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Differential Styles of Emotional Reactivity and Antisocial Behavior Relative to Post-Traumatic Stress Disorder Symptom Expression in Detained Youth

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Differential Styles of Emotional Reactivity and Antisocial Behavior Relative to Post-Traumatic
Stress Disorder Symptom Expression in Detained Youth

A Thesis

Submitted to the Graduate Faculty of the
University of New Orleans
in partial fulfillment of the
requirements for the degree of

Master of Science
In
Psychology

By

Molly A. Miller

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Abstract

This study sought to explore whether PTSD symptoms in detained adolescents were differentially related to high and low patterns of emotional reactivity, as determined based on callous-unemotional (CU) traits and emotion dysregulation. Analyses revealed four distinct groups based on these criteria: a low/no trauma control group with few PTSD symptoms and three groups whose PTSD symptoms were distinguished by symptoms of emotional numbing. The study sought to determine whether these profiles were related to distinct patterns of aggression and delinquency. Results revealed that the low/no PTSD symptom group exhibited the least aggression and delinquency. Further, results indicated that higher CU traits and violent offending are associated with a combined PTSD symptom profile. Results suggest a relationship between PTSD symptoms, delinquency, aggression and CU traits. Findings provide support for the existence of a secondary variant of CU youth who are more emotionally dysregulated and prone to both arousal and emotional detachment.

Key Words: Juvenile Offending, Emotional Arousal, Callous-Unemotional Traits, Aggression, PTSD, Violent Delinquency

Overview

Antisocial behavior develops from a combination of both individual and environmental factors. For example, research indicates that exposure to violence (e.g., Widom, 1989), stressful life events (e.g., Guerra, Huesmann, Tolan, Van Acker, & Eron, 1995), and associating with delinquent peers (e.g., Moffitt, 1993) are all predictors of antisocial behavior in youth. However, not all youth exposed to these particular environments exhibit antisocial behavior. This highlights the importance of examining factors related to the individual as well as the environment in order to gain a better understanding of the developmental trajectories associated with such outcomes. Characteristics of the individual, such as emotional reactivity (e.g., Loney, Frick, Clements, Ellis, & Kerlin, 2003), and temperamental traits, such as fearlessness and behavioral inhibition (e.g., Kochanska, 1993), are often linked with antisocial and delinquent behavior in later childhood and adolescence.

The heterogeneous nature of antisocial behavior has led researchers to examine whether there are distinct developmental pathways associated with different types of antisocial outcomes. One theory with a great deal of empirical support is that antisocial youth may fall into distinct subgroups based on different patterns of emotional reactivity (i.e., high emotional reactivity and low emotional reactivity; Frick & Morris, 2004; Loney et al., 2003). Previous research indicates that patterns of high and low reactivity are associated with distinct profiles of emotion processing (Frick & Morris, 2004), aggression (Hubbard et al., 2002; Vitaro, Brendgen, & Tremblay, 2002), and delinquent behavior (Frick et al., 2003).

Although these distinctions are well established, less is known about the role of certain environmental factors (e.g., trauma) on subsequent antisocial behaviors among youth with low and high emotional reactivity. Trauma exposure is reported at significantly high rates within

juvenile detention settings, with estimates as high as 93% among detained boys and 84% among detained girls (Abram et al., 2004; Chamberlain & Moore, 2002). Further, symptoms of Post-Traumatic Stress Disorder (PTSD; American Psychological Association, 2000) predict aggressive and delinquent behavior in youth prone to both high arousal (Stimmel, Cruise, Ford, & Weiss, 2014), and low arousal (Allwood, Bell, & Horan, 2008). Thus, trauma exposure and response are important to consider when identifying distinct trajectories to antisocial behavior. Styles of reactivity may manifest in different expression of PTSD symptoms that can be targeted for intervention. Although some studies have examined PTSD symptoms in the context of delinquent behavior, no existing research addresses how those symptom patterns relate to emotional reactivity and subsequent profiles of antisocial behavior. The current study examined differences in delinquent behavior (i.e., violent and nonviolent offending) and aggression (i.e., proactive and reactive types) as they related to both high and low emotional reactivity patterns and symptoms of PTSD.

High Emotional Reactivity

Emotional reactivity is typically measured in terms of the individual's threshold for emotional arousal, the intensity with which the emotion is experienced, and the duration of the emotion (Rothbart & Derryberry, 1981). Emotionally reactive individuals may become more easily frightened, angry, or upset in response to seemingly minor stimuli, or they may continue to experience emotions longer following the removal of the stimuli compared with less emotionally reactive individuals (Eisenberg, 2000). Higher levels of emotional reactivity are also more difficult to regulate (Eisenberg, Cumberland, & Spinrad, 1998). The relationship between high emotional reactivity and psychopathology is moderated by an individual's ability to self-regulate his or her emotions (e.g., Eisenberg, 2000; Gratz & Roemer, 2002; Hare et al., 2008). In other

words, highly reactive individuals may not develop distressing or problematic behavior if they have effective emotion regulation strategies.

Emotion regulation refers to the individual's efforts to manage, modulate, inhibit, and enhance emotions (Cole, Martin, & Dennis, 2004; Thompson, 1994). Emotion regulation strategies begin to develop in infancy and are influenced by a number of factors including internal (e.g., ability to inhibit responses; Rothbart, Posner, & Kieras, 2006) and external (e.g., parental socialization of emotions; Eisenberg et al., 1998; Morris, Silk, Steinberg, Myers, & Robinson, 2007) processes. Problems regulating emotions often referred to as *emotion dysregulation*, have been linked with a wide range of behavior problems. For example, the inability to regulate sadness and fear is linked to internalizing behavior problems (e.g., depression and anxiety; Eisenberg, Shepard, Fabes, Murphy, & Guthrie, 1998; Rubin, Chen, & Hymel, 1993). Additionally, the inability to regulate anger is linked to externalizing behavior problems (e.g., fighting and impulsivity; Eisenberg et al., 2001; Morris et al., 2007).

Emotion dysregulation, particularly anger dysregulation, has been consistently linked to conduct problems, including aggression and delinquency (Marsee & Frick, 2007; Moffitt & Caspi, 2001; see also Frick and Morris, 2004, for a review). Specifically, emotionally dysregulated youth are more likely to exhibit aggression that is primarily reactive in nature (Dodge & Coie, 1987; Dodge, Lochman, Harnish, Bates, & Pettit, 1997; Marsee & Frick, 2007). Aggression, generally defined as any act committed with intent to harm (Berkowitz, 1993), is considered a multidimensional construct that can be disaggregated into distinct functions: proactive and reactive aggression (Crick & Dodge, 1996; Poulin & Boivin, 2000; Price & Dodge, 1989; see also Card & Little, 2006, for a review). While proactive aggression refers to unprovoked acts that are motivated by a desire for personal gain, reactive aggression typically

occurs as a defensive response to perceived threat or provocation within the context of associated intense fear, anger, or frustration (Dodge, 1991; Dodge & Coie, 1987). In general, reactive aggression is associated with a great deal of negative emotionality and heightened emotional arousal. For example, reactively aggressive children are more likely than proactively aggressive children to display symptoms of both depression (Dodge et al., 1997) and anxiety (Raine et al., 2006). Psychophysiological (i.e., resting heart rate, skin conductance, heart rate variability) correlates of aggression indicate that reactive aggression is uniquely associated with elevations on measures of arousal. For example, Hubbard and colleagues (2002) reported that reactive, but not proactive, aggression was associated with increased skin conductance. Scarpa, Haden, and Tanaka (2010) found that reactively aggressive children exhibited lower baseline levels of heart rate variability, indicative of reduced parasympathetic activity. Additionally, Pitts (1997) reported that while both proactively and reactively aggressive children exhibited lower resting heart rate compared with non-aggressive peers, only the reactive group showed a significant increase in heart rate in response to provocation. Taken together, aggression, particularly reactive aggression, may be the result of an inability to effectively control emotional states, as well as an inability of the parasympathetic nervous system to down-regulate physiological arousal. These results provide further support for the association between reactive aggression and emotional dysregulation.

Although high levels of negative emotionality and reactive aggression are often observed in delinquent youth (e.g., Marsee & Frick, 2007; Marsee et al., 2014), high emotional reactivity may be negatively related to levels of delinquent and violent behavior. For example, Vitaro and colleagues (2002) found that reactive aggression was associated with lower delinquency scores, perhaps because high levels of depression and anxiety among the reactively aggressive youth in

the study may suggest a strong inhibition system that acts as a deterrent against delinquent behavior. Additionally, Scarpa and colleagues (2010) reported that while reactive aggression was associated with higher autonomic arousal and mood/anxiety problems, it was not significantly related to delinquency. Further, delinquent youth who are more emotionally reactive may exhibit less violent behavior than those who are under-reactive, possibly the result of these individuals' ability to attend to (and be inhibited by) the distress cues of others (e.g., Blair, 1999; Frick et al., 2003). However reactive youth may have a higher susceptibility to anger due to perceived provocation from peers, resulting in impulsive and aggressive behavior within the context of high emotional arousal (e.g., Brendgen, Vitaro, Tremblay, & Lavoie, 2001; Loney et al., 2003). Taken together, some highly reactive youth may be protected from serious violent delinquency by an over-active inhibition system (Gray, 1987) and sensitivity to cues of distress in others, while others may be more prone to outbursts driven by under-controlled anger and hostile attribution biases (i.e., attribution of hostile intent to ambiguous situations). Research that identifies environmental factors that are common among aggressive and delinquent youth (e.g., exposure to trauma) is needed to test for associations between youth's external environments and subsequent antisocial behavior. Specifically, reactively aggressive youth who are exposed to trauma may be more prone to experience high levels of anxiety or related symptoms that inhibit violent behavior. However, not all youth exhibit high emotional reactivity and dysregulation. A second subgroup of youth with conduct problems is characterized by extremely *low* levels of emotional reactivity that may lead to a more stable, severe, and violent pattern of antisocial behavior (Muñoz et al., 2007; see also Frick & Morris, 2004).

Low Emotional Reactivity

In contrast to youth with over-reactive emotion processing styles characterized by high levels of emotion dysregulation, under-reactive youth are often characterized by a fearless temperamental style that may impair children's ability to develop conscience, empathy, and guilt (Kochanska, 1993). The fearless temperament is often accompanied by insensitivity to punishment (Dadds & Salmon, 2003) as well as thrill-seeking behavior (Raine, 2002). One possible explanation for increased thrill seeking in these youth is that low arousal may be experienced as unpleasant, leading individuals to seek out stimulation to increase arousal (Raine, 2002). This pattern of low emotional reactivity is commonly seen in youth with high levels of callous-unemotional (CU) traits (e.g., Eisenberg, 2000; Frick, 2009; Frick & White, 2008).

Conceptualized as a downward extension of adult psychopathic traits (e.g., Frick & Viding, 2009), CU traits represent an interpersonal style that is characterized by lack of empathy and callous disregard for the feelings of others (Cornell & Frick, 2007; Frick & White, 2008). Children with CU traits often present with low levels of anxiety and exhibit few fearful inhibitions (Frick & Viding, 2009). Limited emotional reactivity may underlie a number of distinctions between antisocial children and adolescents with and without CU traits.

First, low fearfulness in youth with CU traits is associated with an insensitivity to punishment cues during reward-dominant tasks (Barry et al., 2000; Frick et al., 2003) and a tendency to underestimate the likelihood of punishment for poor behavior (Pardini, Lochman, & Frick, 2003). For example, Raine and colleagues (1990) found that adolescents with lower autonomic arousal, (i.e., electrodermal activity, resting heart rate, and EEG activity) engaged in significantly more criminal behavior at age 24 compared with adolescents with normal or high autonomic arousal. Thus, low fearfulness may lead to insensitivity to punishment and result in a

failure to internalize rules and norms, impairing conscience development and leading to antisocial behavior later in life (Dadds & Salmon, 2003; Kochanska, 1993; Frick & Morris, 2004).

Second, children and adolescents with CU traits show reduced physiological responsiveness to several types of emotional stimuli. For example, Blair (1999) found that children with CU traits show reduced skin conductance (i.e., electrodermal measure of affective arousal) in response to distressing stimuli compared with controls. Similarly, Kimonis and colleagues (2008) found that CU traits were related to lower skin conductance reactivity in response to peer provocation in detained adolescents. Further, youth with CU traits exhibited blunted cortisol (i.e., a hormonal measure of stress responsiveness) reactivity under conditions of experimentally induced stress (Stadler et al., 2011). Thus, youth with CU traits exhibit a physiologically distinct profile of emotional responsiveness compared with the highly reactive antisocial youth.

Third, patterns of aggressive behavior displayed by youth high in CU traits notably differ from more emotionally reactive youth. Children with disruptive and antisocial behavior problems often fall into one of two groups of aggressive behavior, one characterized by higher levels of both proactive and reactive aggression, and the other characterized by primarily reactive aggression, with significantly less aggression overall (Crapanzano, Frick, & Terranova, 2010; Munoz et al., 2008). In contrast to reactive aggression, proactive aggression refers to unprovoked acts that are motivated by the individual's desire for personal gain (Dodge, 1991; Dodge & Coie, 1991). A number of studies have found that proactive aggression is associated with CU traits in youth. For example, Frick and colleagues (2003) found that youth with conduct problems who did not display CU traits showed no significant differences from non-aggressive youth on levels of proactive aggression. However, youth with conduct problems and high CU traits showed

significantly higher proactive aggression than those without CU traits. Similarly, Crapanzano and colleagues (2010) found that children who displayed high levels of both proactive and reactive aggression had significantly higher CU traits than children who were reactively aggressive or non-aggressive. Proactive aggression has been linked to many of the same patterns of low emotional reactivity seen in youth with CU traits. For example, a study by Hubbard and colleagues (2002) found that proactive aggression, but not reactive aggression, was associated with reduced skin conductance and heart rate acceleration during provocation tasks. Further, Muñoz and colleagues (2008) reported that youth with high rates of both proactive and reactive aggression high in CU traits exhibited lower levels of emotional reactivity in response to provocation than youth high on only reactive aggression. These findings provide additional support for a link between low emotionality, CU traits, and the use of proactive aggression in antisocial youth.

Finally, youth with CU traits consistently differ from antisocial youth without CU traits in terms of the level of violence exhibited in delinquent behavior. Specifically, antisocial youth with CU traits are typically more violent, aggressive, and engage in more criminal behaviors than youth without CU traits (Forth & Mailloux, 2000; Ridenour, Marchant, & Dean, 2001). For example, Pardini (2006) found that low levels of temperamental fearlessness and high levels of CU traits were linked with increased levels of serious violent behavior. Further, adolescent offenders with CU traits display more serious forms of violence that result in more severe injuries to their victims (Kruh, Frick, & Clements, 2005; Murrie, Cornell, Kaplan, McConville, & Levy-Elkon, 2004). Further, low levels of fear can lead to both impaired conscience development, insensitivity to punishment, and a tendency to engage in novel and dangerous behavior (Frick & Morris, 2004; Pardini, 2006). Thus, violent behavior in CU youth likely

develops due to low temperamental fearfulness and insensitivity to punishment associated with low emotional arousal.

Distinct Emotion Processing Pathways to Antisocial Behavior

Taken together, evidence suggests there are distinct developmental pathways to antisocial behavior in youth. The first is a “high arousal” pathway, characterized by problems in emotion regulation, comorbid internalizing behavior problems, reactive aggression, and possibly less frequent delinquency due to a strong inhibition system. The second is a “low arousal” pathway, characterized by low fearfulness, high CU traits, proactive and reactive types of aggression, and more severe and violent delinquent behavior. Although it is important to consider the role of biologically influenced characteristics such as emotional reactivity and regulation in the development of antisocial behavior, it is equally important to examine the ways in which certain aspects of the youth’s environment may contribute to the development and maintenance of these behavioral patterns. For youth in the juvenile justice system, exposure to trauma and symptoms of PTSD are particularly relevant.

PTSD, Emotional Reactivity, and Antisocial Behavior

Exposure to traumatic events places youth at risk for a variety of adverse outcomes throughout early development, including both internalizing and externalizing behavior problems (Ford, Chapman, Mack, & Pearson, 2006; Lansford et al., 2002; Stimmel et al., 2014). Further, youth in the juvenile justice system report significantly higher (i.e., two-thirds higher) rates of trauma exposure compared with non-offending peers, suggesting that trauma may be an important factor in the development of juvenile delinquency (Dodge, Pettit, Bates, & Valente, 1995). For example, Widom and Maxfield (2001) found that being abused in childhood

increased the likelihood of arrest for a violent crime by 30 percent. Baglivio and colleagues (2015) reported that children who faced multiple adverse experiences engaged in earlier and more chronic patterns of offending, even after controlling for other known risk factors for offending, such as antisocial peers and lack of parental supervision. Further, Teague, Mazerolle, Legosz, and Sanderson (2008) found that youth who were victims of violent crime were more likely to engage in serious delinquent behaviors than peers and were more likely to recidivate as juvenile and throughout adulthood. Thus, exposure to trauma is uniquely associated with delinquent behavior and a significant risk factor for future criminality.

In addition, trauma exposure also places youth at risk for developing symptoms of PTSD. Studies suggest up to 50 percent of juvenile offenders meet diagnostic criteria for PTSD (e.g., Steiner, Garcia, & Matthews, 1997), although subclinical PTSD symptom expression is likely much higher. That is, it is likely that many youth in detention settings experience PTSD symptoms but do not meet diagnostic criteria for the disorder. As defined in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed. text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000), PTSD is comprised of a constellation of symptoms that arise following exposure to a traumatic event. An event is considered traumatic when it causes serious psychological, physical, or emotional distress or harm and involves a threat to safety or stability of the individual. Symptoms of PTSD are closely related to both high and low emotional reactivity. For example, hyperarousal symptoms include irritability, exaggerated startle response, angry outbursts, and reckless behavior. Symptoms of emotional detachment and numbing often include restricted affect, difficulty experiencing positive feelings, and a feeling of being disconnected from others.

PTSD symptoms that are associated with increased arousal have been linked with antisocial behavior. Buckley and colleagues (2002) reported that individuals with PTSD devoted more attentional resources to threatening stimuli, resulting in increased hostile attribution biases. Additionally, Scheeringa and Zeenah (2008) found that PTSD symptoms were associated with intense emotional reactivity, often in the form of anger and oppositional behavior. Similarly, Steiner and colleagues (1997) found that individuals with PTSD exhibited higher levels of impulsivity, more difficulty suppressing aggression, and tended to utilize immature coping strategies, such as projection and withdrawal. Further, in a study examining the effects of hurricane exposure on youth, Marsee (2008) found that trauma exposure was indirectly linked to reactive aggression through the experience of dysregulated emotions brought on by symptoms of PTSD. The association between reactive aggression, emotion dysregulation, and PTSD remained significant after controlling for proactive aggression. Thus, emotionally dysregulated youth who experience symptoms of PTSD may be at increased risk of responding to provocation using reactive aggression. Moreover, in a sample of detained youth, Stimmel and colleagues (2014) reported that the severity of hyperarousal symptoms of PTSD was positively associated with higher levels of reactive aggression, indicating that individual symptom categories of PTSD may provide a clearer picture of the relationship between trauma and externalizing behaviors. Taken together, these findings indicate that high emotional reactivity has been linked to increases in arousal symptoms of PTSD, possibly leading to increased hostile attribution and reactive aggression in antisocial youth.

PTSD symptoms associated with low emotional arousal are linked with antisocial behavior via CU traits. Specifically, Bennett and Kerig (2014) reported that trauma-exposed youth who had high levels of CU traits exhibited significantly more symptoms of emotional

numbing than non-CU youth. Further, Kerig and colleagues (2012) found that emotional numbing symptoms mediated the relationship between trauma exposure and callousness. Low emotional reactivity may be associated with frequent symptoms of emotional detachment and numbing. More research is needed to determine whether individuals exhibit differences in aggressive (i.e., increased proactive aggression) and delinquent (i.e., increased violent offending) behavior consistent with the high/low reactivity model proposed by Frick and Morris (2004).

Statement of the Problem

Antisocial behavior in youth seems to develop along distinct developmental pathways influenced by emotional reactivity and environmental characteristics such as trauma. First, highly emotional youth have difficulty regulating their emotional responses to stimuli they perceive as threatening. These individuals are often prone to internalizing behavior problems, such as depression and anxiety, as well as externalizing behavior problems, such as aggression and delinquency. Emotion dysregulation is uniquely associated with reactive aggression. Reactively aggressive individuals are often more likely to perceive neutral or non-threatening events as hostile and are also more likely to react impulsively in these situations. Consequently, reactive aggression has consistently been linked with delinquent behavior in youth. However, the higher incidence of internalizing behavior problems in emotionally dysregulated youth often protects against violent criminal offending.

The second group of antisocial youth displays low emotional reactivity. These individuals are temperamentally prone to display limited emotional responses. This pattern of emotional under-responsivity often impairs a person's ability to develop empathy and is linked with callous-unemotional (CU) traits in youth (Frick & Morris, 2006). CU traits in youth may be a precursor to adult psychopathy and may indicate a stable pattern of severe antisocial behavior. Further, CU traits are associated with the use of both proactive and reactive aggression. Unlike reactive aggression, proactive aggression is typically more instrumental in nature, with individuals using aggression as a means to attain a goal or for some sort of personal gain. These individuals often exhibit fearlessness and lack of guilt associated with their aggressive or delinquent behavior, and may therefore be more likely to engage in violent offending.

Although the ability to process and regulate emotions is often considered a biologically influenced (i.e., temperamental) characteristic, aspects of the individual's environment also contribute to the development and maintenance of these traits. For example, exposure to trauma can lead to symptoms of PTSD (e.g., hyperarousal, emotional numbing) that may be similar to temperamental styles of emotion processing and regulation. Trauma exposure and PTSD are particularly relevant when examining antisocial and delinquent behavior, given the disproportionately high rates of trauma reported in justice-involved youth. Trauma exposure in youth is associated with a number of behavioral and emotional characteristics that place them at increased risk of aggressive and delinquent behaviors. For example, trauma exposure has been associated with poor emotion regulation and reactive aggression (e.g., Marsee, 2008). Although fewer studies have examined associations between trauma and proactive aggression, some trauma-exposed youth may use proactive as well as reactive aggression in response to the traumatic experience. These youth may develop an interpersonal style that is consistent with CU youth.

Recently, a body of research examined associations between PTSD symptoms and antisocial behavior. Symptoms of emotional numbing are associated with CU traits in trauma-exposed youth while symptoms of hyperarousal are associated with reactive aggression. PTSD symptom expression may parallel emotional reactivity profiles associated with distinct pathways to antisocial behavior. However, existing research is limited in two main ways.

First, although previous research has established a link between PTSD symptoms, emotion dysregulation, and reactive aggression (Marsee, 2008), no study has examined ways in which exposure to trauma may lead to proactive aggression. The current study compared PTSD symptoms in high and low reactivity groups to both proactive and reactive types of aggression.

Since proactive aggression tends to be a marker for more severe and stable antisocial behavior research that continues to address unique characteristics of proactively aggressive youth is needed.

Second, studies have yet to examine whether low- and high-reactivity groups differ in the types of offenses they commit (i.e., violent versus non-violent). Thus, the current study examined whether certain PTSD symptoms were associated with violent or nonviolent offending.

Identification of distinct groups of youth who differ in the types and severity of their delinquency will increase our understanding of pathways to antisocial behavior and may inform methods of treating justice-involved youth (i.e., providing trauma-focused interventions). Given these goals for the current study, the following hypotheses were examined.

Hypotheses

1. It is hypothesized that the following associations among the main study variables will emerge:
 - a. Trauma exposure will be positively associated with reactive aggression, proactive aggression, PTSD symptoms of hyperarousal and emotional numbing, CU traits, emotion dysregulation, violent delinquency, and delinquency.
 - b. Hyperarousal symptoms (i.e., increased startle response, hypervigilance) will be positively associated with emotion dysregulation.
 - c. Emotional numbing symptoms (i.e., restricted affect, feelings of detachment from others) will be positively associated with CU traits.

2. Hyperarousal will be positively associated with reactive aggression (controlling for proactive aggression) and with non-violent delinquency (controlling for violent delinquency).
3. Emotional numbing will be positively associated with proactive aggression (controlling for reactive aggression), nonviolent delinquency, and violent delinquency.
4. Three distinct groups will emerge using latent profile analysis: a group with high levels of emotion dysregulation and hyperarousal (high arousal group), a group with high levels of CU traits and emotional numbing (low arousal group), and a group with few or no PTSD symptoms and no significant differences in emotion dysregulation and CU traits.
5. The following differences between groups are expected:
 - a. Compared to the low arousal group and the control group, the high arousal group will show more nonviolent than violent delinquency and more reactive than proactive aggression.
 - b. Compared to the high arousal group and the control group, the low arousal group will show higher levels of proactive aggression, violent delinquency, and nonviolent delinquency.

Methods

Participants

Participants were 198 male adolescents (aged 12 to 19 years; $M = 15.37$; $SD = 1.21$) who participated in a larger research study on emotional and behavioral correlates of aggression in detained youth. Study participants were incarcerated at one of three juvenile detention centers in southeast Louisiana and were predominantly African-American (82%; see Table 1).

Procedures

After IRB approval, adolescents were recruited from intake records at each of three juvenile detention centers in the southeast Louisiana area. Parental consent was obtained for each youth via telephone and consent was recorded and stored in an audio file on a secure hard drive. In addition to consent for youth to participate, parents were asked to allow researchers access to the child's case files and behavioral records kept by the facility. Youth were excluded from participation if the parent reported any educational exceptionality (e.g., mild or moderate mental retardation), although no youth were excluded based on these criteria. Following parental consent, a team of researchers met with youth at the detention facility and obtained youth assent prior to record review or youth participation. As a reward for participation, youth were given a snack and soda at the conclusion of the session.

To control for differences in reading ability, trained graduate and undergraduate research assistants read all questionnaires aloud to participants. When more than 2 youth were completing questionnaires simultaneously, one research assistant read questionnaires while another acted as a proctor to ensure that participants were answering according to instructions and were working at similar paces. Records were reviewed in a separate room while youth completed the survey.

Measures

Demographic Information. The standard record review form collected information on each youth's age, ethnicity, gender, and arrest history.

Reaction Index (RI; Nader, Pynoos, Fairbanks, & Frederick, 1990; Pynoos et al., 1987).

The RI is a 33-item self-report measure of trauma exposure and PTSD symptoms based on DSM-IV criteria. The measure is divided into three sections. The first section consists of a single question to determine whether the individual has experienced any event that might be considered traumatic. If the youth answers "no" to this item, he or she is instructed to skip the remaining sections and move on to the next measure in the battery. If the youth answers "yes," he or she is instructed to complete the remaining sections of the measure. The second section consists of 13 items to assess the extent of the traumatic experience, (e.g., "did someone die?"; "were you scared that someone else would be hurt badly?"). Based on procedures used in previous research (e.g., Weems, Pina, et al., 2007), respondents indicate *no* (0) or *yes* (1) as to whether they were exposed to the specific events or situations. The total trauma exposure score is obtained by summing the 13 items in this section (range = 0-13). Several studies have shown a positive relationship between total RI scores and severity of trauma exposure (Lonigan, Shannon, Finch, Daugherty, & Taylor, 1991; Lonigan, Shannon, Taylor, Finch, & Sallee, 1994).

The third section consists of 20 items designed to assess the frequency of PTSD symptoms in response to the traumatic event. Each item is scored on a 3-point Likert-type scale from 0 (*none of the time*) to 2 (*most of the time*). Five of these items are designed to assess criterion for each DSM-IV PTSD symptom. (e.g., *hyperarousal*: "I feel jumpy or startle easily, like when I hear a loud noise or when something surprises me;" "I watch out for danger or things I am afraid of"; *emotional numbing*: "I have trouble feeling sadness or anger;" "I feel alone

inside and not close to other people.”). Total scores for each symptom category are computed by summing the items for each symptom (range = 0-15). Previous research has indicated acceptable to good internal validity for each of these subscales (hyperarousal: $\alpha = .78$; emotional numbing: $\alpha = .86$; re-experiencing: $\alpha = .86$; Vernberg, LaGreca, Silverman, & Prinstein, 1996). For the purposes of this study, the hyperarousal and emotional numbing scores were calculated and showed good internal consistency (hyperarousal: $\alpha = .86$; emotional numbing: $\alpha = .86$). The total trauma exposure score was calculated for descriptive purposes and demonstrated excellent internal consistency (Cronbach’s $\alpha = .90$).

Abbreviated Dysregulation Inventory (ADI; Mezzich, Tartar, Giancola, & Kirisci, 2001).

The Abbreviated Dysregulation Inventory is a 30-item self-report questionnaire designed to measure behavioral, cognitive, and emotional/affective regulation in adolescents. The emotional/affective dysregulation (ED) subscale consists of 10 items measuring poorly regulated emotional behavior (e.g., “I have trouble controlling my temper”; “often I am afraid I will lose control of my feelings”). The cognitive dysregulation (CD) subscale consists of 10 items measuring goal-directed behavior, ability to learn from mistakes, thinking and planning behavior, and task persistence (e.g., “I think about the future consequences of my actions”). The behavioral dysregulation (BD) subscale consists of 10 items measuring behavioral impulsivity (e.g., “I have difficulty remaining seated at school or at home during dinner”), hyperactivity, aggression, and sensation seeking. Each item on the ADI is rated on a 4-point Likert-type scale from 0 (*Never True*) to 3 (*Always True*). The ADI has shown significant correlations with established measures of emotional and behavioral distress in adolescents (Pardini et al., 2003). Further, the ED subscale has been shown to be uniquely associated with reactive aggression in detained adolescent girls after controlling for proactive aggression (Marsee & Frick, 2007). The ED

subscale has shown good internal consistency in previous studies (Cronbach's $\alpha = .88$; e.g., Marsee, 2008). For the purposes of the current study, the ED scale was calculated and demonstrated good internal consistency (Cronbach's $\alpha = .86$).

Inventory of Callous-Unemotional Traits—Youth Self-Report (ICU; Frick, 2004). The ICU is a 24-item self-report questionnaire designed to assess CU traits in youth. Items are scored on a 4-point scale (0 = *not at all true*, 1 = *somewhat true*, 2 = *very true*, and 3 = *definitely true*). The ICU was developed from the 4-item CU subscale of the Antisocial Process Screening Device (APSD; Frick & Hare, 2001), a widely used measure of antisocial behavior in children. The CU subscale has been shown to designate a subgroup of antisocial youth with more severe conduct problems than other youth with conduct disorder. The CU component of the APSD has emerged as a unique factor in both clinic and community samples (Frick, Bodin, & Barry, 2000), although the subscale has shown only moderate internal consistency in previous studies (e.g., Loney et al., 2003), likely due to its small number of items ($n=6$). The ICU was developed to overcome these issues and to extend the construct of CU traits. It was constructed using 4 of the original 6 items ('is concerned about the feelings of others,' 'feels bad or guilty,' 'is concerned about schoolwork,' and 'does not show emotions') on the CU subscale that loaded significantly on the CU factor in both clinic and community samples (Frick et al., 2000). Three negatively and three positively worded items were constructed from each of these four original items of the APSD. Positively worded items are reverse-scored and then items are summed to obtain a total score. Results of factor analytic studies have indicated that the best-fitting factor structure is one specifying a general CU factor (total CU) and three subscale factors: callousness, uncaring, and unemotional (Essau, Sasagawa, & Frick, 2006; Kimonis et al., 2008). However, recent research has indicated that CU traits are best conceptualized as a unidimensional construct in which the

total ICU score is used as a continuous measure of CU traits (Frick & Ray, 2014; Ray et al., 2015). Thus, the current study assessed CU traits using only the total ICU scores.

The reliability and validity of the total ICU score has been supported in both community (e.g., Essau et al., 2006) and detained (e.g., Kimonis et al., 2008) samples, with internal consistency ranging from acceptable (e.g., $\alpha = .77$) to good (e.g., $\alpha = .81$). In addition, the total ICU score has shown significant associations with aggression, delinquency, and both physiological and self-report indices of emotional reactivity (Kimonis et al., 2008). Reliability of the ICU total score in the current study was acceptable (Cronbach's $\alpha = .75$).

Peer Conflict Scale (PCS: Marsee et al., 2011). The PCS is a 40-item self-report measure designed to assess aggression in youth. It includes 20 items assessing reactive aggression (including reactive overt: "When someone threatens me, I end up getting into a fight"; and reactive relational: "Sometimes I gossip about others when I am angry at them") and 20 items assessing proactive aggression (including proactive overt: "I start fights to get what I want"; and proactive relational: "I gossip about others to become popular"). For the purposes of the current study, total reactive and total proactive scales were calculated. Items are rated on a 4-point scale (0 = *not at all true*, 1 = *somewhat true*, 2 = *very true*, and 3 = *definitely true*) and scores are calculated by summing the items to create total reactive or total proactive scales (range = 0-60).

In a community sample of trauma-exposed youth (Marsee, 2008), good internal consistencies were reported for the total reactive and proactive subscales (reactive: $\alpha = .87$; proactive $\alpha = .86$). The reactive and proactive scales have demonstrated acceptable internal consistency in samples of detained adolescents (reactive: $\alpha = .86$; proactive: $\alpha = .77$; Munoz et al., 2008). Research has shown that the reactive subscale of the PCS is associated with emotion dysregulation and greater autonomic reactivity during provocation while the proactive subscale

is associated with violent delinquency and CU traits (Marsee, 2008; Munoz et al., 2008). In the current study, both proactive (Cronbach's $\alpha = .81$) and reactive (Cronbach's $\alpha = .84$) aggression subscales demonstrated good internal consistency.

Self-Report of Delinquency Scale (SRD; Elliot, Huizinga, & Ageton, 1985). The SRD is a 43-item structured interview to assess delinquent behavior, including 8 items assessing violent (“Have you ever attacked someone with the idea of seriously hurting or killing them?”) and 34 items assessing non-violent (“Have you ever purposely damaged property that did not belong to you?”) offenses committed by youth. For each of 42 delinquent acts the youth is asked (a) whether or not he or she has ever engaged in the stated problem behavior, (b) the age at which he or she first engaged in the behavior, (c) the number of times he or she has engaged in the behavior, and (d) the number of times he or she has engaged in the behavior in the past 12 months. The remaining item assesses the arrest history of members of the youth's immediate family (“Has anyone in your family ever been arrested?”). For the purposes of the current study, total scores were calculated for violent (range = 0-8) and non-violent (range = 0-34) delinquency by summing the number of yes ratings for part a. Scores on the SRD demonstrate good internal consistency ($\alpha = .88$ for boys and $.82$ for girls; Krueger et al., 1994). In the current study, violent delinquency demonstrated acceptable internal consistency (Cronbach's $\alpha = .63$) and nonviolent delinquency showed good internal consistency (Cronbach's $\alpha = .86$).

Results

Preliminary Analyses

Table 1 reports the means, standard deviations, and correlations for demographic (i.e., age and ethnicity) and main study variables. Bivariate correlational analyses indicated that age was positively associated with trauma exposure ($r = .17; p < .05$), PTSD symptoms of hyperarousal ($r = .15; p < .05$), and nonviolent delinquency ($r = .20; p < .01$), indicating that older youth reported more significant trauma histories and symptoms of hyperarousal, as well as higher rates of nonviolent offenses than younger peers. Age was negatively associated with CU traits, ($r = -.17; p < .05$), indicating that younger children were more likely to report high levels of CU traits. In order to calculate correlations with ethnicity, the variable was recoded into a “dummy variable,” such that African American = 1 and all other ethnicities = 0. Ethnicity was negatively associated with trauma exposure ($r = -.18; p < .05$), indicating that African American youth reported less extensive trauma ($M = 4.17; SD = 4.08$) histories compared with other youth in the sample ($M = 6.25; SD = 3.88$).

Hypothesis 1

Hypothesis 1 consisted of three parts: (a) that trauma exposure would be positively associated with PTSD symptoms, aggression, and delinquency, CU traits, and emotion dysregulation; (b) that hyperarousal symptoms of PTSD would be associated with emotion dysregulation; and (c) that emotional numbing symptoms of PTSD would be associated with CU traits. To test this hypothesis, bivariate correlations were calculated. As illustrated in Table 1, trauma exposure was positively associated with hyperarousal ($r = .81; p < .001$), emotional numbing ($r = .70; p < .001$), emotion dysregulation ($r = .28; p < .01$), reactive ($r = .20; p < .01$)

and proactive ($r = .19; p < .05$) aggression, and both violent ($r = .45; p < .001$) and nonviolent ($r = .52; p < .001$) delinquency. Hyperarousal symptoms were positively associated with emotion dysregulation ($r = .38; p < .01$) and emotional numbing symptoms were positively associated with CU traits ($r = .19; p < .05$). Contrary to the hypothesis, trauma exposure was not related to youth's level of CU traits, consistent with the notion that CU traits are more temperamentally related and less related to environmental influences, such as traumatic stress. However, given the significant association between CU traits and emotional numbing symptoms of PTSD, this finding highlights the importance of examining specific reactions to trauma, rather than simply evaluating the presence or absence of trauma.

Table 1. Means, standard deviations, and correlations of main study variables.

	1	2	3	4	5	6	7	8	9	10	M	SD
1. Age	1										15.37	1.17
2. Ethnicity	.02	1									-	-
3. TE	.17*	-.18*	1								4.55	4.10
4. HypArou	.15*	-.10	.81**	1							3.39	3.16
5. EmoNumb	.002	-.14	.70**	.74**	1						2.40	2.96
6. EmoDys.	-.06	.03	.28**	.38**	.35**	1					13.11	7.10
7. CU	-.17*	.10	.08	.13	.19*	.24**	1				28.76	8.69
8. RA	-.04	.05	.20**	.23**	.26**	.46**	.30**	1			12.82	8.17
9. PA	-.01	.04	.19*	.20**	.24**	.31**	.35**	.72**	1		5.03	6.29
10. VioDel	.06	.101	.45**	.42**	.41**	.39**	.32**	.38**	.30**	1	2.20	1.64
11. NVioDel	.20**	-.12	.52**	.49**	.37**	.29**	.10	.24**	.17*	.66**	11.04	6.37

Note: TE = Trauma Exposure; HypArou = Hyperarousal; EmoNumb = Emotional Numbing; EmoDys = Emotion Dysregulation; CU = callous-unemotional traits; RA = Reactive Aggression; PA = Proactive Aggression; VioDel = Violent Delinquency; NVioDel = Nonviolent Delinquency * $p < .05$; ** $p < .01$ Ethnicity Coding: 1= African-American; 0 = all other ethnicities

Hypothesis 2

Hypothesis 2 stated that hyperarousal symptoms would remain positively associated with nonviolent delinquency after controlling for violent delinquency and with reactive aggression after controlling for proactive aggression. These assertions were tested using hierarchical linear regression, results of which are presented in Table 2. Due to high correlations between each set of predictor variables, multicollinearity indices were reviewed, specifically tolerance and variance inflation factor (VIF) values. All tolerance values were greater than .40 and all VIFs were lower than 2.5, which are considered acceptable values (Tabachnick & Fidell, 2001). An initial model tested the links between hyperarousal and non-violent delinquency. Nonviolent delinquency was entered as the dependent variable. Violent delinquency was entered into the first step of the regression to control for its effects and hyperarousal was entered into the second step. As expected, the relationship between hyperarousal and nonviolent delinquency remained significant after controlling for violent delinquency ($\beta = .26, t = 4.57, R^2 = .51, p < .01$). In the second model, reactive aggression was entered as the dependent variable. Proactive aggression was added in the first block in order to control for its effects, and hyperarousal was entered into the second block as a predictor. Contrary to expectations, reactive aggression was not significantly associated with hyperarousal after controlling for proactive aggression ($\beta = .09, t = 1.69, R^2 = .54, p = .09$).

Hypothesis 3

The third hypothesis stated that symptoms of emotional numbing would remain positively associated with proactive aggression after controlling for reactive aggression. This hypothesis was tested using the same hierarchical regression procedure outlined above (see Table 2). Reactive aggression was entered into the first step of the regression, emotional numbing was

entered into the second, and proactive aggression was entered as the dependent variable. Examination of VIF and tolerance values indicated there were no problems with multicollinearity among the variables. Contrary to predictions, results indicated that proactive aggression did not account for significant variance in symptoms of emotional numbing, beyond the effects of reactive aggression ($\beta = .06, t = 1.15, R^2 = .52, p = .25$). Hypothesis 3 also stated that emotional numbing would remain positively associated with both violent and nonviolent delinquency after controlling for each opposite type respectively. To test this hypothesis, violent delinquency was first entered as the dependent variable while nonviolent delinquency was entered into the first step of the regression and emotional numbing was entered into the second step as the predictor. This process was repeated with nonviolent delinquency entered as the dependent variable and violent delinquency controlled for in the first step. There was no indication of problematic multicollinearity among the variables based on VIF and tolerance values. As predicted, emotional numbing symptoms remained positively associated with nonviolent ($\beta = .11, t = 1.98, R^2 = .46, p < .05$) and violent ($\beta = .18, t = 3.06, R^2 = .48, p < .01$) delinquency after controlling for each opposite type.

Table 2. Regression Analyses Examining Independent Associations between Aggression, Delinquency and PTSD Symptoms

Model 1a: NVioDel	B	Std. Error	β	<i>t</i>	<i>p</i>	Semi-Partial	<i>R</i> ²
<i>Step 1</i>							
VioDel	2.63	.21	.67	12.27	.000	.67	.67**
<i>Step 2</i>							
VioDel	2.21	.22	.56	9.88	.000	.51	.71**
HypArou	.53	.12	.26	4.57	.000	.32	
Model 1b: RA							
<i>Step 1</i>							
PA	.95	.07	.73	14.30	.000	.73	.53**
<i>Step 2</i>							
PA	.92	.07	.71	13.70	.000	.69	.54
HypArou	.23	.13	.09	1.69	.093	.09	
Model 2a: PA							
<i>Step 1</i>							
RA	.55	.04	.72	13.24	.000	.67	.52**
<i>Step 2</i>							
RA	.54	.04	.70	13.24	.000	.51	.52
EmoNumb	.13	.11	.06	1.15	.251	.06	
Model 2b: VioDel							
<i>Step 1</i>							
NVioDel	.17	.01	.67	12.36	.000	.67	.45**
<i>Step 2</i>							
NVioDel	.16	.02	.61	10.66	.000	.57	.48**
EmoNumb	.10	.13	.18	3.06	.003	.16	
Model 2c: NVioDel							
<i>Step 1</i>							
VioDel	2.63	.21	.67	12.36	.000	.67	.45**
<i>Step 2</i>							
VioDel	.16	.23	.63	10.66	.000	.58	.46*
EmoNumb	.25	.13	.12	1.98	.050	.11	

Note: NVioDel = Nonviolent Delinquency; VioDel = Violent Delinquency; HypArou = Hyperarousal; EmoNumb = Emotional Numbing; RA = Reactive Aggression; PA = Proactive Aggression N=188; ***p*<.01 **p*<.05

Hypothesis 4

Latent Profile Analysis. Latent Profile Analysis (LPA; Lazarsfeld & Henry, 1968) was conducted using Mplus 7.11 (Muthén & Muthén, 2013) with robust maximum likelihood estimation, to test the hypothesis that distinct groups would emerge that differ on levels of PTSD symptoms and emotional reactivity styles. Emotion dysregulation and CU traits were selected as theoretical representations of high and low reactivity. Hyperarousal and emotional numbing symptoms were selected as PTSD symptoms that were expected to mirror emotional reactivity styles

LPA is a type of person-centered analysis, in that it attempts to identify distinct population subgroups defined by their shared response patterns (“profiles”) on a set of variables (Lanza & Cooper, 2016) thought to be influenced by one or more latent variables. Said differently, the analysis assumes that individual scores are drawn from a mixture of subpopulations with different characteristics. Multiple fit indices are examined to determine the best-fitting model (i.e., the best number of groups or classes of individuals). LPA is often preferred over traditional cluster analyses because it is a model-based technique, and defines groups based on probabilities of group membership, rather than defining groups based on distances from sample means (e.g., Euclidian distance), resulting in greater classification accuracy (Vermunt & Magidson, 2002).

Starting with a one-group model, a series of models with an increasing number of groups were estimated until the addition of new groups no longer improved model fit (Nylund, Asparouhov, & Muthen, 2007). As recommended by Nylund and colleagues (2007), determination of the best fitting model was made using a combination of likelihood ratios, goodness-of-fit indices, and theoretical considerations. Fit statistics for all models are presented

in Table 3. For the current analyses, these consisted of Akaike Information Criteria (AIC; Akaike, 1981), Bayesian Information Criteria (BIC; Schwarz, 1978), and Sample-Size Adjusted BIC (SSA-BIC; Sclove, 1987), with lower values of each criterion indicative of better fit to the data. Additionally, the entropy statistic assesses accuracy of the classification and ranges from 0-1, with higher scores representing greater classification accuracy. Finally, the Vuong-Lo-Mendell-Rubin test (VLMR; Lo, Mendell, & Rubin, 2001) was used to compare the likelihood ratio for each estimated model with that of a model containing one less class. A significant VLMR test indicates that the model with more classes fits significantly better.

Results of the VLMR test revealed no improvement in model fit after the 4-group model; therefore, the 5-class model was eliminated from consideration. The 1- and 2-group models had significantly lower values on all fit indices; therefore, these models were eliminated, and only the 3- and 4-group models were retained for further analyses. Initially, models were computed assuming that group membership would account for all of the covariation among the four indicator variables (i.e., covariances among indicators was forced to be 0). Forcing the covariances to zero enforces the assumption of homogeneity of variance within classes, but this is a controversial assumption of latent profile analysis, and the assumption can be empirically tested. To test the assumption, the covariances among the indicators were freely estimated to determine whether permitting non-zero covariances among indicators would improve model fit. Specifically, each model was re-estimated a second time to determine whether estimating within-class correlations among the indicators would improve model fit. The only significant covariance was between CU traits and emotion dysregulation and was thus the only one retained in the final analysis. Fit statistics from this analysis are presented in Table 4. The AIC, BIC, and SSA-BIC all showed modest decreases as the class size went from three to four classes. The inclusion of

the covariance of CU traits and emotion dysregulation into the model also improved the VLMR of the 4-group model, suggesting that the 4-group was now a significantly better fit for the data than the 3-group model. Further, although the entropy value was slightly lower in the 4-class model, a value of .90 indicates that this model maintained a high degree of classification accuracy. Thus, the 4-class model was selected as the best-fitting model for the data.

Table 3. *Model fit statistics for Latent Profile Models*

Model	AIC	BIC	SSA-BIC	Entropy	VLMR (<i>p</i> -value)
1-group	4683.14	4709.45	4684.11	-	-
2-group	4478.50	4521.25	4480.06	0.86	>.001
3-group	4396.02	4455.21	4398.19	0.92	>.05
4-group	4335.55	4411.18	4338.32	0.90	0.06
5-group	4313.85	4405.92	4317.22	0.90	0.52

Note: AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; SSA-BIC = Sample-Size Adjusted BIC; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test

Table 4. *Model fit statistics for Latent Profile Models following inclusion of covariates*

Model	AIC	BIC	SSA-BIC	Entropy	VLMR (<i>p</i> -value)
3-group	4371.81	4440.86	4374.33	0.94	>.01
4-group	4330.24	4409.16	4333.79	0.90	>.05

Note: AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria; SSA-BIC = Sample-Size Adjusted BIC; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test

Profile Characteristics: Class membership details are presented in Table 5 and are visually depicted in Figure 1. Group characteristics were as follows.

Group 1 ($n = 95$): Group 1, labeled “Low/No Trauma,” demonstrated lower scores on all indicator variables. Group 1 was significantly lower on hyperarousal ($M = 0.62$; $SD = 1.14$) than the second group ($M = 7.64$; $SD = 1.28$), third group ($M = 5.74$; $SD = 1.79$) and the fourth group ($M = 5.82$; $SD = 1.80$). Group 1 was significantly lower on emotional numbing ($M = .16$; $SD = .49$), than the second group ($M = 9.29$; $SD = 1.44$), the third group ($M = 1.77$; $SD = 1.02$), and the fourth group ($M = 5.06$; $SD = .93$). On symptoms of emotion dysregulation ($M = 10.84$; $SD = 6.90$), the Low/No Trauma group was significantly lower than the second group ($M = 19.85$; $SD = 6.44$) and the fourth group ($M = 14.38$; $SD = 5.66$) but not the third group ($M = 13.00$; $SD = 7.87$). Finally, the Low/No Trauma group was significantly lower on CU traits ($M = 27.83$; $SD = 8.19$) compared to the second group ($M = 33.93$; $SD = 10.45$), but not the third ($M = 28.10$; $SD = 8.25$) or fourth ($M = 29.43$; $SD = 8.62$) groups.

Group 2 ($n = 14$): Group 2 was labeled “High Combined” due to significantly higher scores on most indicator variables. Specifically, this group had significantly higher symptoms of hyperarousal, emotional numbing, and emotion dysregulation compared to all other groups. Group 2 was significantly higher on CU traits compared with groups 1 and 3, but was not significantly different on this variable compared with group 4.

Group 3 ($n = 31$): Group 3 was labeled “Arousal Only.” This group was significantly lower than the High Combined (Group 2) on all indicator variables, was significantly higher than the Low/No Trauma (Group 1) on hyperarousal and emotional numbing. The Arousal Only group was significantly lower on symptoms of emotional numbing compared with the fourth group—all other differences between these two groups were non-significant.

Group 4 ($n = 50$): Group 4, labeled “Arousal+Numbing,” did not significantly differ from any other group on CU traits. They were significantly higher than the Low/No Trauma group and significantly lower than the High Combined group on emotion dysregulation, hyperarousal, and emotional numbing. Further, groups 3 and 4 had nearly identical scores on hyperarousal but group 4 had significantly higher scores on emotional numbing symptoms.

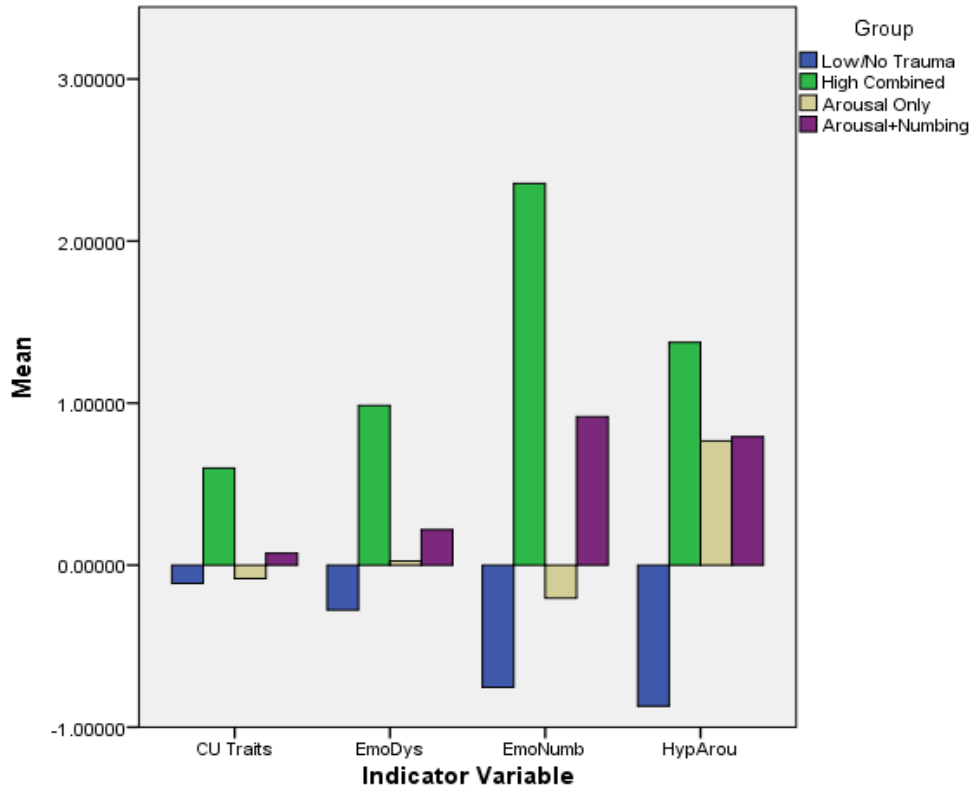
A one-way ANOVA was computed to determine whether the three groups with elevated PTSD symptoms differed on their level of trauma exposure. Results indicated a significant between-groups difference, $F(3, 190) = 75.82; p < .001$. However, post hoc pairwise comparisons indicated that none of the groups exhibiting symptoms of PTSD was significantly different from each other on trauma exposure scores. The Low/No Trauma group was significantly lower on trauma exposure ($M = 1.56; SD = 2.90$) compared to the High Combined ($M = 9.14; SD = 2.66$), Arousal Only ($M = 6.97; SD = 2.54$), or Arousal+Numbing ($M = 7.53; SD = 4.14$) groups. The extremely low trauma scores, combined with PTSD symptom scores that were all lower than 1 supports the classification of this group as the Low/No Trauma control group.

Table 5. *Profile Membership by Indicator Variable*

Group	Overall		1		2		3		4	
	M	SD	M	SD	M	SD	M	SD	M	SD
			Low/No Trauma $n=95$		$n=14$		$n=31$		$n=50$	
CU	28.80	8.55	27.99 ^b	8.23	33.93 ^{a,c}	10.45	28.10 ^b	8.25	29.44	8.53
ED	12.82	7.14	10.88 ^{b,d}	6.82	19.85 ^{a,c,d}	6.45	13.00 ^b	7.87	14.61 ^{a,b}	5.84
EN	2.37	2.93	0.16 ^{b,c,d}	0.49	9.29 ^{a,c,d}	1.44	1.77 ^{a,b,d}	1.02	5.06 ^{a,b,c}	0.93
HYP	3.34	3.13	0.62 ^{b,c,d}	1.15	7.64 ^{a,c,d}	1.28	5.74 ^{a,b}	1.79	5.82 ^{a,b}	1.80

Note: Superscripts indicate significant differences in pairwise comparisons across rows. CU = Callous-unemotional Traits; ED = Emotion Dysregulation; HYP = Hyperarousal; EN = Emotional Numbing

Figure 1. Standardized group means on indicator variables



Note: EmoDys = Emotion Dysregulation; EmoNumb = Emotional Numbing; HypArou = Hyperarousal

Hypothesis 5

A series of one-way ANOVAs were computed to evaluate whether the four groups differed on reactive aggression, proactive aggression, nonviolent delinquency, and violent delinquency.

Means and standard deviations for each group on the four variables are presented in Table 6. Results revealed a significant difference between groups on reactive aggression, $F(3, 190) = 4.23; p = .006$, proactive aggression $F(3, 190) = 4.03; p = .008$, violent delinquency $F(3, 190) = 9.37; p < .001$, and nonviolent delinquency $F(3, 190) = 12.69; p < .001$. Standardized

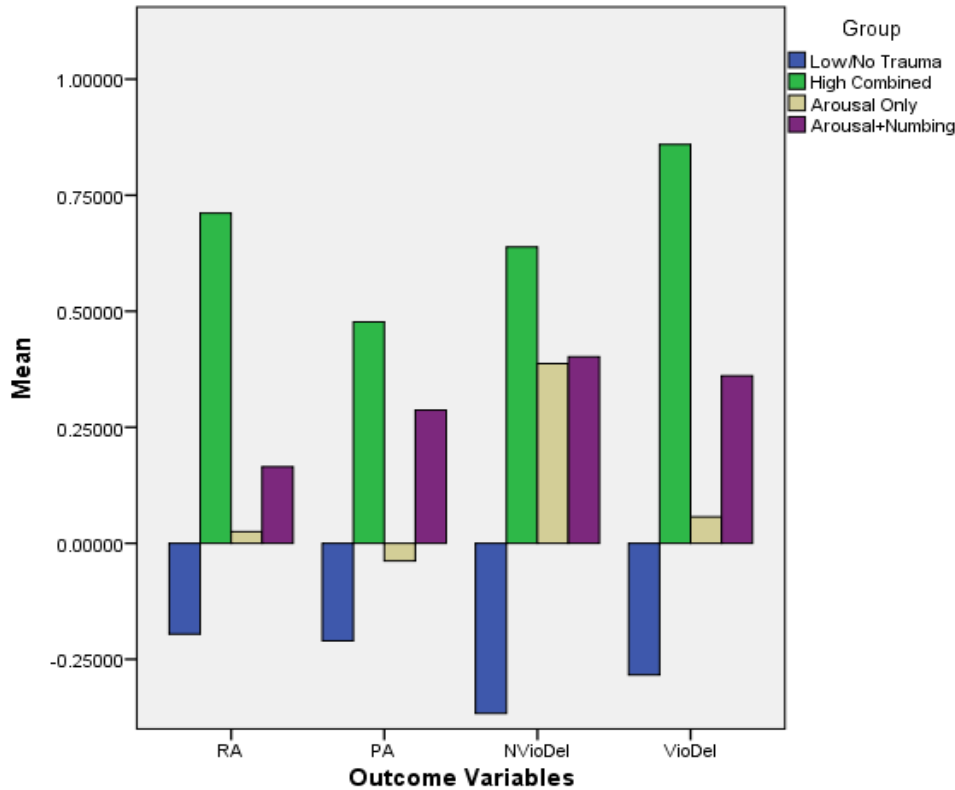
means across groups are visually depicted in Figure 2. For reactive aggression, post hoc pairwise comparisons were examined using a Bonferonni correction to reduce Type II error. Only the Low/No Trauma and High Combined were significantly different from each other, with those in the High Combined group having higher reactive aggression. For proactive aggression, post hoc pairwise comparisons indicated that the Low/No Trauma group scored significantly lower than the Arousal+Numbing group. There were no other significant differences between groups. This finding partially supports the hypothesis that individuals with higher emotional numbing symptoms display increased proactive aggression. For nonviolent delinquency, post hoc comparisons revealed that the Low/No Trauma group scored significantly lower than all other groups, but no other between groups differences were significant. Pairwise comparisons for violent delinquency were examined using Dunnett's C due to a significant Levene's test, indicating homogeneity of variance could not be assumed. The Low/No Trauma group scored significantly lower than the High Combined group and the Arousal+Numbing group. This finding also partially supports the hypothesis that individuals with higher emotional numbing symptoms would exhibit higher violent delinquency.

Table 6. Group Differences on Aggression and Delinquency Variables

Group	Overall		Low/No Trauma <i>n</i> =95		High Combined <i>n</i> =14		Arousal Only <i>n</i> =31		Arousal+Numbing <i>n</i> =50	
	M	SD	M	SD	M	SD	M	SD	M	SD
Variable										
RA	12.80	8.13	11.24 ^b	7.75	18.58 ^a	9.18	13.00	8.38	14.14	7.63
PA	4.99	6.18	3.77 ^{b,d}	5.06	7.94 ^a	7.46	4.76	6.93	6.77 ^a	6.80
VD	2.16	1.64	1.67 ^{b,d}	1.19	3.57 ^a	2.17	2.26	1.53	2.70 ^a	1.91
NVD	10.81	6.40	8.29 ^{b,c,d}	5.23	14.90 ^a	7.45	13.29 ^a	6.22	13.12 ^a	6.41

Note: Superscripts indicate significant differences in pairwise comparisons across rows; RA = Reactive Aggression; PA = Proactive Aggression; VD = Violent Delinquency; NVD = Nonviolent Delinquency

Figure 2. Standardized group means on outcome variables



Note: RA = Reactive Aggression; PA= Proactive Aggression; NVioDel = Nonviolent Delinquency; VioDel = Violent Delinquency

Discussion

The goals of this study were (1) to determine whether PTSD symptoms were associated with the distinct developmental trajectories leading to antisocial behavior (i.e., a high reactivity pathway and a low reactivity pathway), and (2) determine whether distinct PTSD symptom presentations were associated with different patterns of antisocial behavior. Results provide partial support for a link between PTSD symptoms and emotional reactivity. As hypothesized, emotion dysregulation was associated with high levels of hyperarousal symptoms. However, contrary to expectations, emotion dysregulation was also associated with high levels of emotional numbing symptoms. Similarly, CU traits were associated with high levels of emotional numbing symptoms, but were also associated with high levels of hyperarousal. Taken together, these findings suggest that hyperarousal symptoms do not directly parallel emotion dysregulation and emotional numbing symptoms do not directly parallel CU traits.

The finding that individuals with high CU traits had high levels of emotion dysregulation and PTSD symptoms is interesting for two reasons. First, CU trait development is typically less influenced by features of the environment and more influenced by genetic factors (e.g., Viding, Blair, Moffit, & Plomin, 2005). The relationship between CU traits and PTSD symptom severity in the current study suggests that some youth with high CU traits are strongly affected by environmental influences (i.e., trauma). Second, since youth with CU traits do not usually experience strong negative emotionality, they have fewer problems with regulation of emotions (e.g., Frick et al., 2003). In youth who have experienced significant trauma, CU traits may be accompanied by emotion dysregulation, consistent with recent research that has suggested there are distinct variants of CU traits: primary and secondary (e.g., Kimonis, Frick, Cauffman, Goldweber, & Skeem, 2012).

Whereas primary CU traits are characterized by a fearless temperamental style, low anxiety, and minimal emotional engagement (Frick & White, 2008; Kimonis et al., 2012), secondary CU traits are associated with high anxiety (Kimonis et al., 2012) and problems with impulse control (Kahn et al., 2013), a key feature of emotion dysregulation in youth with conduct problems (e.g., Frick & Morris, 2004). Further, youth in the secondary CU variant are more likely than primary CU youth to have histories of abuse and trauma (Tatar, Cauffman, Kimonis, & Skeem, 2012). Taken together, the High Combined group in the current study may represent a secondary variant of CU traits.

Despite differences in emotional arousal and anxiety, primary and secondary variants may not differ in their level of CU traits (Blagov et al., 2011), highlighting the importance of examining underlying mechanisms involved in CU trait development. Results of the present study suggest that PTSD symptoms may be one of the mechanisms involved with the development of CU traits. Specifically, when youth experience high levels of emotional numbing, they may present with a shallow affect and emotional detachment. When high levels of hyperarousal symptoms are also experienced at high levels, youth may become hypervigilant and easily provoked. In the current study, the combination of high CU traits and high symptoms of both hyperarousal and emotional numbing was associated with higher rates of violent and nonviolent delinquency, and reactive and proactive aggression. Thus, the risk of serious aggression and delinquent behavior may be highest among those who are easily provoked to respond aggressively while maintaining a level of emotional detachment that impairs empathic responding.

Even at lower levels of PTSD symptoms, the presence of emotional numbing was associated with differences in aggression, delinquency, and emotion dysregulation. Compared to

the Low/No Trauma control group, the Arousal+Numbing group had significantly higher levels of proactive aggression, violent and nonviolent delinquency, and emotion dysregulation, while the Arousal Only group did not. Given the nearly equivalent hyperarousal scores between the Arousal Only and the Arousal+Numbing groups, emotional numbing symptoms may be an indicator of poor emotion regulation. In other words, some youth may attempt to regulate emotions following traumatic experiences by using maladaptive strategies, such as emotional detachment. In contrast, the Arousal Only group did not significantly differ from the Low/No Trauma control group on emotion dysregulation, reactive or proactive aggression, or violent delinquency. Thus, there may be some protective mechanism preventing youth in the Arousal Only group from engaging in more extreme antisocial behavior. Symptoms of hyperarousal are closely related to symptoms of anxiety (e.g., hypervigilance, heightened startle response), and may be indicative of a stronger behavioral inhibition system (BIS; Gray, 1987). However, when symptoms of emotional numbing are also present, hyperarousal may not result in stronger behavioral inhibition.

The current study found no significant differences across PTSD symptoms groups (i.e., High Combined, Arousal Only, Arousal+Numbing) in the level and severity of trauma exposure, though all three reported significantly more trauma than the Low/No Trauma control group. This finding suggests that although trauma exposure alone increases the risk for antisocial behavior, this risk becomes more clearly delineated when considering how the individual responds and reacts to the trauma. In other words, irrespective of trauma severity, youth in the current study show distinct post-trauma reaction patterns that are associated with different types and levels of antisocial behavior.

Implications

The present study extends existing knowledge about the relationship between PTSD symptoms, emotional reactivity, and antisocial behavior in youth. Findings from the current study suggest a relationship between CU traits in adolescent offenders and PTSD symptoms, particularly those related to emotional numbing and detachment. This finding is important, given that conduct-disordered youth with CU traits are among the most difficult in clinical settings and are often resistant to treatment (e.g., Hawes, Price, & Dadds, 2014). Therefore, these youth may be more susceptible to treatment that includes a strong trauma-focused component and addresses limited emotional expression in the context of PTSD.

Further, results provide support for the existence of distinct variants of CU traits in youth. For individuals in the current study, CU traits were related to significantly high rates of PTSD symptoms. The relationship between high levels of PTSD symptoms and CU traits indicates that youth may develop callous and unemotional interpersonal styles due to extreme reactions to traumatic events. Consistent with the behavioral profile of primary CU youth, individuals with high CU traits and high PTSD symptoms (i.e., “secondary” CU) exhibited increases in violent and nonviolent delinquency, and reactive and proactive aggression. Thus, our study reflects the importance of examining subtypes of CU traits as a way of developing interventions that are more effective for antisocial adolescents.

Finally, different PTSD symptom patterns were associated with different patterns of antisocial behavior. This finding may be useful for identifying risk and protective factors for juvenile offending following trauma. Specifically, identifying patterns of PTSD symptom expression that are associated with increased delinquency will facilitate effective targeting of high-risk youth for early intervention.

Limitations/Future Directions

The current study should be interpreted in light of several limitations, many of which can be used to inform future research. First, the cross-sectional nature of the data prevents the inference of causal conclusions. Future research would benefit from the use of longitudinal designs to examine how PTSD symptoms change over time and whether changes in PTSD symptoms are associated with subsequent reductions in antisocial behavior, CU traits, or emotion dysregulation. A second limitation is the use of the Reaction Index (RI; Nader, Pynoos, Fairbanks, & Frederick, 1990; Pynoos et al., 1987) which does not include items assessing specific trauma (e.g., witnessing violence, being a victim of violence, etc.). As a result, although the present study was able to identify distinct groups based on PTSD symptoms, results could not be interpreted in the context of specific traumas. The type of trauma to which youth were exposed may predict different symptom presentations. In other words, youth who are victims of violent acts may be more likely to respond by using emotional detachment and numbing while youth who witness violence may be predominantly hypervigilant and easily startled (i.e., hyperarousal). Further, the RI does not assess the frequency of traumatic events, which may be a key distinction among youth with PTSD symptoms. For example, experiencing frequent or repeated trauma may result in more emotional numbing than hyperarousal. Future research should examine differences in PTSD symptoms among those who report a single versus multiple traumatic experiences.

Third, although CU traits and emotion dysregulation are often representative of high and low emotional reactivity, they are not direct measures of reactivity or arousal. The significant relationship between CU traits and emotion dysregulation in the current study suggests that these two constructs may not be reliable ways of measuring emotional reactivity. Future research

should include direct measures of reactivity and arousal such as cortisol activity, heart rate variability, as well as EEG or ERP for measuring cortical activity. These instruments will allow for a more precise evaluation of arousal and would be useful for comparing youth self-report of arousal with the actual physiological arousal level.

Fourth, the hyperarousal and emotional numbing symptoms are very highly correlated, limiting the extent to which conclusions can be drawn about the independent effects of either symptom type. Findings in the current study suggest that emotional numbing symptoms may play a significant role in the development of certain aggressive and delinquent behaviors. Therefore, rather than attempting to identify distinct associations between hyperarousal and emotional numbing, future research should consider examining emotional numbing symptoms in the context of a total PTSD symptom score. Specifically, researchers should attempt to determine whether the severity of emotional numbing symptoms is associated with increased violent delinquency or aggression irrespective of overall PTSD symptom severity.

Fifth, the present study relied exclusively on youth self-reports of behavior. Self-report data may be influenced by a number of factors, including participant honesty, level of understanding, and ability to report trauma accurately (Fan et al., 2006). Future research should use a multi-informant approach, gathering parent and teacher data in addition to youth self-report data. The addition of psychophysiological measures will be crucial for determining the accuracy of self-reported arousal and reactivity.

Finally, although juvenile detention centers are ideal setting for studying antisocial behavior, results of this study may not generalize to youth in community or clinic samples. Future research should examine whether similar patterns of PTSD symptom presentation emerge among youth in these settings.

Conclusions

In summary, results support past research that has shown a link between trauma, PTSD, and antisocial behavior. The severity of the trauma may not be as important for predicting future antisocial behavior as the severity of PTSD symptoms. Although trauma severity and PTSD symptom severity are certainly linked, trauma-exposed groups in the current study exhibited numerous differences in PTSD symptom severity, but did not differ on the severity of trauma. Further, findings in the current study provide some support for the hypothesis that PTSD symptoms, like emotional reactivity profiles, are associated with distinct patterns of antisocial behavior. However, contrary to predictions, PTSD symptom patterns did not mirror the emotional reactivity profiles that represent the pathways to antisocial behavior outlined by Frick and Morris (2004). Rather than distinct high and low reactivity profiles, the results suggest that youth experiencing PTSD symptoms are largely prone to a more reactive pattern of behavior. The distinguishing feature among these youth seems to be the presence or absence of emotional numbing symptoms of PTSD. These findings expand our current understanding of how trauma and PTSD symptoms contribute to aggressive and delinquent behavior during adolescence. The association between violence, proactive aggression, and CU traits in youth with more severe post-trauma reactions may provide insight into the importance of developing individualized, trauma-focused interventions for justice-involved youth.

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Vita

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