differences in core characteristics related to the CU behavior construct emerge at around ages 2–3 years old, including the capacity for empathic concern (Eisenberg & Fabes, 1990), helping others (Vaish, Carpenter, & Tomasello, 2010), lying about committing a transgression (Crossman & Lewis, 2006; Talwar & Lee, 2002), and the emergence of the distinction between 'nice' versus 'nasty' Theory of Mind (Ronald, Happe, Hughes, & Plomin, 2005). We use the term 'CU behavior' to distinguish this work from that focused on later CU traits and emphasize that there is little evidence CU behaviors are 'trait-like' (e.g., unchangeable, highly stable) in early childhood (Hyde, Shaw, Gardner, et al., 2013; Waller et al., 2013).

Can CU behavior be measured in early childhood?

Based on this literature, measures of early CU behavior from ages 2 or 3 onwards could incorporate items tapping deficits in empathic concern, prosociality, sharing, and deceptive or sneaky behavior as these constructs begin to emerge and show individual differences. In support of this notion, Kimonis and colleagues (2006) examined CU behavior in the preschool period. The authors assessed CU behavior in children ages 2 to 5 via parent and teacher reports on a standard CU behavior scale, the Antisocial Process Screening device, which has been used most often with older children (APSD; Frick & Hare, 2001). In this study, CU behavior predicted higher teacher-reported proactive aggression one year later (Kimonis et al., 2006).

We wanted to follow-up on this work in the early preschool period in two relevant large longitudinal studies but did not have a formal CU behavior measure in either case. Thus, we first derived a 'home-grown' measure of CU behavior at ages 2–4 among a high risk sample of 731 children (49% female), who were being assessed annually as part of the Early Steps Multisite Project (referred to hereafter as Early Steps), an ongoing randomized controlled trial of the Family Check-Up intervention (Dishion et al., 2008). To assess CU behavior in this sample, we chose eight items from three separate parent-reported questionnaires: the preschool Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000), the Eyberg Child Behavior Inventory (ECBI) (Robinson, Eyberg, & Ross, 1980), and the Adult-Child Relationship Scale (Pianta, 2001). Items were identified that reflected lack of guilt, lack of affective behavior, or deceitfulness and/or were similar to items in widely-used measures of CU behavior, including items on the APSD (Frick & Hare, 2001).

Initially, we used exploratory factor analysis in a random half of our sample. These analyses suggested that five items loaded onto a single factor: 'doesn't seem guilty after misbehaving', 'punishment doesn't change behavior', 'selfish /won't share', 'lies', and 'sneaky/tries to get around me [parent]'. We then used confirmatory factor analysis (CFA) in the other half of the sample to confirm this factor structure. Interestingly, results from the EFA and CFA suggested that two traditional 'unemotional' items associated with the CU behavior construct ('does not show affection'; 'is unresponsive to affection') did not load onto our CU behavior factor (Hyde, Shaw, Gardner, et al., 2013). This result is consistent with other psychometric work that we and others have done recently, suggesting that 'unemotional' as indexed in many CU behavior measures may not contribute psychometrically to the overarching construct (e.g., Hawes et al., 2014; Waller, Wright, et al., 2014). As such, we termed the factor 'deceitful-callous behavior' to index the shift away from 'unemotional', to acknowledge the presence of items indexing deceitful and sneaky behavior, and to emphasize that we were measuring risk behaviors rather than 'traits' (Hyde, Shaw, Gardner, et al., 2013). CFA models also showed that the deceitful-callous behavior items loaded separately from six oppositional-defiant items, suggesting independence of CU behavior items from other items assessing early child behavior problems. The deceitful-callous factor items loaded together well and showed reasonable internal consistency at ages 3 and 4, but not at age 2, suggesting that these behaviors may not form a coherent or developmentally appropriate construct until at least age 3.

Concurrently to our work, Willoughby and colleagues (Willoughby, Mills-Koonce, Gottfredson, & Wagner, 2014; Willoughby, Waschbusch, Moore, & Propper, 2011) adopted a similar analytic approach to derive a CU behavior factor from the parent-reported preschool CBCL (ASEBA; Achenbach & Rescorla, 2000). In their sample of 3-year olds drawn from the community ($N = 207$), they used CFA to demonstrate that a 5-item CU behavior scale (e.g., 'shows lack of guilt after misbehavior'), a 6-item oppositional scale (e.g., 'defiant'), and 6-item ADHD scale (e.g., 'can't stand to wait') formed separable dimensions. The separation of these dimensions was theoretically-driven to separate out dimensions within items that typically tap broad early child conduct problems: high emotional dysregulation (oppositional behavior), lack of inhibition and impulsivity (ADHD behavior), and callousness, low emotion, and lack of empathy and guilt (CU behavior) (see Dadds & Rhodes, 2008; Frick & Morris, 2004). Recently, we sought to replicate these findings among 240 children (118 girls) aged 3 years old from the Michigan Longitudinal Study (MLS), an ongoing prospective, longitudinal study of young children at risk of developing AB (Olson, Sameroff, Kerr, Lopez, & Wellman, 2005). We extended prior factor analytic work by demonstrating that a three-factor model using the same 17 preschool CBCL items fit equally well across different informants (mothers versus fathers) and across child gender (Waller, Hyde, Grabell, Alves, & Olson, 2015), and further confirming that CU behaviors to be separable from other early externalizing behaviors at age 3.

Does CU behavior in childhood predict more severe forms of AB later in life?

In addition to measurement, another important test of the CU behavior construct in early childhood centers on its predictive validity and whether early childhood measures of CU behavior add to the *unique* prediction of later AB, and thus designate children at risk of poorer outcomes and persisting behavior problems. Consistent with studies at later ages (Frick et al., 2014), a handful of recent studies have shown that CU behavior in early childhood does predict worse AB over time. For example, using Early Steps data, we used latent growth curve modeling to show that our CU behavior measure at age 3 robustly predicted stable high trajectories of child behavior problems from ages 2–4, both within and across informants. Interestingly, when dichotomized into 'high' versus 'low' CU-behavior groups, the 'high' CU behavior group showed no significant variance around their higher trajectory of behavior problems from aged 2–4 within a multi-group latent growth curve. In other words, 'high' CU behavior appeared to identify a group of youth with a homogenous and more severe trajectory of behavior problems than other youth in the sample (Hyde, Shaw, Gardner, et al., 2013). Similarly, Willoughby and colleagues found that scores on their 5-item CU behavior measure at age 3 predicted elevated and stable teacher-reported aggression from 6–12 years old (Willoughby et al., 2014). Our recent work using MLS data, which followed the approach of Willoughby and colleagues, also demonstrated that age 3 CU behavior predicted teacher-reported AB at age 6 over and above earlier teacher-reported externalizing and parent-reported ADHD and oppositional behaviors at age 3 (Waller, Hyde et al., 2015). Taken together, these findings indicate that CU behavior from around age 3 uniquely identifies those children at high risk of developing more severe and persistent AB. Robustness of this conclusion is supported by the replicability of findings across three different samples, use of different approaches/items for making an early CU behavior scale, and the unique effects of CU behavior on later AB, which emerged in autoregressive models that controlled for earlier externalizing behavior.

In a more recent follow-up study using Early Steps data, we demonstrated that our measure of deceitful-callous behavior (Hyde, Shaw, Gardner, et al., 2013) also predicted worse and persisting AB into the *late* childhood period (i.e., age 9.5). This more recent study used multi-trait, multi-method (MMMT) models to simultaneously test the possibility that parents' negative beliefs or biases about their child could have been what was leading to the predictive power of the CU behavior measure (i.e., associations actually reflect something about the parent and their perceptions if they rate a child as 'callous' at age 3) (Waller, Dishion, et al., under review). Within MMMT models, we defined 'trait' factors as variance in items loading on our five-item deceitful-callous behavior measure versus items loading on a general 35-item measure of disruptive behavior across informants. At the same time, drawing across different reports of deceitful-callous behavior and disruptive behavior from two different caregivers, we defined 'method' as informant type, comparing variance in a factor for primary caregiver reports (typically mothers) versus alternative caregiver reports (typically fathers, grandparents, or a co-parent) assessing their ratings across all items on both scales. That is, we examined the predictive validity of variance in child deceitful-callous behavior and behavior problems ('trait') controlling for variance in parent ratings ('method') (Waller, Dishion, et al., under review).

Overall, the deceitful-callous behavior 'trait' factor consistently predicted both aggressive and rule-breaking outcomes at age 9.5 years across informants (i.e., primary vs. alternate caregivers), taking into account variance in the behavior problems factor and variance in informant perceptions. At the same time, we found that the 'method' factors across ages 2–4 also predicted both aggression and rule-breaking at age 9 and in both 'within' informant and 'across' informant models (i.e., primary caregiver *method* factor predicted both primary caregiver- and teacher-reported outcomes). Beyond predicting later AB, the deceitful-callous behavior 'trait' factor at ages 3 and 4 robustly and uniquely predicted CU traits at age 9.5, controlling for behavior problems and method factors. CU traits at age 9.5 were assessed via scores on the Inventory of Callous-Unemotional Traits (ICU; Frick, 2004), a fuller, widely-used, and 'purpose-developed' measure of CU traits in children and adolescents. The convergence of our early measure of childhood deceitful-callous behavior with CU traits in late childhood represented a useful test of construct validity, as both our brief 'home-grown' deceitful-callous behavior measure and the purpose-developed ICU tap variance relating to a lack of empathic concern and deficits in guilt, albeit via different items at different ages. Our findings increase confidence that what we are measuring in our early 'deceitful-callous behavior' scale relates to later CU traits.

Taken together, findings across these different studies are consistent with previous studies that have demonstrated that CU behaviors identify children at risk of more severe and persistent forms of AB (Frick et al., 2014). Moreover, our findings are novel in the CU literature because they also demonstrate that accounting for variance in informant method factors (i.e., parental beliefs, attributions, or other measurement error) contributes important variance in the prediction of AB (Waller, Dishion, et al., under review). Notably, the parent 'method' factor at age 2 predicted *teacher*-reported AB at age 9.5 years. This finding suggests that parents could be seeing something 'negative' in children's early behavior that is not being measured well by either the disruptive behavior or deceitful-callous behavior items, but that has important predictive validity, even as young as 2 years old. Alternatively, ratings could reflect stable attributional biases or attitudes that parents hold about the child (Snyder, Cramer, Afrank, & Patterson, 2005; Waller, Gardner, Dishion, Shaw, & Wilson, 2012). A final possibility is that parents could report their child's behavior in a negative way because of genetic risk for CU behavior/AB between parent and child, which is also related to increased likelihood that child will show school-aged behavioral problems (i.e., aggression/rule-breaking or CU behavior).

What is the unique nomological network of early childhood CU behavior?

Drawing across these findings and work by others (e.g., Willoughby et al., 2014; Willoughby et al., 2011), there appear to be a set of behaviors in early childhood that are separable from other dimensions of AB, can be reliably measured, predict later CU traits, and uniquely predict worse and persisting AB over time. However, while these items have predictive power, a question that arises is: what do these behaviors really *mean*? In particular, beyond separating CU behavior from other early forms of AB psychometrically, it is important to demonstrate that these behaviors have a distinct nomological network, consistent with underlying theory of the construct and that they have convergent validity with other measures of CU traits (see above). We had already demonstrated that CU, oppositional, and ADHD behaviors at age 3 could be separated in measurement models using MLS data. Next, to examine a distinct nomological network between these three domains of externalizing behaviors, we showed that CU behavior at age 3 was uniquely associated with lower moral regulation, guilt, and empathy across different informants. At the same time, oppositional behavior was strongly related to higher anger/frustration and ADHD behavior was uniquely related to lower observed effortful control and lower attention focus (see Figure 1). In sum, each of these three constructs related differentially to criterion variables as specified by theory (Frick & Morris, 2004) and emphasized that this measure of CU behavior was uniquely related to disruptions in moral development, guilt and empathy.

Similarly, using a person-centered approach, Willoughby and colleagues found that a group of 3 year-olds with high oppositional combined with high CU behavior showed lower behavioral distress and reduced cardiac response to a face-to-face paradigm designed to elicit infant distress when compared with a non-oppositional low CU behavior group (Willoughby et al., 2011). These children were also the least responsive to parent efforts to soothe them when upset. These findings are consistent with the notion that CU behavior is related to lower temperamental fear and affective responsivity (Frick & Morris, 2004). In contrast, children with high oppositional but low CU behavior had been rated by both parents and observers as infants who had difficulty regulating negative affect after becoming upset (Willoughby et al., 2011). Thus CU behavior, even in the preschool years, appears distinguishable from other disruptive behaviors by specific deficits in conscience and empathic concern, as well as greater deceitfulness (Waller, Hyde et al., 2015) and appears to be preceded by lower temperamental fear and distress during infancy (Willoughby et al., 2011), whereas oppositional and defiant behaviors appear distinguishable by unique deficits in anger/frustration (Waller, Hyde et al., 2015) and is preceded by higher emotional dysregulation in infancy (Willoughby et al., 2011).

Despite growing evidence that supports the construct and predictive validity of CU behavior in early childhood, two important limitations need to be acknowledged. First, a key limitation centers on the assumption that individual differences in items that we have measured specifically index ‘CU behavior’ in young children. While these measures clearly have validity in the prediction of later AB and CU traits, it may be that individual differences in items simply assess developmental *delay* in empathic concern and moral regulation, rather than any meaningful foreshadowing of psychopathology. We have highlighted one study linking early childhood CU behavior with a well-established measure of CU traits in late childhood (Waller, Dishion, et al., under review) and a handful of studies that have examined the nomological network of early CU behavior relative to other brief scales of oppositional and ADHD behaviors. However, these studies represent only an initial step in demonstrating the convergent and discriminant validity of CU behavior measures in children aged 2–3 years old. More research is needed to more thoroughly examine temperamental correlates and precursors of CU behavior to differentiate this construct from normative individual differences or delays in developmental trajectories of empathic concern and related socioemotional behaviors.

A second issue requiring continued consideration is the potential hazard of labeling very young children as ‘callous and unemotional’. Relevant considerations surrounding the question of labeling include the need to keep evaluating the developmental appropriateness of items used to assess CU behavior, the assumption that individual differences reflect psychopathology versus developmental delay (or other processes, e.g., autism), and the importance of recognizing important changes in child personality and temperament features across childhood (Seagrave & Grisso, 2002). At the same time, there may also be potential *positive* value in better identifying young children who are at particularly high risk of escalating behavior problems based on the presence of CU behavior and/or individual differences in empathic concern, prosociality, or moral regulation to better develop and target effective treatments. Thus, we emphasize that our conceptualization of CU behavior represents one way to identify children who may be at most risk of poor outcomes, and who would benefit from empirically-supported and tailored interventions that best meet their socioemotional and behavioral needs. We certainly do not imply that early CU behaviors are CU ‘traits’ (e.g., unchangeable, highly stable), nor that these lead to psychopathy in adulthood.

Are parenting practices associated with the development of CU behavior?

Beyond these caveats, as evidenced through the findings outlined above, it appears that CU behavior in the preschool years can be reliably measured beginning at age 3 years and exhibits both construct and predictive validity. A key question, based on the independence of the CU behavior construct, centers on its etiology and early risk factors that might be specific to the development of CU behavior. The empirical literature has focused heavily on the biological basis of CU behavior, with studies demonstrating high heritability of AB in the context of CU behavior (Viding, Jones, Paul, Moffitt, & Plomin, 2008) and unique neural correlates of CU behavior in the functioning of the amygdala and other neural regions (Blair, 2013; Hyde, Shaw, & Hariri, 2013). However, research is also now beginning to adopt an ecological perspective to understand the development of CU behavior, which builds on models of broader AB development that have benefited from examining contextual risk factors (Belsky, 1984). Indeed, parenting practices are a well-established and robust risk factor for AB (Shaw & Gross, 2008; Shaw & Shelleby, 2014). For example, coercive parent–child interactions (Patterson, DeBaryshe, & Ramsey, 1989) and low positive parent–child engagement (Gardner, Ward, Burton, & Wilson, 2003) have been shown to predict increases in AB over time. This broader contextual research on AB has been important in informing the design and implementation of effective interventions for AB (e.g., parent management training; Kazdin, 1997; Patterson et al., 1989; Webster-Stratton & Taylor, 2001).

Thus, a key question is whether the broader context, and particularly parenting, is also related to the development of CU behavior, especially in early childhood. A handful of early studies addressing this question appeared to support the idea that parenting is related to the development of CU traits, at least within older samples of children and via self-reported parenting. For example, parental harshness predicted increases in CU behavior in samples assessed in late childhood and early adolescence within prospective longitudinal designs (e.g., Frick, Kimonis, Dandreaux, & Farell, 2003; Pardini, Lochman, & Powell, 2007). In particular, harsh punishment is thought to elicit high levels of arousal, making it difficult for children to internalize parental messages about prosocial behavior (Pardini et al., 2007). Positive affective dimensions of parenting, including parental warmth, are also thought to be of particular relevance to the development or prevention of CU behavior (Kroneman, Hipwell, Loeber, Koot, & Pardini, 2011; Pardini et al., 2007; Pasalich, Dadds, Hawes, & Brennan, 2011). Parental warmth and responsiveness are theorized to work against the development of AB and CU behavior by promoting empathy and prosociality and early attachment security has been proposed to represent an important foundation for future socialization processes within the parent-child dyad (Kochanska & Kim, 2012).

Studies had thus begun to show that parental harshness and a lack of parental warmth predicted increases in child CU behavior at older ages and particularly when parents reported on their parenting (Frick et al., 2003; Pardini et al., 2007). However, research was needed to examine these processes in *early childhood*, particularly using observational methods to assess parenting to strengthen the inference in establishing these links (i.e., that any parenting-CU behavior links were not due to parent reporting patterns as seen in some of our previous findings adopting a MMMT approach; Waller, Dishion, et al., under review). To address these gaps in the literature, we examined links between observed measures of parenting and CU behavior during the preschool period within the Early Steps study described above. In these analyses, we found that observed parental harshness was related to increases in child CU behavior from ages 2–4, over and above earlier behavior problems and relevant covariates (Waller, Gardner, Hyde, et al., 2012). Next, using both self-reported parental warmth and two observed measures of parental warmth (assessed via global coding of parent-child interactions in the family home and coding of parental five-minute speech samples; Waller, Gardner, Dishion et al., 2012), we found that parental warmth and CU behavior were reciprocally related from ages 2–3, even taking into account shared method variance across parental reports of higher behavior problems and their parental warmth at both ages 2 and 3 (Waller, Gardner, et al., 2015; Waller, Gardner et al., 2014). Specifically, early parent-reported CU behavior in toddlers predicted fewer observed displays of parental warmth over time, while lower parental warmth simultaneously and *uniquely* predicted increases in child CU behavior, controlling for earlier and concurrent behavior problems (Waller, Gardner et al., 2014). These findings fit with the theoretical proposal that both the parent and young child experience a mutually warm relationship as rewarding and pleasurable, such that positive affect becomes positively reinforcing (MacDonald, 1992). Reduced quality of positive affective interactions of parent and child could represent a unique risk factor for increases in CU behavior, and greater likelihood of children showing escalating behavior problems over time. Moreover, consistent with a recent systematic review of the parenting-CU behavior literature (Waller et al., 2013), our findings underscore the point that both harsh and warm aspects of parenting influence CU behavior in early childhood and that child CU behavior may simultaneously influence parenting over time.

What about broader sources of contextual risk and inequality?

Different parenting practices appear related to the development of CU behavior across development, beginning during the toddler and preschool years (Waller et al., 2013). However, little work has examined the broader contextual ecology of the child and parent. These few existing studies suggest that broader social and contextual factors, such as high levels of chaos in the home (Fontaine, McCrory, Boivin, Moffitt, & Viding, 2011) and low socioeconomic status (Barker, Oliver, Viding, Salekin, & Maughan, 2011), are important to CU behavior development, particularly in late childhood. Recently, we also found that violence exposure predicted membership in a high and stable trajectory of CU traits over five years among a high risk sample of male adolescents (Waller, Baskin-Sommers, & Hyde, under review). This finding is consistent with a model linking violence exposure to delinquency and AB via emotional detachment or diminished empathy (i.e., CU behavior; Allwood, Bell, & Horan, 2011).

Building on these findings, we were interested in examining how different contextual factors could undermine parenting, which in turn could contribute to CU behavior and severe AB development starting in early childhood. We were guided by Belsky's model of the determinants of parenting (1984), which proposes that three domains (maternal psychological resources, social context, and child characteristics) are likely to influence parenting practices and put children at greater risk for developing AB. In support of this theoretical premise, an extensive literature has linked risk factors that undermine parenting to subsequent youth AB, including greater parental stress and low social support (Shaw, Criss, Schonberg, & Beck, 2004), living in an impoverished neighborhood (Bradley & Corwyn, 2002), and having a child that is difficult to manage (e.g., Patterson et al., 1989). Indeed, in some but not all cases, these risk factors predict youth AB via their effect on parenting (Shaw & Shelleby, 2014),

To examine Belsky's (1984) model in relation to the development of CU behavior, we used data from the Pitt Mother & Child Project (Shaw et al., 2003), a sample of 310 low-income males and their mothers, recruited in infancy and followed with high retention to early adulthood. Using a multi-method, multi-informant approach, we examined contextual risk, social and financial inequality, and parenting characteristics assessed at 18-months old across the domains of maternal psychological resources (aggressive personality, low empathy, age, education, depressive symptoms); contextual sources of stress (neighborhood risk, social support, daily hassles); and child characteristics (difficult temperament). Consistent with previous findings, observed parental warmth at age 2 uniquely predicted parent-reported CU behavior at ages 10–12, controlling for both concurrent AB and early contextual risk factors across domains (Waller, Shaw, Forbes, & Hyde, 2014). In addition, there were direct zero-order associations between neighborhood impoverishment, assessed via census data at age 2, and higher CU behavior at ages 10–12 and age 20 (range, $r = .19 – .25$, $p < .01$). Consistent with the theoretical model, contextual risk and maternal characteristics were also linked to later child CU behavior *indirectly* by shaping less warm caregiving practices. For example, maternal low empathetic awareness at age 2 predicted CU behavior *at age 20* via lower observed parental warmth at age 2 and CU behavior at ages 10–12. These findings reinforce the notion that a parenting style characterized by aggression, low empathetic awareness for the needs of the child, or a lack of warmth may increase risk of children developing CU behavior and/or more severe forms of AB, risk for which may be particularly exacerbated among families living in poverty (Shaw & Shelleby, 2014; Waller et al., 2013; Waller, Shaw et al., 2014).

What are ongoing challenges to improving our understanding of the development of CU behavior?

Early childhood CU behavior comprises a constellation of socioemotional and temperamental characteristics, including lack of empathic concern, reduced prosociality, deception, fearlessness, and deficits in conscience (Waller, Hyde et al., 2015) and evidence supports the notion that these characteristics are often temporally preceded by specific parenting practices, including low parental warmth and high levels of harshness; parental characteristics, including low empathy and aggressive personality styles; and social inequality, including neighborhood impoverishment and community violence. In particular, the findings of our systematic review (Waller et al., 2013) and recent empirical studies (e.g., Waller, Gardner, Hyde et al., 2012; Waller, Gardner et al., 2014; Waller, Shaw et al., 2014) have helped to challenge a previous focus on CU behavior as unchangeable 'traits' and a previous research focus in this area that had mostly focused on biological determinants of CU behavior. However, observational study designs, even prospective studies that control for autoregressive effects, do not lend themselves to drawing *causal* inferences about the development of CU behavior. Furthermore, creative study designs are needed to reconcile findings from studies that have examined parenting as a predictor alongside studies that have demonstrated and emphasized the high heritability of CU behavior and AB (Viding et al., 2008).

In particular, there is a pressing need for studies to consider gene-environment correlations (*r*GE) when examining parenting as a risk factor for CU behavior. That is, associations between parenting and CU behaviors could reflect non-heritable (i.e., 'true' environmental) parenting effects and/or they could reflect correlation between genes and environments via two types of *r*GE. First, *passive r*GE reflects a shared genetic predisposition of parent and child for the same underlying traits, which could inflate the magnitude of associations found between harsh aspects of parenting or low parental warmth and child CU behavior when children are reared by their biological parents. For example, parents may be harsher because they themselves have high CU behavior, the inherited risk for which they have passed on to the child that they are parenting. The issue of *r*GE can be exacerbated if studies rely solely on cross-sectional measurement of parenting and child behavior using parent report only (Waller, Dishion, et al., under review; Waller et al., 2013). Second, *evocative r*GE reflects the genetic mechanisms through which child CU behavior might elicit greater harshness or lack of reciprocal warmth and affection from a parent. Thus, a child could inherit genes that increase the likelihood of the child developing CU behavior, which could in turn evoke harsher parenting behaviors or lower parental warmth. Observational studies, even within prospective longitudinal designs, are limited in the extent to which they can disentangle passive and evocative *r*GE, which are confounds and sources of important unobserved variance in traditional observational study designs simply because parents and biological children share traits through heritable genetic factors.

The potential confounding effect of *r*GE on the development of CU behavior has been underscored by the recent findings by Dadds and colleagues (2014). They demonstrated that (biological) father's fearlessness was correlated with eye contact deficits specifically among those children with high CU behavior, and that these deficits were linked to less positive maternal feelings toward the child (Dadds et al., 2014). Drawing on these results, we have suggested that father's fearlessness could represent a heritable trait also related to child's eye contact, which may then evoke less warm parenting from mothers (Hyde et al., 2014). In this case, if reduced eye contact is a function of the tendency to be high on CU behavior and fearlessness, and if CU behavior has a genetic component, then biological parents and children could share both the genes for CU behavior/fearlessness and the corresponding tendency to make less eye contact with others and thus passive *r*GE could be reflected in any paternal parenting-child CU relationships. Moreover, evocative *r*GE could be reflected in inherited lower eye contact being related to less maternal warmth. However, as illustrated by this study, it is difficult to disentangle what may be environmental versus heritable effects in this type of non-genetically-informed design.

How can we examine the effects of *r*GE?

A promising avenue to control for the effects of passive *r*GE and measure evocative *r*GE and thus better understand relationships between child CU behavior, parental characteristics, and parenting practices is within the context of a full adoption study, where the adoption occurred at or within with first weeks of birth, where data are available on children from an early age, and where data are also available on both biological and adoptive parents. Thus, the effects of *passive r*GE (i.e., shared genetic vulnerability between child and *biological* parent) are eliminated when measuring associations between the adoptive parent and child because they are genetically unrelated, and genetic main effects can be estimated by examining whether biological parent's traits are associated with child behavior. In contrast, associations that are found between adoptive parent characteristics or parenting practices and child CU behavior could reflect either non-heritable parenting effects via the rearing environment or could reflect *evocative r*GE (i.e., a child's genetically or biologically influenced behavior evoking specific parenting behaviors from a caregiver).

Heritable and evocative *r*GE effects on a variety of child outcomes can be tested in the Early Growth and Development Study (EGDS), a novel and ambitious adoption study. Specifically, EGDS is a linked set of participants including 561 adopted children (42.8% female), their adoptive parents (567 adoptive mothers and 552 adoptive fathers, including 41 same sex parent families), their birth mothers (n = 554), and their birth fathers (n = 208). Children were adopted within a few days of birth (median = 2 days; M = 6.2 days, SD = 12.45; range = 0–91 days), limiting the extent to which biological parents may have influenced their child's behavioral trajectory via postnatal environmental effects (Leve, Neiderhiser, et al., 2013). The sample from EGDS is also relatively diverse, as just over half of children are Caucasian (55.6%) and others are typically multi-racial (19.3%), African-American (13%), or Latino (10.9%). The EDGS contains a wealth of measurement of parent and child behavior via assessments consisting of a 2½- to 4-hr interview in participants' homes with many observational measures of child and parent behavior. Further information regarding the EGDS recruitment, procedures, sample, and assessment methods is available elsewhere (Leve, DeGarmo, et al., 2013; Leve et al., 2007)

Using this important and innovative design, the EGDS has demonstrated genetic main effects, evocative *r*GE, and non-heritable parenting effects in the development of broader AB. For example, Elam and colleagues (2014), found evidence of evocative *r*GE in that birth mother low behavioral motivation predicted toddler low social motivation (i.e., a genetic main effect), which in turn predicted both adoptive mother-child and adoptive father-child hostility (i.e., evocative *r*GE). Interestingly, both adoptive mother-child and father-child hostility then predicted children's later socially disruptive behavior. These findings demonstrate the importance of considering how children's genetically-influenced characteristics influence (genetically-unrelated) parenting behaviors, with important links to future AB (Elam et al., 2014). In another example, Harold and colleagues (2013) demonstrated genetic main effects by linking biological mother ADHD symptoms to higher child impulsivity at age 4.5 (Harold et al., 2013). Harold and colleagues also found that child impulsivity at age 4.5 was related to higher levels of adoptive mother's hostility (i.e., genetically-unrelated child evoking parenting behavior in an adoptive parent), which in turn, predicted higher subsequent levels of child ADHD symptomatology at age 6 (Harold et al., 2013). This significant indirect pathway provided strong evidence of an *r*GE effect. In particular, genetic influences on early disrupted child behavior marked by child impulsivity/activation (i.e., biological mother ADHD symptoms that indexed greater genetic risk) evoked hostility from the *rearing* mother toward her child (see Harold et al., 2013, p. 1044). These intriguing findings raise the question of whether cascading genetic influences on early child CU behavior could influence subsequent adoptive parenting practices, with links to future child AB outcomes.

Applying models of CU behavior within an adoption design

Building on these findings and the assumptions of the adoption design, we have recently begun to apply our models of CU behavior development to the EGDS. Our goal is to examine similar questions to those we have addressed in previous studies using similar measures of early CU behavior. By answering questions within the EGDS' genetically-informed design, we can examine issues surrounding *r*GE more explicitly and add nuance to our understanding of how associations between parenting and early CU behavior develop. We present brief preliminary analyses using EGDS data to set a foundation for future research that will better disentangle passive versus evocative *r*GE in understanding the development of CU behavior.

Measuring early CU behavior

Based on the measurement model tested in one of our previous studies (Waller, Hyde et al., 2015), our first goal was to test whether we could replicate previous findings and independently measure adoptive parent-reported CU, ADHD, and oppositional behaviors within the EGDS. Closest to the age at which we had previously tested a three-factor model (i.e., 3 years old) was assessment of adoptive parents and adopted children at 27–months old, for whom data were available for both Cohort I and II within the EGDS ($N = 561$) (for more details about the cohorts, see Leve, Neiderhiser, et al., 2013). At 27 months, adoptive parents completed the preschool CBCL (Achenbach & Rescorla, 2000), a 99-item measure of toddler's behavioral and emotional problems. Consistent with the approach by Willoughby and colleagues and one of our previous studies (Waller, Hyde et al., 2015; Willoughby et al., 2011), we examined 17 preschool CBCL items across three domains (ADHD, oppositional, and CU behaviors) using CFA in Mplus version 7.2 (Muthén & Muthén, 2014) with mean and variance adjusted weighted least squares estimation (WLSMV) appropriate for use with ordinal items. The five CU behavior items were the same as those reported in previous studies (Waller, Hyde et al., 2015; Willoughby et al., 2011): 'punishment does not change behavior', 'doesn't feel guilty after misbehaving', 'shows too little fear', 'does not show affection'; and 'is unresponsive to affection'. Consistent with previous studies, we found differentiation of CU, ADHD, and oppositional behaviors, with a three-factor model providing the best fit to the data across both adoptive parents' reports (see Figure 2; Table 1). Corrected chi-square differences test (using DIFFTEST) indicated that the three-factor model provided a significantly better fit than competing models (Table 1). For primary adoptive parent reports (i.e., mothers as well as 36 male same-sex parents), factor loadings were moderate and statistically significant (Figure 2; range $\beta = .41–.86$, $p < .001$). Consistent with previous findings, latent correlations between factors were moderate to high but within the acceptable range (range, $r = .70–.77$, $p < .001$), indicating distinct but highly overlapping constructs (see Figure 2). Similar estimates were obtained using alternative adoptive parent reports (i.e., fathers as well as 46 female same-sex parents; data available upon request).

Predictive validity of CU behavior

We then examined whether CU behavior showed unique prediction of severe behavior problems later in childhood. We tested associations between primary adoptive parent reports for CU, ADHD, and oppositional behaviors at 27 months and teacher-reported externalizing behavior at age 7 using EGDS Cohort I ($n = 361$; data not yet available on Cohort II) via the Teacher Report Form of the CBCL (Achenbach, 1991). There was a significant zero-order correlation between CU behavior at 27 months and teacher-reported externalizing at age 7 ($r = .27$, $p < .01$), but zero-order correlations for ADHD and oppositional behavior at age 27 months with age 7 externalizing problems were very modest and non-significant (ADHD, $r = .02$; oppositional, $r = .04$). Next, we regressed teacher-reported externalizing behavior at age 7 onto all three behavior dimensions simultaneously to examine unique predictive effects within the three-factor latent framework, controlling for child gender. Consistent with previous publications from EGDS, we also included the following demographic covariates in all of our statistical models: child gender, degree of openness in the adoption (level of contact and knowledge between birth and adoptive families; for a description of how this measure was constructed, see Ge et al., 2008) and an index of perinatal risk (i.e., maternal pre-eclampsia, prenatal substance use, and low birth weight) assessed via the McNeil-Sjöström Scale for Obstetric Complications (McNeil, Cantor-Graae, & Sjöström, 1994). We found that that only CU behavior uniquely predicted later teacher-reported externalizing at age 7 ($\beta = .58$, $p < .01$), and it predicted later externalizing over and above the effects of early oppositional and ADHD behavior. The overall model explained 18% of the variance in teacher-reported externalizing at age 7. Thus it appears that CU behavior at 27 months in the EGDS sample is separable from other behavior factors and a valuable predictor of school-age externalizing problems in school across informants. It is also interesting to note that greater perinatal risk was marginally associated with higher CU behavior scores, but not oppositional, ADHD or later teacher-reported externalizing scores, highlighting an interesting avenue for future research in this sample addressing the role of perinatal risk on CU behavior.

Is adoptive parent parenting related to CU behaviors?

Finally, as a first step to examine whether parenting effects on CU behavior found in our previous work could be replicated within *adoptive* parent-child relationships, we examined associations between observed measures of both primary and secondary adoptive parents' positive reinforcement and child behavior. We focused on observations of positive reinforcement to be consistent with our previous work examining associations between positive affective aspects of parenting (e.g., warmth, praise) and child CU behavior (see Waller, Gardner et al., 2015; Waller, Gardner et al., 2014). Positive reinforcement was assessed at 27-months via microsocial coding of a 3-minute clean-up task, during which parents had to guide the child to put toys away, based on codes derived from the Child Free Play and Compliance Task Coding Manual (Pears & Ayers, 2000). We examined within-time correlations between observed positive reinforcement and CU, ADHD, and oppositional behaviors within the three factor framework (Figure 2). As before, we controlled for the effects of child gender, adoption openness, and perinatal complications. For primary adoptive parents, lower levels of observed positive reinforcement were significantly and uniquely correlated with child CU behavior ($r = -.17$, $p < .05$), but not correlated with either ADHD or oppositional behavior. For the other/secondary adoptive parent, lower levels of observed positive reinforcement were related to higher levels of concurrent child behavior problems across all three dimensions (ADHD behavior, $r = -.18$, $p < .01$; oppositional behavior, $r = -.15$; CU behavior, $r = -.31$, $p < .001$). The magnitude of the correlations differed across the three dimensions and Fisher's r-to-z transformations indicated that the correlation between the secondary adoptive parent's positive reinforcement and CU behavior was significantly higher than the correlation for either ADHD behavior ($z = 1.85$, $p < .05$) or oppositional behavior ($z = 2.27$, $p < .05$). Thus, at least cross-sectionally, it appears that observations of parenting in early childhood are correlated with CU behavior and that this correlation is independent of passive *r*GE and other confounds (e.g., perinatal risk).

Summary and future directions

Taken together, these preliminary findings suggest that we can measure CU behavior in early childhood within an adoption sample, opening up a wealth of potential questions that can be addressed to tease apart evocative versus passive *r*GE associated with the development of CU behavior. Consistent with previous studies at a similar age, CU, ADHD, and oppositional behaviors formed separable constructs at 27 months, which was corroborated across ratings of behavior by both adoptive parents. In line with our previous studies using multiple independent samples, we found that child CU behavior uniquely predicted future teacher-reported externalizing behavior problems assessed 5 years later, highlighting that the items comprising the CU behavior measure identify children at high risk of poor outcomes into later childhood. Finally, we found unique cross-sectional associations between CU behavior and observations of primary and secondary adoptive parent positive reinforcement. These correlations are striking because they take into account overlap between CU behavior with both ADHD and oppositional behavior, and correlation between primary and secondary adoptive parent positive reinforcement.

Based on these cross-sectional analyses, however, it is still difficult to draw conclusions about causality or eliminate the possibility that significant parenting associations could be driven by evocative *r*GE. Thus, a major next step as this sample ages will be to use cross-lagged models to examine the extent to which parenting or child CU behavior influence each other *over time*, and to consider birth parent traits. The advantage of the adoption design is that we can infer that the robust cross-sectional link we found between lower adoptive parent positive reinforcement and higher child CU behavior is not accounted for by passive *r*GE between the parent and child. Thus, it may be that children's CU behavior elicits lower warmth from adoptive parents (i.e., evocative *r*GE); or vice versa, that low parental warmth, even in the absence of shared genetic risk, is an important risk factor for the unique development of child CU behavior. Likely, it is a combination of both processes. An important future step is also to consider the effects of adoptive parent characteristics (e.g., psychopathology; negative attribution biases about the child), which could underpin both more negative ratings of child CU behavior by adoptive parents and lower levels of observed adoptive parent positive reinforcement. Finally, future studies are needed that can incorporate biological parent characteristics (e.g., AB, fearlessness) into models to test whether these characteristics predict early CU behavior in children adopted into other families. We see the application of this innovative genetically-informed design as an important next step in understanding how contexts, such as parenting, influence the development of behaviors and traits that put children at highest risk for later AB outcomes.

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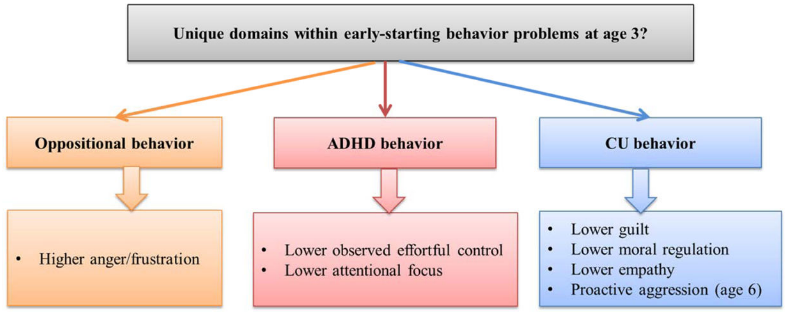

Figure 1. Unique nomological network of three domains within early childhood disruptive behavior disorder- oppositional, ADHD, and CU behavior

Note. Figure adapted from Waller, Hyde et al. (2015). We examined associations between CU behavior, oppositional behavior, and ADHD behavior subscales and relevant socioemotional, behavioral, and cognitive correlates at age 3, controlling for overlap between subscales and child verbal IQ, age in months, and family income. ADHD scores were related to lower effortful control and attentional focus; oppositional behavior was related to higher anger/frustration; and CU behavior was related conscience deficits and uniquely predicted higher teacher-reported externalizing behavior at age 6, including higher proactive aggression. These results support the existence of unique correlates for different components of early-starting disruptive behavior. We replicated findings using cross-informant models incorporating both mother versus father reports of CU, oppositional, and ADHD behavior at age 3.

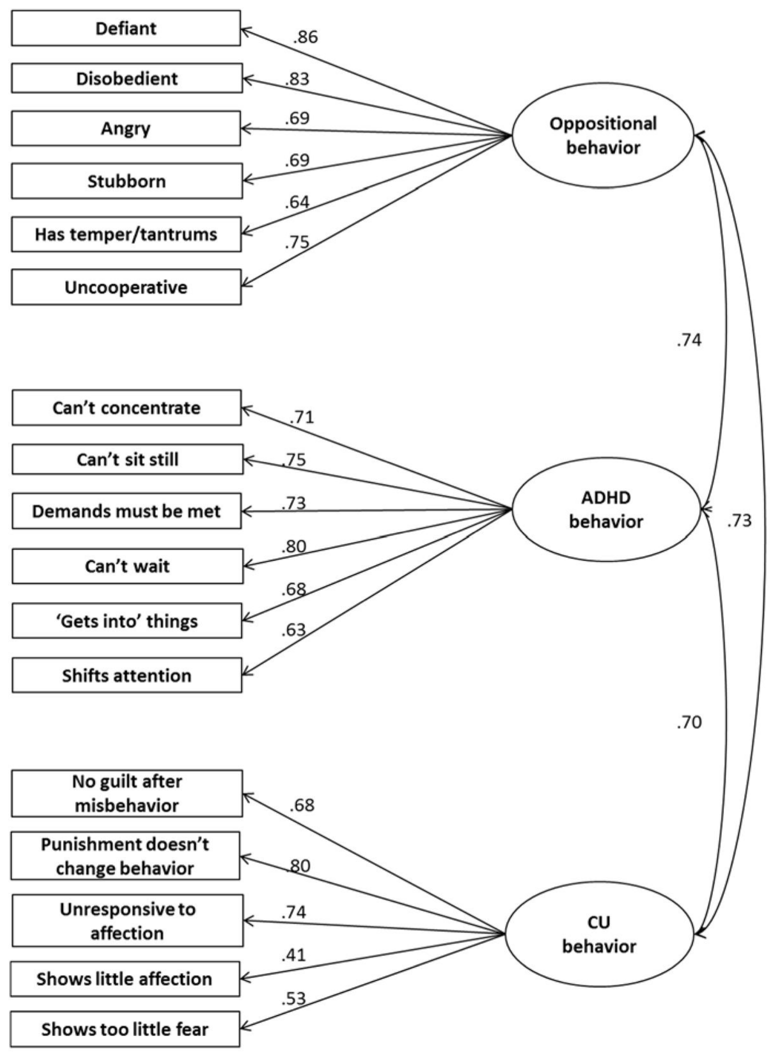

Figure 2. Factor structure showing best-fitting three-factor model of adopted parent early child behavior problems showing separate oppositional, ADHD, and CU behavior factors at 27 months

Note. Model fit statistics: $\chi^2 = 391.97$, df = 116, $p < .001$; CFI = .94, TLI = .93, RMSEA = .069. All factor loadings and inter-factor correlations significant at $p < .001$. Results shown for adoptive parent 1 (typically adoptive mother). Pattern of factor loadings very similar for adoptive parent 2 (tyically adoptive father) – results not shown for brevity).

Table 1

Synopsis of Confirmatory Factor Analysis models testing 17 items of the preschool CBCL and comparing model fit via the DIFFTEST procedure for a one-factor model, three two-factor models, and a three-factor model for reports by both adoptive parents

Adoptive parent 1			
Model description	$\chi^2(df)$	**CFI**	**RMSEA**
1 Factor	576.33 (119), $p < .001$	.90	.088
2 Factor (CU vs. other)	534.25 (118), $p < .001$	.91	.085
2 Factor (ODD vs. other)	453.34 (118), $p < .001$	.93	.076
2 Factor (ADHD vs. other)	437.69 (118), $p < .001$	.93	.074
3 Factor (CU, ODD, ADHD)	391.97 (116), $p < .001$	.94	.069
Corrected Chi Square differences test (DIFFTEST)			
3 Factor (CU, ODD, ADHD) vs. 1 Factor		118.35 (3), $p < .001$	
3 Factor (CU, ODD, ADHD) vs. 2 Factor (CU vs. other)		87.92 (2), $p < .001$	
3 Factor (CU, ODD, ADHD) vs. 2 Factor (ODD vs. other)		42.96 (2), $p < .001$	
3 Factor (CU, ODD, ADHD) vs. 2 Factor (ADHD vs. other)		33.94 (2), $p < .001$	

Adoptive parent 2			
Model description	$\chi^2(df)$	**CFI**	**RMSEA**
1 Factor	511.30 (119), $p < .001$	.92	.084
2 Factor (CU vs. other)	456.90 (118), $p < .001$	.93	.078
2 Factor (ODD vs. other)	405.02 (118), $p < .001$	.94	.072
2 Factor (ADHD vs. other)	399.95 (118), $p < .001$	.94	.071
3 Factor (CU, ODD, ADHD)	345.68 (116), $p < .001$	.95	.065
Corrected Chi Square differences test (DIFFTEST)			
3 Factor (CU, ODD, ADHD) vs. 1 Factor		114.71 (3), $p < .001$	
3 Factor (CU, ODD, ADHD) vs. 2 Factor (CU vs. other)		76.43 (2), $p < .001$	
3 Factor (CU, ODD, ADHD) vs. 2 Factor (ODD vs. other)		42.99 (2), $p < .001$	
3 Factor (CU, ODD, ADHD) vs. 2 Factor (ADHD vs. other)		38.46 (2), $p < .001$	