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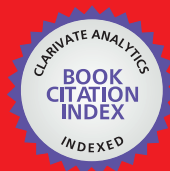
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Development of Psychopathy from Childhood

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Abstract

Serious conduct problems are a serious mental health and public policy concern. Such conduct problems are highly related to criminal behavior and are associated with a host of other social, emotional, and academic problems. In addition, serious conduct problems in childhood predict later impairments in the domains of mental health, legal, educational, social, occupational, and physical health. In the past two decades, a significant body of research has emerged refining how the key features associated with psychopathy may be expressed in children and adolescents. These researches have focused largely on the presence of callous-unemotional traits, which correspond closely to the affective dimension of psychopathy — core to the construct in adult samples. Several reviews have focused on important theoretical questions related to how best to identify psychopathy in children and adolescents but do not directly address their importance for understanding, classifying, and treating youths with severe conduct problems. So, in the forefront of these studies, I aimed to review the development of psychopathy from childhood. In this chapter, topics related to psychopathy, such as diagnosis and nosology, epidemiologic studies, etiologic factors, assessment, diagnostic interviews, comorbid disorders and longitudinal outcome, treatment modalities, and treatment outcome in samples of children and adolescents, were included.

Keywords: child, adolescent, psychopathy, conduct, development

1. Introduction

Psychopathy is defined as complex disorder of personality conceptualized by a constellation of behavioral attributes and personality traits centered on one of three main dimensions: (a) an impulsive/antisocial lifestyle, (b) callous, arrogant, and deceitful interpersonal behavior, or (c) deficient affective responses [1].

It has strong associations with criminality and recidivism [2], and those with high levels of psychopathy are likely to relate in both reactive and premeditated aggression and to demonstrate little remorse for their actions [3].

Conduct disorder, antisocial personality disorder, and psychopathy are known as developmental disorders and the terms can be used interchangeably sometimes. However, there are significant differences between them and related factors [4]. Conduct disorder and antisocial personality disorder primarily focus on behavioral problems, but differently, Hare's psychopathy describe is emphasized that deficits in affective and interpersonal functioning [3]. However, people with these traits exhibit a more severe, violent, and chronic pattern of antisocial behavior [5, 6]. Understanding the construct of psychopathy is important to the legal system, to the mental health system, and for research attempting to explain the causes of antisocial and aggressive behavior. Importantly, research has shown that adults with psychopathic traits often have long histories of antisocial behavior that often extend well into childhood [7].

As a result, there have been numerous attempts to define developmental precursors to psychopathy. In this chapter, we reviewed the development of psychopathy from childhood and related issues in children and adolescents.

2. Diagnosis and nosology

For many years, the construct of psychopathy has had an important role in understanding antisocial behavior and criminality in adults, and the adult psychopathy literature provides the foundation for the youth psychopathy construct [8].

Regardless of disagreement and debate concerning the structure and measurement of the psychopathy construct theories in the adult literature, interest has grown in examining psychopathic traits in youth. First, the strong associations between psychopathy factors and antisocial behavior and violence in the adult literature have prompted interest in whether conduct problems, aggression, and violence in some youth might be explained by similar personality correlates [9]. Second, Lynam has proposed that, to prevent the serious negative outcomes associated with psychopathy, the early identification of psychopathic traits is essential because (a) attempts to treat psychopathy in adulthood have proven to be quite unsuccessful [10, 11]; and (b) evidence suggests that psychopathic individuals have antisocial and criminal histories that begin prior to adulthood [8].

Before the recent increased interest in psychopathic traits in youth, attempts already have been made to improve the psychopathy construct to juveniles. The DSM-III was categorized children with conduct disorder (CD) who were "socialized" or "undersocialized." The undersocialized type was characterized by a failure to experience normal degrees of affection, empathy, or interpersonal bonds; a lack of peer relationships; egocentrism; manipulation; callous behavior; and a lack of guilt type, and it was clearly connected to the adult psychopathic personality. In contrast, "the socialized type of CD was characterized by behaviors that were similar to those currently associated with the deviant lifestyle factor." Within this system, youth were also categorized as aggressive/nonaggressive [12].

Research using these DSM-III categories revealed that undersocialized aggressive children were more likely to have continued CD into adulthood and generally poorer developmental outcomes [13, 14].

However, DSM-III listed only one symptom specific to the “affective and interpersonal dimensions of psychopathy (i.e., does not ‘apparently feel guilt or remorse when such a reaction is appropriate not just when caught or in difficulty’). The other four symptoms focused on indicators of social attachment (e.g., does not have ‘one or more peer group friendships that have lasted over 6 months’), which have not proven to be highly indicative of the construct of psychopathy in samples of children and adolescents” [15].

As a result of these definitional problems, the undersocialized distinction was not continued in later editions of the DSM. In the next version of the DSM (DSM-III-R; American Psychiatric Association [16]), the CD subtyping criteria were revised to focus on more easily measured behavioral criteria [16]. This change moved the CD subtyping criteria farther from a focus on interpersonal and affective factors that were closely tied to adult psychopathy [17]. As a result of this change, conceptualizations about the development of child behavior problems were also changed; researches in the conduct problems literature became increasingly focused on specific antisocial behaviors in children and less focused on psychological dimensions related to antisocial behavior [18, 19].

Some models were suggested for subtyping of aggression and psychopathy in children and adolescent. First, childhood onset conduct disorder and Attention Deficit and Hyperactivity Disorder (ADHD) may be precursors for psychopathy in children and adolescents. In support of this approach, there have been several reviews indicating that children with both types of problems show a more severe and aggressive pattern of antisocial behavior than children with conduct problems alone [20, 21]. But all of these patients are not related at higher risk for antisocial and criminal outcomes in adulthood. Another subtyping method for these children that two forms of aggression can be identified in samples of children or adolescents with conduct problems [22, 23]. Reactive aggression is characterized by impulsive-defensive responses to a perceived provocation or threat and is usually accompanied by a display of intense physiological reactivity [24, 25]. However, proactive or instrumental aggression is usually intended and it is not associated with provocation [22, 24]. The second group is similar to adult offenders with psychopathic traits who have been shown to be more aggressive [26, 27].

However, in the past two decades, a significant body of research has emerged refining how the key features associated with psychopathy may be expressed in children and adolescents [15, 28]. These conceptualizations have focused largely on the “presence of callous-unemotional (CU) traits (e.g., lack of empathy and guilt, failure to put for the effort on important tasks, shallow and deficient emotions), which correspond closely to the affective dimension of psychopathy—core to the construct in adult samples” [29]. An increased literature has accumulated regarding psychological and behavioral differences between impulsive conduct-disordered (high I/CP) children exhibiting low versus high levels of CU tendencies [30–32]. The studies with nonclinic control children, high CU clinic-referred youth, and high I/CP children with low levels of CU features are prone to reactive aggression, but not proactive aggression. In addition, compared with control group, high CU conduct-problem children exhibit high levels of proactive as well as reactive aggression. Relatedly, there is evidence that the presence

of CU traits prospectively predicts later incidence of aggression and violence over and above I/CP tendencies [33].

As a result of these studies, the most recent revision of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association [34]) has integrated these changes into the diagnostic criteria for conduct disorder.

The DSM-5 criteria for conduct disorder were presented below:

A. Repetitive and persistent pattern of behavior in which the basic rights of others or major age-appropriate societal norms or rules are violated, as manifested by the presence of at least three of the following 15 criteria in the past 12 months from any of the categories below, with at least one criterion present in the past 6 months:

Aggression to people and animals

1. Often bullies, threatens, or intimidates others.
2. Often initiates physical fights.
3. Has used a weapon that can cause serious physical harm to others (e.g., a bat, brick, broken bottle, knife, gun).
4. Has been physically cruel to people.
5. Has been physically cruel to animals.
6. Has stolen while confronting a victim (e.g., mugging, purse snatching, extortion, armed robbery).
7. Has forced someone into sexual activity.

Destruction of property

8. Has deliberately engaged in fire setting with the intention of causing serious damage.
9. Has deliberately destroyed others' property (other than by fire setting).

Deceitfulness or theft

10. Has broken into someone else's house, building, or car.
11. Often lies to obtain goods or favors or to avoid obligations (i.e., "cons" others).
12. Has stolen items of nontrivial value without confronting a victim (e.g., shoplifting, but without breaking and entering; forgery).

Serious violations of rules

13. Often stays out at night despite parental prohibitions, beginning before age 13 years.
14. Has run away from home overnight at least twice while living in the parental or parental surrogate home, or once without returning for a lengthy period.
15. Is often truant from school, beginning before age 13 years.

B. The disturbance in behavior causes clinically significant impairment in social, academic, or occupational functioning.

C. If the individual is 18 years or older, criteria are not met for antisocial personality disorder.

Specify whether:

Childhood-onset type: Individuals show at least one symptom characteristic of conduct disorder prior to age 10 years.

Adolescent-onset type: Individuals show no symptom characteristic of conduct disorder prior to age 10 years.

Unspecified onset: Criteria for a diagnosis of conduct disorder are met, but there is not enough information available to determine whether the onset of the first symptom was before or after age 10 years.

Specify if:

With limited prosocial emotions: To qualify for this specifier, an individual must have displayed at least two of the following characteristics persistently over at least 12 months and in multiple relationships and settings. These characteristics reflect the individual's typical pattern of interpersonal and emotional functioning over this period and not just occasional occurrences in some situations. Thus, to assess the criteria for the specifier, multiple information sources are necessary. In addition to the individual's self-report, it is necessary to consider reports by others who have known the individual for extended periods of time (e.g., parents, teachers, co-workers, extended family members, peers).

Lack of remorse or guilt: Does not feel bad or guilty when he or she does something wrong (exclude remorse when expressed only when caught and/or facing punishment). The individual shows a general lack of concern about the negative consequences of his or her actions. For example, the individual is not remorseful after hurting someone or does not care about the consequences of breaking rules.

Callous—lack of empathy: Disregards and is unconcerned about the feelings of others. The individual is described as cold and uncaring. The person appears more concerned about the effects of his or her actions on himself or herself, rather than their effects on others, even when they result in substantial harm to others.

Unconcerned about performance: Does not show concern about poor/problematic performance at school, at work, or in other important activities. The individual does not put forth the effort necessary to perform well, even when expectations are clear, and typically blame others for his or her poor performance.

Shallow or deficient affect: Does not express feelings or show emotions to others, except in ways that seem shallow, insincere, or superficial (e.g., actions contradict the emotion displayed; can turn emotions "on" or "off" quickly) or when emotional expressions are used for gain (e.g., emotions displayed to manipulate or intimidate others).

Specify current severity:

Mild: Few, if any, conduct problems in excess of those required to make the diagnosis are present, and conduct problems cause relatively minor harm to others (e.g., lying, truancy, staying out after dark without permission, other rule breaking).

Moderate: The number of conduct problems and the effect on others intermediate between those specified in “mild” and those in “severe” (e.g., stealing without confronting a victim, vandalism).

Severe: Many conduct problems in excess of those required to make the diagnosis are present, or conduct problems cause considerable harm to others (e.g., forced sex, physical cruelty, use of a weapon, stealing while confronting a victim, breaking and entering) [34].

We concluded that all of studies about this issue were implicated that CU traits are most studied predictors for psychopathy in children and adolescents.

3. Epidemiology

Children with conduct problems (CP), commonly identified as either having oppositional defiant disorder (ODD) or conduct disorder (CD), comprise about 5–10% of youth aged 8–16 years [35]. Prevalence of CP is even higher in preschool populations ranging from 7 to 25% [36]. In a study, the prevalence for psychopathy in young offender sample was 21.5% [37], and the prevalence rate found for adult psychopathy ranges from approximately 15–30% [38]. In a population of adolescents involved with criminal or psychiatric services, using a Psychopathy Checklist—Youth Version (PCL–YV) cut-off score of >30 psychopathy, Forth and Burke found rates of 3.5% in young people in community care, 12% in those on probation, and 28.3% in those incarcerated [39]. Brandt et al. using PCL–YV cut-off score of >28 reported a prevalence of 37% in incarcerated youths [40].

No epidemiological data exist that directly quantify the prevalence rates of psychopathy across the population; however, people have used data from forensic and clinical samples to estimate that approximately 0.75–1% of the population may be psychopaths. A similar percentage of children present with both severe antisocial behavior and CU features. It is estimated that there are more males than females presenting with these traits, although the gender ratio is unclear [41].

4. Etiology

4.1. Genetic factors

Several studies examined the heritability of CU traits, and these studies provided estimates of the amount of variation in CU traits accounted for by genetic effects ranging from 42 to 68% [42–45]. Additionally, although a large proportion of the correlation between CU traits and

conduct problems has been reported to be due to shared genetic effects, studies have consistently found unique genetic influences to both constructs as well supporting at least partially distinct etiological underpinnings [44, 46–48]. In a study of 7-year-old twins, the genetic influences on childhood-onset conduct problems were teacher-reported CU traits (81%) higher than normal group (30%) [49]. The research team also found that the level of genetic influence on conduct problems in those with increased levels of CU traits was not related to the severity of conduct problems and it was not related to ADHD symptoms when the children were 9 years of age [50].

Specifically, one twin study in a sample of boys aged 10–13 reported that left posterior cingulate and right dorsal anterior cingulate gray matter concentrations showed significant heritability (0.46 and 0.37) and that common genes explained the phenotypic relationship between these regions and psychopathic traits and these data suggest that the genetic contribution to CU traits might manifest through an impact on anterior and posterior cingulate cortex development [51].

Several studies have investigated potential genetic polymorphisms associated with CU traits. Especially, Viding et al. documented several potential autosomal single-nucleotide polymorphisms that could play a role in the development of CU traits [52]. Furthermore, Hirata et al. explored the role of COMT gene variants in child aggression and in CU traits and they reported CU traits among children and adolescents were associated with two catechol O-methyltransferase (COMT) polymorphisms [53]. COMT is an enzyme that metabolizes catecholamines including dopamine and norepinephrine, and its activity is mainly located in the frontal areas of the brain, including regions important in regulating aggressive behavior. Male mice lacking COMT displayed increased aggression [54]. Fowler et al. also found evidence to suggest that COMT polymorphisms may be related to CU traits. Additionally, they explored also MAO-A and 5-HTT genes among adolescents (ages 12–19) with childhood ADHD, they demonstrated that the high activity COMT Val/Val genotype, a low activity monoamine oxidase-a receptor (MAO-A) allele, and who were homozygous for the low activity serotonin transporter (5-HTT) allele significantly higher associated with CU traits [55]. In another study of 162 children and adolescents (ages 6–16), CU traits were associated with two polymorphisms on the oxytocin receptor (OSTR) gene [56]. Finally, in a recent study, Hirata et al. explore the role of prolactin and prolactin receptor gene (PRLR) variants in child aggression and CU traits. They found that one of the three single-nucleotide polymorphisms (SNPs) of the PRLR gene (rs187490) was significantly associated with CU traits and participants who carrying the GG genotype having higher CU scores than A-allele carriers [57].

Another promising candidate is FKBP5, which codes for a protein, FK506 binding protein, and regulates the affinity of the glucocorticoid receptor for cortisol [58]. The most prominent polymorphism in this gene (rs1360780) has been linked to increased aggression. Specifically, an interaction effect of FKBP5 diplotypes and childhood trauma was found on lifetime aggressive behavior in 411 male prisoners; carriers of the diplotype linked to increased FKBP5 expression were found to exhibit increased aggression and violent behavior in jail following childhood abuse [59]. This finding has been replicated on a brain imaging by two studies showing that FKBP5 variants interacted with childhood adversity to predict threat-induced activity in the amygdala [60, 61].

A small number of candidate genes (e.g., COMT, MAOA, OSTR, PRLR) are associated with CU traits across independent studies; however, failures to replicate also exist. Studies of gene-environment interplay show that CU traits genetic predispositions also contribute to selection into higher risk environments and that environmental factors can alter the differentially methylated CU trait candidate genes. The field's understanding of CU traits etiology will benefit from larger, adequately powered studies in gene identification efforts; the incorporation of polygenic approaches in gene-environment interplay studies; attention to the mechanisms of risk from genes to brain to behavior; and the use of genetically informative data to test quasi-causal hypotheses about purported risk factors.

In the future, genetic findings can predict whether aggression will occur in children and it will persist into adulthood, and it may be possible to provide preventive interventions or more targeted treatments for those at high risk. Overall, with further genetic researches may lead to new avenues of risk prediction, prevention, and treatment of aggressive behaviors.

4.2. Temperament and personality

In the researches of this area, the most consistent finding is that CU traits are associated with lower levels of fear and lower levels of anxiety (or neuroticism) [62], although, as a group children with conduct problems showed higher levels of trait anxiety (perhaps secondary to the stressors they experience as a result of their maladaptive behaviors) [63].

Fearlessness is central to developmental models of psychopathy and increasing risk for callous-unemotional behaviors [64]. In recent study, it was shown that fearless temperament at age 2 predicted both CU traits and conduct problems at age 13 [65].

Another temperament dimension central to psychopathy is low affiliative behavior, operationalized as low interpersonal warmth or affection. Although direct prospective links from low affiliative behavior have not been tested, recent studies suggest that callous-unemotional behaviors are related to lower quality of positive affective parent-child interactions, including lower eye contact, warmth, [66, 67] and empathy [68].

Additionally, narcissistic traits have been found positively associated with CU traits [69–71].

In summary, the studies demonstrate that although fearlessness and low affiliative behavior are passed from mother to child and that increasing risk for callous-unemotional behaviors, highly positive parenting can buffer risk.

4.3. Neurobiological factors

Functional abnormalities of amygdala are the most consistent findings in psychopathic-like adolescents. Adolescents with conduct problems and callous-unemotional traits show less amygdala responsiveness to fearful faces (but not other emotional expressions) compared to healthy controls [72–75] and compared to children with conduct problems but low CU traits [76]. Functional imaging studies of children and adolescents have also found youths with both conduct problems and either psychopathic traits exhibit lower right amygdala activity during an affective theory of mind task [77].

Another imaging study showed that youths with CD or ODD and high levels of psychopathic traits showed disruptions in amygdala-prefrontal functional connectivity [78]. The same research group reported that youths with both conduct problems (aged 10–17 years) and elevated CU traits demonstrated increased activity bilaterally in the medial frontal gyri and abnormal activity within the ventromedial prefrontal cortex during punished reversal errors compared to normal controls. This shows that psychopathic traits are associated with abnormal processing of reinforcement information [79].

In contrast to functional imaging, there have been null findings regarding the structural integrity of the amygdala in children with CU traits [80, 81]. Wallace et al. found reduced amygdala volumes in children with CD but they noted that CU traits were not effective on this volume. Also, in another study found that “reduced amygdala gray matter volume in adolescents with CD, but no significant differences associated with CU traits” [82]. One structural imaging study reported that, compared to normal developing boys, boys with both conduct problems and elevated CU traits showed increased gray matter concentration in the medial orbitofrontal and anterior cingulate cortex, in addition to increased gray matter volume and concentration in the temporal lobes bilaterally [81]. Additionally, “this finding is consistent with the findings of the twin study reported previously showing that common genes seemed to explain the association between right dorsal anterior cingulate gray matter concentrations and psychopathic traits” [51]. In the recent study, it were explored that longitudinal data spanning an average of 22 years to comprehensively examine whether adult male subjects with low amygdala volume have a longstanding developmental history of aggression and psychopathic features that persist into the future. They found that men with lower amygdala volume associated with higher levels of aggressive behavior and psychopathic traits from childhood. It was found that in adolescence and young adulthood, lower amygdala volume was also associated with proactive aggression. More importantly, “this is the first study to demonstrate that adult men with lower amygdala volume were at increased risk for exhibiting future aggression, violence, and psychopathic traits, even after controlling for earlier levels of these features and several potential confounds” [83].

Prefrontal cortex and its role in psychopathy in children and adolescents is increasing in the researchs, in the literature, there is a few studies about structural MRI. Two studies found that psychopathic adolescents who were incarcerated had decreased gray matter volumes in the orbitofrontal cortex [84, 85]. In contrast, De Brito et al. found increased gray matter concentration in the medial orbitofrontal cortex and anterior cingulate cortex of boys with elevated CU traits. This finding led to note that “normal cortical maturation involves gray matter loss, and consequently their finding of increased gray matter in their juveniles may reflect a delay in prefrontal maturation” [81]. Finger et al. compared youth with disruptive behavior disorders (DBD) to healthy controls and showed “hypoactivity in the orbitofrontal cortex in response to early stimulus-reinforcement exposure and rewards.” The psychopathic adolescents demonstrated reduced neural activity when the task was related to stimuli-reinforcement associations, when they completed the task correctly, and when they were rewarded [86].

White et al. investigated the relationship between a large cavum septum pellucidum (CSP) and symptom severity in disruptive behavior disorders (DBD; conduct disorder and oppositional

defiant disorder). They observed that individuals with a large CSP have a higher risk for aggressive behavior, psychopathic traits, and being diagnosed ODD/CD. However, it should be noted that the presence of a large CSP was not associated with a more severe form of DBD (CD vs. ODD) [87].

Resting state fMRI (rs-fMRI) studies are also limited in this area. We found three rs-fMRI studies with CD: firstly Zhou et al. found that the CD participants showed decreased the amplitude of low-frequency fluctuations (ALFF) in the bilateral amygdala/parahippocampus, right lingual gyrus, left cuneus, and right insula and greater ALFF was showed in the right fusiform gyrus and right thalamus in the CD group compared to the TD group [88]. The other study implicated that adolescents with CD showed decreased functional connectivity within the bilateral PCC, bilateral precuneus, and right superior temporal gyrus relative to TD group. It could be speculated that CD is associated with decreased functional connectivity within the default mode network (DMN) and between the DMN and other regions [89, 90]. Cikili-Uytun et al. found that increased DMN activity in ADHD+CD group compared to ADHD and in the ADHD group compared to controls in several DMN regions. This result is consistent with rs-fMRI studies, which showed that the increased DMN with ADHD but different from the study which showed decreased DMN activity with CD adolescents [91]. Increased activity in the DMN was present in some previous studies, and this study is consistent with the hypothesis that ADHD individuals may have increased disturbances during task performance and that reflect faulty deactivation of the DMN [92]. They speculated that this hypothesis is also could be reason for CD. But all of inthese resting state studies, CU traits did not differ from in the conduct disorder criteria.

With some exceptions, the majority of studies to date have demonstrated reduced function, volume, and connectivity in the frontal cortex and the amygdala in psychopathic adults and adolescents; two brain areas strongly implicated in prosocial behavior and decision making. Amygdala plays role in different functions such as fear of punishment, or aversion to causing fear/pain and impaired amygdala functioning and structure would lead to disturbances in antisocial children and adolescents. The prefrontal cortex is implicated in a number of functions such as executive functioning, impulse control, moral decision-making, reward and punishment processing, behavioral inhibition, and planning for the future, and if it was impaired, it would have significant influence on tendency toward antisocial behavior.

Although more imaging studies are needed, especially comparing children and adolescents with conduct problems with and without elevated levels of CU traits, these studies are implicated that the neurological markers for some of the emotional and cognitive characteristics of children and adolescents with severe conduct problems and elevated CU traits [93].

4.4. Cognitive factors

One consistent finding related to cognitive studies is that CU traits are associated with abnormalities in the processing of punishment cues. Specifically, CU traits have been associated with an insensitivity to punishment cues and the youth has to respond to an increasing ratio of punished to rewarded responses [94, 95]. Blair et al. explored different punishment schedules, youths with behavior problems and high levels of psychopathic traits have been reported as responding more poorly to gradual punishment compared to youths with behavior problems

but normative levels of psychopathic traits. In addition, boys with elevated CU traits were less sensitive to potential punishment when compared to boys with normative levels of CU traits [96]. Blair et al. also found children with psychopathic tendencies made significantly more errors when processing fearful expressions than the comparison group, and they were also significantly less sensitive to sad expressions than the comparison group, as indicated by increased response stage to sadness [97].

Dadds et al. explored whether children with high CU traits are in fact callous and unemotional across all situations or whether they demonstrate emotional responsiveness and emotion regulation strategies in response to complex fear and attachment-related stimuli. They found that children in the high CU traits group expressed more happiness in the fear scene than the low-CU and healthy children. In the attachment scenario, high CU children expressed similar higher emotional responses and emotion regulation strategies than low CU children and control children. The results support the idea that high CU children may have the potential for emotional responsiveness to complex emotional stimuli in attachment contexts [98].

Also, several studies reported that children and adolescents with severe conduct problems and elevated CU traits show deviant social responses that include viewing aggression as a more acceptable means for obtaining goals, blaming others for their misbehavior, and emphasizing the importance of dominance and revenge in social conflicts [99–102].

Deficits in affective empathy (i.e., experiencing negative emotions due to the harm caused to others) were consistently reported that associated with CU traits [102–104], and this association remains significant after controlling for level of impulsivity and conduct problems [100] and level of aggression [105]. However, the association between CU traits and deficits in cognitive empathy (i.e., the ability to take the perspective of others) has been reported in some studies [102, 106, 107].

In the children and adolescents, who have conduct problems and CU traits, intelligence was examined in four clusters. They found that “the conduct problems—only cluster had a lower average full scale intelligence score compared to the cluster of children with both conduct problems and CU traits and the cluster with low conduct problems and low CU traits” [108]. Loney et al. replicated these results in a sample of 117 clinic-referred children (6–13 years old) and found that, compared to a clinical control group, children with conduct problems demonstrated a verbal intelligence deficit only in the absence of CU traits [109].

Some studies reported that adolescents with both conduct problems and elevated levels of CU traits were less impaired in their verbal abilities [109, 110], were less likely to show a hostile attribution bias [95], and showed greater flexibility in developing solutions in social problem-solving tasks [111] than other adolescents with conduct problems. However, such evidence for less impaired cognitive abilities in youths with elevated CU traits has not been found in all studies [112, 113] and requires further testing.

In summary, the available research strongly suggests that children and adolescents with conduct problems and higher levels of CU traits differ from other youths with conduct problems by showing abnormalities in the processing of punishment cues, by endorsing more deviant social goals, and by showing deficits in affective empathy. In contrast, deficits in cognitive empathy and cognitive perspective taking have not been as consistently documented with elevated levels of CU traits in children and adolescents.

4.5. Parenting and environmental factors

The most consistent finding from these studies is that parenting factors tend to have different associations with conduct problems depending on whether it is accompanied by high levels of CU traits. Many studies that have tested the moderating role of CU traits in the association between parenting and serious conduct problems focus on harsh discipline, lack of parental warmth, or inconsistency in parenting practices. Studies examining these aspects of negative parenting practices are more strongly related to conduct problems in those low on CU traits. Specifically, harsh, inconsistent, and coercive discipline has consistently been shown to be more highly associated with conduct problems in youths with normative levels of CU traits [114–116]. In the studies, it is found that chronically elevated levels of callousness have been longitudinally related to harsh parenting in children aged 2–4 years [117], as well as poor parent-child communication among male adolescents with symptoms of ODD/CD [118]. Longitudinal studies have found evidence that positive parenting relates to lower rates of externalizing problems later in childhood for youth with elevated levels of CU traits [119, 120]. Additionally, in some studies, low warmth as another factor in parenting appears to be more highly associated with conduct problems in youths with elevated CU traits [116, 121].

Also several studies have investigated associations between psychopathic traits and attachment style; especially dismissive attachment and disorganized attachment style were found related with psychopathic traits [116, 122]. Dadds et al. explored the problems related to attachment and they reported that children with high levels of CU traits made less eye contact with their parents in both free play and in “emotional talk” situations, different from ADHD and conduct problems [123].

In the literature, it is known that the prevalence of reported physical, emotional, and sexual abuse were higher in the delinquent youth than control group [124–126]. Krischer and Sevecke showed that relationships between physical traumatization and the CU traits could be confirmed among criminal boys, but not among delinquent girls. However, they found that in girls, other family-related variables, such as nonparental living arrangements, seemed to be more influential in developing the psychopathy syndrome than traumatization [127].

Very minimal research has been conducted on the peer groups of children with elevated levels of CU traits. In one of the few studies, Muñoz et al. reported that, although adolescents with high levels of CU traits had as many friends as other adolescents, the friendships were less stable and were viewed as more controversial [128]. Another study showed that peer victimization at age 10 predicted CU traits at age 13 in children who scored high on a measure of irritability [129]. One consistent finding on the peer groups of children and adolescents with high levels of CU traits is often associate with delinquent and antisocial peers, and this level of deviant friendship seems to be higher than in children and adolescents with conduct problems but without CU traits [118, 130, 131].

In summary, it can be made based on the available research on parenting practices is that harsh and coercive parenting appears to have stronger associations with conduct problems in those without significant levels of CU traits. However, a few studies have suggested that warm parenting may be directly related negatively to CU traits or to the conduct problems displayed by children and adolescents with elevated CU traits. Furthermore, there may be

some subgroups of children and adolescents with elevated CU traits whose problems are more likely to have developed as a result of harsh and abusive parenting.

Also, although it is clear that adolescents with CU traits tend to associate with deviant and antisocial peers, data are limited about the peer relationships of youths with higher CU traits.

4.6. Other biological factors

Most of the studies show that some psychophysiological factors correlates to CU traits in children and adolescents with nonnormative levels of CU traits. Two studies were found that youths with both CD and higher CU traits showed a lower changing of heart rate to emotionally reminiscent films compared to youths with CD but without CU traits [132, 133]. In addition, it was demonstrated that when anticipating aversive stimuli, skin conductance reactivity reduced in adolescents with psychopathic traits compared to controls [134, 135]. Additionally, CU traits were negatively related to skin conductance reactivity when responding to peer provocation in a sample of detained adolescent boys [136]. Finally, children with CU traits have shown blunted cortisol reactivity to experimentally induced stress [137].

Such studies are very limited and should replicate the current findings; it would provide more definitive support for the proposed etiological links between these biological factors and psychopathy.

In **Table 1**, genetic, neurobiological, and other biological factors were summarized.

Study	Sample	Results
Viding et al. [49]	N =7374; age =7; population-based community sample	Conduct problems in children high on CU traits showed stronger genetic influence than those low on CU traits
Viding et al. [50]	N =3730; age =9; population-based community sample	Conduct problems in children high on CU traits showed stronger genetic influence than those low on CU traits, even controlling for the presence of ADHD symptoms
Bezdjian et al. [42]	N = 1219; age =9–10; community sample	Significant genetic influences on psychopathic traits were found for both boys and girls
Rijsdijk et al. [51]	N = 123; age = 10–13; male; community sample	Left posterior cingulate and right dorsal anterior cingulate gray matter concentrations showed significant heritability, and common genes explained the phenotypic relationship between these regions and CU traits
Beitchman et al. [56]	N =162; age = 6–16; clinical sample	CU traits were associated with two polymorphisms on the oxytocin receptor (OXTR) gene alleles OXTR_rs237885 A allele and OXTR_rs2268493es A allele
Fowler et al. [55]	N = 147; age =12–19; clinical sample	Among adolescents with childhood ADHD, those possessing a low activity MAOA allele, those who were homozygous for the low activity 5HTT allele, and those with the high activity COMT Val/Val genotype demonstrated significantly higher CU traits even after controlling for CD
Hirata et al. [53]	N =144; age =6–16; clinic-referred sample	Within a sample of children and adolescents high on conduct problems, CU traits were associated with two COMT polymorphisms
Hirata et al. [57]	N = 123; age = 6–16 clinically referred sample	The one of the three SNPs of the PRLR gene was significantly associated with CU traits with participants carrying the GG genotype having higher CU scores than A-allele carriers

Study	Sample	Results
Marsh et al. [72]	N =36; age =10–17; community sample	Youths with elevated CU traits showed reduced amygdala activation while processing fearful expressions compared to youths with ADHD and normal controls
Jones et al. [73]	N =30; age =10–12; male, community twin sample	Boys with conduct problems and elevated CU traits demonstrated lower right amygdala activity in response to fearful faces
Finger et al. [79]	N =42; age =10–17; community sample	Youths with psychopathic traits demonstrated abnormal responses within the ventromedial prefrontal cortex during punished reversal errors
Sebastian et al. [77]	N =47; age 10–16; male community sample	CU traits demonstrated a negative association with activity in the right amygdala in response to affective Theory of Mind scenarios after controlling for conduct problems
White et al. [87]	N =20; age =11–17; community sample	While playing a social Exchange game, participants with higher levels of CU traits demonstrated a weaker relationship between increases in punishment of unfair offers and increased dorsal anterior cingulate cortex (dACC) and anterior insula activity
Finger et al. [78]	N =31; mean age =14.8, community sample	Youths with CD/ODD and high levels of psychopathic traits had disruptions in amygdala-prefrontal functional connectivity but no disruption in structural connections of the uncinate fasciculus or white matter tracts
Fairchild et al. [82]	N =42; age =14–20; mixed clinical and community sample	CU traits were positively associated with bilateral middle/superior orbitofrontal (OFC) volume controlling for lifetime history of CD and ADHD. Girls with CD and CU traits had reduced right anterior insula volume compared to girls with CD and normative levels of CU traits
De Brito et al. [81]	N =48; mean age = 11.7; male; community sample	Boys with conduct problems and elevated CU traits showed increased gray matter concentration in the medial orbitofrontal and anterior cingulate cortices in addition to increased gray matter volume and concentration in the temporal lobes bilaterally
White et al. [61]	N=59; mean age =14.90; community sample	Compared to controls, youths with ODD/CD had a larger CSP
Wallace et al. [80]	N=49; age=10–18; community sample	Youths with CD show reduced cortical thickness within superior temporal regions, some indications of reduced gyrification within ventromedial frontal cortex and reduced amygdala and striatum (putamen and pallidum) volumes.
Cope et al. [85]	N = 39; mean age = 17.6 years; incarcerated female adolescents	The regional gray matter volumes were negatively related to psychopathic traits in female youth offenders in limbic and paralimbic areas, including orbitofrontal cortex, parahippocampal cortex, temporal poles, and left hippocampus
Zhou et al. [88]	N=36; age = 15–17; forensic sample	Adolescents with CD showed significantly reduced functional connectivity within the bilateral posterior cingulate cortex (PCC), bilateral precuneus and right superior temporal gyrus relative to TD controls. CD is associated with reduced functional connectivity within the DMN and between the DMN and other regions
Zhou et al. [89]	N=36; age= 15–17; forensic sample	Compared with the TD participants, the CD participants showed lower ALFF in the bilateral amygdala/parahippocampus, right lingual gyrus, left cuneus, and right insula. Higher ALFF was observed in the right fusiform gyrus and right thalamus in the CD participants compared to the TD group

Study	Sample	Results
Uytun et al. [91]	N=30; age= 9–16; clinical sample	The findings revealed group differences between cingulate cortex and primary motor cortex; cingulate cortex and somatosensory association cortex; angular gyrus (AG) and dorsal posterior cingulate cortex, in these networks increased activity was observed in participants with ADHD+CD compared with the ADHD
Cheng et al. (2012)	N =28; age = 15–18; male; forensic sample	The offenders both low and high on psychopathic traits demonstrated higher pain thresholds. Youths high on psychopathic traits showed impairment in both early and late processing of empathy, evidenced by decreased frontal N120, central P3, and late positive potential (LPP)
Anastassiou-Hadjicharalambous and Warden [132]	N = 95; age =7–11; high-risk community sample and clinical sample	Youths with CD and elevated CU traits exhibited lower magnitude of heart rate change while watching an emotionally evocative film
De Wied et al. [133]	N =63; age =12–15; male; high-risk community sample	Resting RSA was significantly lower in youths with conduct problems and elevated CU traits compared to other conduct problem youths and age-matched normal controls. Youths with conduct problems and elevated CU traits also demonstrated less change in heart rate response to empathy inducing film clips involving sadness
Fung et al. [134]	N =130; age =16; male; community sample	Youths who scored high on psychopathic traits exhibited reduced skin conductance activity when anticipating and responding to aversive stimuli compared to control youths with normative levels of psychopathic traits
Isen et al. [135]	N =791; age =9–10; community sample	Boys with higher levels of psychopathic traits showed lower skin conductance reactivity (SCR) to unsigned and nonaversive auditory stimuli There was no relationship between psychopathic traits and SCR hyporeactivity in girls
Kimonis et al. [136]	N =248; age=12–20; forensic sample	Higher levels of CU traits were associated with less empathy, less positive affect, and less skin conductance reactivity to provocations from peers
Stadler et al. [137]	N =36; age =8–14; male; clinical sample	Youths with ADHD, conduct problems, and high levels of CU traits exhibited blunted cortisol reactivity to experimentally induced stress compared to youths with normative levels of CU traits

Table 1. Genetic, neurobiological, and other biological etiological factors.

5. Assessment and diagnostic interviews

Several instruments that were specifically designed to assess psychopathic traits in children and adolescents are currently available [138].

5.1. Psychopathy checklist—youth version (PCL–YV)

The PCL–YV is a 20-item rating scale and the items are scored on the basis of information from a semistructured interview and file review. The PCL–YV has modified item descriptions but it was seen the nearly same on the adult measure. These modifications are intended to

take into consideration adolescent life experiences with an increased emphasis on peer, family, and school adjustment. The PCL–YV is scored on a 3-point scale in which 0 indicates the characteristic is consistently absent, 1 indicates the characteristic is inconsistently present, and 2 indicates the characteristic is consistently present [139].

5.2. Antisocial process screening device (APSD)

The APSD is a 20-item self-report measure and it was designed to assess traits associated with the construct of psychopathy similar the Psychopathy Checklist—Revised (PCL–R; Hare, 1991). The APSD was originally derived to assess psychopathic traits on the ratings by parents and teachers in preadolescent children. Frick later developed a self-report scale. The self-report version of the APSD has been successfully used to differentiate subgroups of juvenile offenders in other adolescent samples [140, 141].

5.3. The Child Psychopathy Scale (CPS)

The Child Psychopathy Scale (CPS) [142] is based on the PCL–R similar to the APSD. However, the items were drawn from the Child Behavior Checklist (CBCL) and the California Child Q-Set (CSQ). CPS contains 13 brief scales and the number of items representing each scale ranges from 2 to 7. [142].

5.4. The Youth Psychopathic Traits Inventory (YPI) and Child Version (YPI-CV)

The Youth Psychopathic Traits Inventory (YPI) [62] is a self-report psychopathy instrument theoretically based on the PCL–R. The YPI includes 10 scales constructed to measure 10 core personality traits associated with psychopathy. Each scale is composed of five items. Youths apply to them on a 4-point Likert scale. This measure is used for ages 12 and older [62].

The Youth Psychopathic Traits Inventory—Child version was developed by van Baardewijk et al. to measure psychopathic traits in 9- to 12-year olds. They found that psychopathic traits can be measured reliably and meaningfully through self-report and that the YPI-CV is potentially a useful instrument [143].

5.5. The Hare P-SCAN: Research Version

Similar to the other measures discussed in this section, the Hare P-SCAN: Research Version is a screening device that draws its conceptual basis and its factor structure from the PCL–R. This 90-item questionnaire is scored on the “0–2” and items are grouped into “interpersonal,” “affective,” and “lifestyle” factors. Although age ranges are not specifically stated, the authors’ references indicate that the P-SCAN is used for individuals aged 13 and older [144].

5.6. Child Problematic Traits Inventory (CPTI)

It is a new teacher-rated instrument to assess psychopathic personality from age 3 to 12 years. The CPTI items designed on three factors: “a Grandiose-Deceitful Factor, a Callous-Unemotional factor, and an Impulsive-Need for Stimulation factor.” All of the factors showed reliability in

Instrument	Developed by	Structure and age
Psychopathy Checklist—Youth Version	Forth, Kosson, & Hare, 2003	A clinician-rated scale is used for adolescents aged 13–18 years
Antisocial Process Screening Device	Frick & Hare [140]	This measure was designed to measure psychopathy in children aged 6–12 years. It is completed by teachers or parents, rather than by self-report or interview with the young people themselves
The Child Psychopathy Scale	Lynam [142]	A parent/teacher-rated scale designed to assess psychopathy in late childhood and early adolescence
The Youth Psychopathic Traits Inventory	Andershed et al. [62]	A self-report, 50-item scale designed for young people of 12 years or older
The Youth Psychopathic Traits Inventory – Child version	Van Baardewijk et al. [143]	It was developed by van Baardewijk et al. to measure psychopathic traits in 9- to 12-year olds
The Hare P-SCAN: Research Version	Hare and Hervé [149]	P-SCAN is used for individuals aged 13 and older
Child Problematic Traits Inventory	Colins et al. [145]	It is a new teacher-rated instrument to assess psychopathic personality from age 3 to 12

Table 2. Current instruments for assessing psychopathy in children and adolescents.

internal consistency and external validity. The all of CPTI factors was a stronger predictor for showing that psychopathic personality construct in early childhood. In conclusion, the CPTI seems to be reliably and validly assessment tool for psychopathic traits in adolescence and adulthood [145].

The instruments for assessing of psychopathy in childhood and adolescence were listed in **Table 2**.

6. Comorbid disorders

The disorders frequently co-occurring with CD include various forms of depression, anxiety, substance use/abuse, and attention problems [146]. But psychopathic traits could be differentiated from CD about comorbid disorders.

In researches about comorbidity, Myers et al. have investigated the relations between psychopathy and Axis I and II psychopathology and delinquent behaviors in 30 psychiatrically hospitalized male and female adolescents. These authors found significant relations between psychopathy and CD, delinquent behaviors, substance abuse, and narcissistic personality disorder. Moreover, Myers et al. emphasized that psychopathic youth had multiple personality problems and they met diagnoses for many of the personality disorders [147].

More recently, Epstein et al. investigated the discriminant validity of psychopathy and mental disorders in a sample of 60 male adolescent adjudicated delinquents who were remanded for treatment. They found relations between adolescent psychopathy and alcohol dependence and substance dependence but not anxiety or depression [148]. Salekin et al. found that CD, ODD, ADHD, adjustment disorder, and substance abuse all correlated highly with the psychopathy scales. They showed also significant correlations across all three psychopathy scales were found for substance abuse, panic disorder, social phobia, and separation anxiety [37].

Bauer and Kosson examined 80 detained adolescent girls and reported that psychopathy was significantly associated with having a greater number of psychiatric diagnoses, and these coexisting disorders include alcohol dependence (61%), drug dependence (72%), ADHD (71%), dysthymia (22%), depression (52%), and PTSD (19%), even after removing CD from their analyses [149].

We need more detailed information about comorbidity and further research is needed regarding the relation between Axis I disorders and the facets of psychopathy with larger samples.

7. Prognosis

It is now well established that the most chronic and severe patterns of antisocial behavior are initiated early in life.

Therefore, understanding the development and stability of psychopathic personality from early childhood to adulthood may well be one of the most important missions for research aimed to understand the determinants of severe and long-lasting criminal behavior. Gretton et al. collected the file data of adolescent offenders and found that higher levels of psychopathic traits predicted an increased likelihood of violent offending 10 years later [150]. CU traits measured at school age predict antisocial and criminal behavior in adulthood, even after controlling for severity and onset of CD [151]. However, a notable longitudinal study found that psychopathic traits measured at age 13 were moderately stable to age 24, despite different informants and assessment instruments used across the two age periods [152].

Consistently with previous research, in the Pittsburgh Youth Study, psychopathy was assessed with the CPS and they were assessed with CPS at 12–13 years of age, which included both a high-risk group with disruptive behavior problems and a normative comparison group and they found that behavior problems were the most frequent, severe, aggressive, and temporally stable delinquent offenders in boys with high scores on the CPS [153].

In a notable study, Frick et al. examined psychopathy over a 4-year period and this sample included groups of children who, at baseline, were “(a) high on both CU traits and a measure of conduct problems; (b) high on CU traits, low on conduct problems; (c) high on conduct problems, low on CU traits; and (d) low on both measures.” They found that “youth who originally had a lower score on psychopathic traits were less likely to have increasing scores over time.” Youth with higher levels of conduct problems and lower levels of positive parenting (youth report) were more likely to have stable psychopathy scores. [154].

Waller et al. showed that adoptive mother observed positive parenting buffered the risk posed by early child fearlessness to later callous-unemotional behaviors [155].

These findings are interesting in that “they suggest that levels of psychopathic traits have the potential to change over time and may even be influenced by identifiable predictors.”

Consistent with a growing literature showing that positive parenting—including warmth, responsivity, and praise—predict callous-unemotional behaviors, and this type of gene-environment interaction suggests that parent-child temperament pathways could also be moderated by caregiving quality [116, 156].

8. Treatment

The few studies that have examined the performance of youth with psychopathic features in treatment settings have found these youth to be more apt to disrupt the treatment and make less progress than youth with fewer psychopathic features [157–159]. Of the studies about treatment that compared the outcome of treatment for youths with conduct problems with and without elevated levels of CU traits, most of the studies reported that the group high on CU traits showed poorer treatment outcomes and treatment noncompliance. Specifically, several studies of adolescents with higher psychopathic or CU traits were demonstrated that adolescents were less compliance in treatment and poorer institutional adjustment and were more likely to reoffend after treatment [157, 160–162]. Similarly, in inpatient psychiatric settings, children (ages 7–11) with elevated levels of CU traits had longer length of stay and experienced more physically restrictive interventions during hospitalization [163]. In a school-aged sample of children enrolled in a summer treatment program for externalizing behavior problems, children with children conduct problems and CU traits responded less well to behavior therapy alone than children with conduct problems without CU traits [164] and less improvement in social skills and problem-solving skills when compared to children with CP alone [162]. Hawes and Dadds also found that boys with CU displayed lower treatment response to behavioral parent training and were particularly less responsive to time-outs [165].

When treatment strategies were investigated, McDonald et al. found that a parenting intervention successfully reduced levels of psychopathy-related traits among children aged 4–9 and that these effects were mediated by a reduction in levels of harsh and inconsistent parenting by mothers [166].

Kolko et al. conducted a randomized controlled trial of an intervention for 6- to 11-year-old children with conduct problems, in which one group was served through community settings (e.g., home, school, and neighborhood) and the other through a clinic. The intervention in both groups included parent training and other treatment methods such as family therapy and cognitive-behavioral therapy for the children. The results indicated that features of psychopathy were reduced in both groups of children, and the reductions were maintained over a 3-year follow-up period. Importantly, this study provides evidence that child psychopathic features can improve over time [167].

Specifically, once a reward-oriented response set has been established, children with elevated CU traits are slower to respond to punishment than children with normative levels of CU traits or children with high levels of anxiety. Thus, parenting practices that seek to encourage positive behavior through reinforcement or through other positive aspects of the parent-child relationship (e.g., fostering parental warmth, parent-child cooperation, positive reinforcement for appropriate child behaviors) may be particularly important for this group of children because of the focus on positive reinforcement rather than punishment [168].

In the recent study, the associations of both positive (i.e., warm and responsive) and negative (i.e., harsh and inconsistent) aspects of parenting with callous-unemotional (CU) traits and conduct problems in kindergarten students were tested, and they found that all three positive parenting variables (parental warmth, positive reinforcement, and parent-child cooperation and communication) were significantly negatively associated with CU trait levels. However, only parental warmth remained significantly negatively correlated with the level of CU traits after controlling the level of conduct problems. Thus, parental warmth may be particularly relevant for the development of CU traits [169]. This aspect of the parent-child relationship has been considered critical for the development of empathy, guilt, and other prosocial emotions, especially in children who have temperamental characteristics (e.g., low fear) that may interfere with the normal development of these emotions [170, 171]. Interventions that have focused on increasing parental warmth and increasing parents' use of positive reinforcement have led to reductions in the level of CU traits in young children [172, 173].

As a new treatment option, recent research has showed that omega-3 essential fatty acids supplementation could be an effective treatment for improving youth psychopathic behavior in the long term. Omega-3 has been known to be important for healthy brain development in children [174, 175] and low levels have been implicated in poor cognitive performance and behavior in children [176]. Another recent randomized controlled study was reported that omega-3 supplementation improved in callous-unemotional traits in 8- to 16-year-old children 6 months after the treatment ended. Additionally, "the parents of children receiving omega-3 supplementation showed a significant long-term reduction in their own psychopathic behavior." They suggested that reduction in parental psychopathy accounted for the improvement in their children's CU traits [177].

In conclusion, we concluded that there are some important points about treatment. First, given that children with CU traits start to show conduct problems early in their development and there are numerous interventions that have proven effective in treating early emerging conduct problems, early intervening of childhood-onset conduct problems were should be an important aim for preventing later serious aggression and antisocial behavior [178]. Second, in older children with severe antisocial behaviors, the most successful interventions are comprehensive and individualized interventions [179]. Researches on this area could help to guide these individualized interventions. For example, interventions that aim on anger control may be more effective for children within the childhood-onset pathway who do not have CU traits but who often show emotional problems. Treatment interventions such as to teach parents the ways to foster empathic concern in their child or help the child develop cognitive perspective-taking skills that aim to improve early in the parent-child relationship and they

may be more effective for children with CU traits. Especially, later in development, reward-oriented response style attempt to motivate children through appealing to their self-interest may be more effective for this group rather than punishment-oriented strategies [180].

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