



Antisocial pathways associated with substance use disorders: characterizing etiological underpinnings and implications for treatment

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The association between substance use disorders (SUDs) and crime is one of the most reliable themes in the SUDs literature. While SUDs undoubtedly contribute to crime, there is also good evidence that specific clinical syndromes place individuals at higher risk for SUDs. Of relevance, two subtypes of individuals, ‘antisocial-only’ and ‘psychopathic,’ are at elevated risk for SUDs. The former, which includes conduct disorder and antisocial personality disorder, involves a failure to regulate affective reactions, which overwhelms inhibitory controls. The latter, which includes antisocial behavior plus callous-unemotional traits and psychopathy, involves a failure of attention to adequately integrate affective experiences to guide behavioral control. We describe how these potentially divergent etiologies can inform personalized treatments.

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Introduction

Substance use disorders (SUDs) are common and costly clinical conditions [1,2]. The prevalence of SUDs are markedly elevated in criminal offenders, with evidence that SUD rates are up to 13 times higher in prisoners compared to the general population [2]. Of note, research has demonstrated that there are two clinically meaningful subtypes of individuals engaging in high levels of antisocial behavior [3–5], and these subtypes appear divergent in their pattern of substance use and the etiology of their antisocial behavior.

The first is a group we term ‘antisocial-only’; these individuals are diagnosed with conduct disorder (CD)

in childhood and antisocial personality disorder (APD) in adulthood, and may be defined by high levels of impulsivity and emotional reactivity. The second group, which we term ‘psychopathy’, are diagnosed in childhood as having CD with callous-unemotional (CU) traits (defined as ‘with limited prosocial emotions’ in the DSM-5), meet criteria for psychopathy in adulthood, and are defined by high rates of antisocial behavior that is impulsive in nature, but is also paired with affective and interpersonal traits marked by callousness, low empathy, and low interpersonal emotions. While both of these subtypes of individuals act on impulse, engage in antisocial behaviors, and manifest self-control deficits under a variety of circumstances, including the misuse of substances, the underlying cognitive-affective mechanisms contributing to these behaviors are relatively distinct. Thus, SUDs, like other antisocial behavior, may be a consequence of distinct cognitive-affective underpinnings that are essential to identify and address in order to implement more effective interventions.

Antisocial and psychopathic subtypes in adults: associations with SUDs

According to the DSM-5, APD encompasses a chronic and pervasive pattern of antisocial attitudes and behaviors that is predated by CD. This antisocial subtype is associated with a greater number of SUD diagnoses (Brennan, Stuppy-Sullivan, Brazil, and Baskin-Sommers, under review), greater substance abuse severity [6], and is a strong predictor of aggression and criminal behavior [7]. Thus, APD symptoms and diagnosis are tightly linked to SUDs.

This link appears to be due to a meta-structure of broad externalizing traits in which APD and SUDs share heritable etiologic processes [8,9], including deficits in behavioral control due to a hypersensitivity to rewards [10,11], emotional reactivity [12], and deficient executive functioning [8,13,14]. Thus, their SUDs, like their other antisocial behavior, may be a consequence of emotional hyper-reactivity and poor executive functioning, leading to overvaluation of the reward and relief afforded by substances, which makes it difficult to inhibit habitual use in the face of psychological or physical distress. That is, substance use may continue due to impulsivity and in the context of intense emotions, even in the face of poor outcomes.

Though many antisocial individuals with SUDs fall into this first, ‘antisocial-only’ group, a smaller group of indi-

viduals show high levels of antisocial behavior paired with distinct maladaptive personality traits. These psychopathic individuals display antisocial behavior and show shallow affect, lack of empathy, impulsive behavior, proneness to boredom, and a chronic antisocial lifestyle. Though psychopathic individuals are certainly impulsive and exhibit increased rates of SUDs [15], their pattern of substance initiation and abuse, as well as its etiology, may differ: Psychopathy appears more strongly related to an earlier age at initiation of use across a range of substances, as well as a greater number of substance abuse (versus dependence) diagnoses (Brennan *et al.*, under review). Additionally, psychopathic traits relate to diminished activity in regions implicated in craving during the presentation of drug cues [16^{*}]. Thus, as compared to ‘antisocial-only’ individuals, psychopathic individuals appear to have a pattern of early, but not necessarily severe, substance use.

This pattern of SUDs in psychopathic individuals may be a consequence of the same type of cognitive-affective mechanisms identified as important for their tendencies toward criminal behavior. In contrast to those with only antisocial behavior, psychopathic individuals tend to have low anxiety, high rates of thrill-seeking, and engage in both reactive and proactive aggression [17]. These characteristics seem to stem from context-specific deficits in affect, behavioral interference, and attentional control [18]. This cognitive-affective dysfunction often results in a myopic perspective on decision-making and behavior, such that individuals with psychopathy are particularly adept at focusing directly on an immediate goal, but fail to integrate important contextual cues, such as emotion or cues to the consequences of their behavior. That is, their impulsive style emanates from poor attention to non-reward cues and the ability to learn from these cues (and punishment). This dysfunction may allow psychopathic individuals to engage in an impulsive lifestyle and experiment with substances, but simultaneously interfere with their ability to process, reflect, and respond to the negative consequences of substance use. Thus, psychopathic individuals may engage in substance misuse partly due to their impulsivity and continue use because they do not integrate information related to the consequences of use. However, because they are not as emotionally reactive, they may not use substances to cope with their emotions in the same way as those showing ‘antisocial-only’ patterns and thus, these psychopathic individuals are less prone to dependence over time.

Broadly, the SUDs of psychopathic individuals may reflect a callous, fearless, irresponsible disposition that stems from a lack of emotional depth. By contrast, the SUDs associated with the antisocial-only individuals may reflect emotional reactivity, excessive reward seeking, intense hostility, and other strong urges that overwhelm inhibitory controls.

CD and callous-unemotional traits in youth: pathways of risk for SUDs

The developmental precursors of antisocial and psychopathic subtypes are typically CD [14] and CD with CU traits [19,20], respectively. Just as with adults, though youth in these diagnostic categories both demonstrate increased impulsive and antisocial behavior, the underlying mechanisms contributing to these behaviors are distinct [21,22].

CD is a clinical syndrome characterized by aggressive behaviors, truancy, violating social norms, and lying [23]. Youth with CD, but without CU traits, display anxiety, emotion dysregulation, and low impulse control [24]. As it relates to SUDs, epidemiological studies demonstrate that children with CD initiate substance use early and have elevated rates of both substance use and SUDs [25,26]. Moreover, temperament and personality (e.g., impulsivity, neuroticism) [27,28^{**}], psychobiological (e.g., executive function) [29], and environmental (e.g., coercive parenting, antisocial peer affiliation) [28^{**},30^{**}] factors interact to increase risk for SUDs in youth with CD [31,32]. The emergence of CD in childhood represents a pathway of heightened risk for developing an early-onset, severe form of SUD [33].

As in adults, this antisocial pathway may stem from cognitive-affective deficits that relate to emotional dysregulation [34,35] and failures of executive functions [36]. Along these lines, Tarter and colleagues [37] identified a developmental pathway rooted in CD and resulting in severe SUDs by young adulthood that was characterized by negative affect, disruptive behaviors, and lower executive function [38]. These factors also are related to problem drinking, with research indicating that high threat-related amygdala activity and low reward-related ventral striatum activity is a neural risk phenotype for problem drinking [39] and CD [3]. The development of SUDs in youth with CD may thus be the result of underlying psychobiological vulnerabilities including emotion dysregulation, disinhibition, and reward-dominant behavior. Thus, substance use may assuage intense emotional reactions, and the diminished ability to inhibit predominant reward-seeking behavior diminishes the relative influence of the consequences of use on later behavior.

In contrast, CU traits are defined as a developmentally inappropriate lack of interpersonal guilt, empathy, and emotional expression [19,40]. Youth with high CU traits demonstrate a particularly severe, aggressive, and stable pattern of antisocial behavior and SUDs [41,42]. Wymbs and colleagues [43] assessed CD and CU traits and found that 6th-grade CU traits uniquely predicted 9th-grade substance use outcomes, particularly in boys. During adolescence, a stable trajectory of high CU traits predicted greater substance use versatility in adulthood

[44**]. Interestingly, among those with both high CU traits and elevated CD, risk for substance use versatility was highest among those with *high* executive control. Although diminished executive function is generally recognized as a risk factor for substance abuse in CD-only youth, these findings suggest a distinct pathway by which high executive control may increase CU youth's risk of using a wider range of substances.

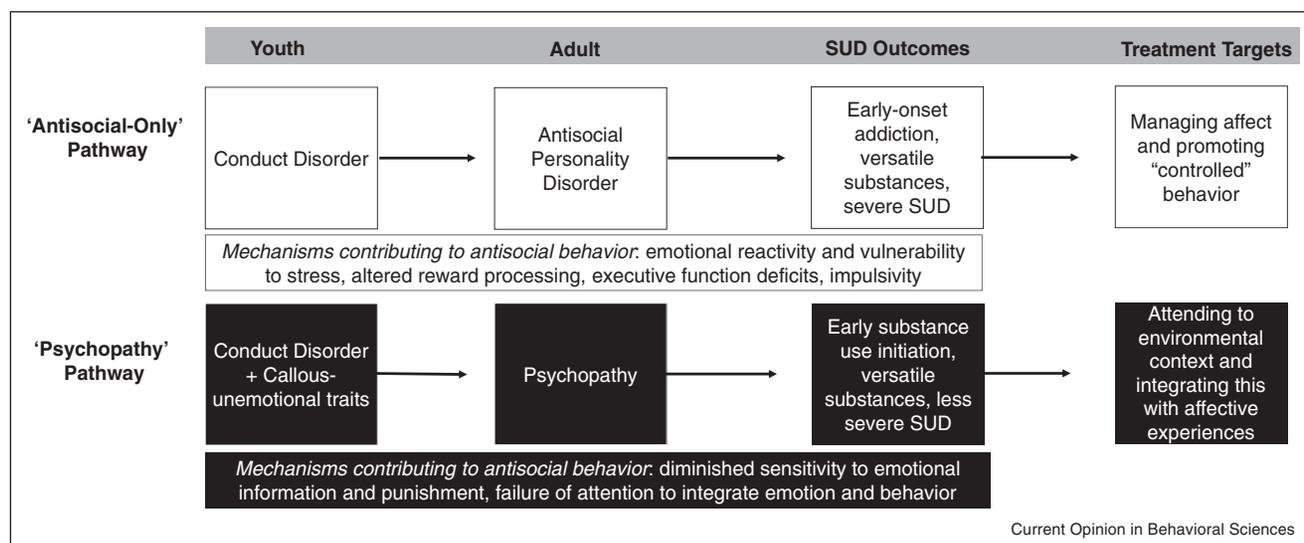
Though substance use is related to CU traits, like adults with psychopathic traits, youth with CU traits display less severe forms of SUDs than children with CD only [43,45]. Youth with CU traits tend to display reduced sensitivity to others' emotion [46,47], have difficulty integrating affective information into their behavior [48], and fail to update their behavior based on outcomes [49]. This pattern of affective hyporeactivity and behavioral dysregulation may increase risk for substance use in youth with CU traits by way of its association with risk-seeking and behaviors that potentially provide rewards, regardless of the negative consequences [21]. Wymbs *et al.* [43] proposed that these individuals might be prone to forming positive expectancies related to substance use, which leads them to experiment earlier than other groups. Additionally, like with psychopathic individuals, their decreased sensitivity to negative affect or consequences while in the pursuit of a goal (e.g., novel experiences, feeling the reward of being 'high') might predispose them to continue using the substance. Engagement with substances from a perspective of positive expectancies or novelty seeking, rather than an exogenous form of emotion regulation, may limit the use of substances as a means for self-medication and, therefore, curb the severity of SUDs in youth with CU traits.

Thus, for CU youth, substance use may not be as strongly influenced by impulsivity, as it is most commonly defined: a lack of premeditation regarding the consequences of one's actions. Rather, the higher risk associated with high executive control in CU youth suggests that they may use a wide range of substances in a more premeditated fashion initially and then are unable to update the contingencies of this action. In contrast, youth with CD only may have use that is more strongly driven by impulsivity potentiated by negative affect. That is, though both groups of youth may have SUDs, for CU youth this behavior is motivated initially by thoughtful planning and maintained by poor attention to the consequences with little use of emotion, whereas for CD youth this behavior is initiated and maintained by an interaction between poor planning and a need to relieve psychological distress.

Implications for intervention

Individuals with antisocial behavior are difficult to treat, and the same treatments that are effective for one subtype may be ineffective for other subtypes of antisocial individuals [50*], quite likely because these treatments do not take into account their specific cognitive-affective deficits. SUDs may develop through an 'antisocial-only' pathway characterized by emotional reactivity and poor executive function. Alternatively, SUDs may develop through a 'psychopathic' pathway characterized by a failure of attention to integrate emotion and behavior. These two pathways represent important developmental and etiological trajectories that must be considered when assigning individuals to treatment (Figure 1).

Figure 1



Trajectories of antisocial traits, associated SUD outcomes, and treatment targets. The 'antisocial-only' and 'psychopathy' pathways are both associated with heightened risk for SUDs but are driven by distinct mechanisms. These mechanisms contribute to all forms of antisocial behavior, including substance use.

A recent study by Baskin-Sommers and colleagues, using adult offenders with SUDs, highlights the utility of identifying and targeting the divergent etiological mechanisms associated with subtypes of antisocial offenders [51^{••}]. Using a 2 × 2 crossover design, inmates characterized as antisocial-only or psychopathic were randomly assigned to one of two computerized training packages. The psychopathy-focused package was designed to enhance attention to and integration of contextual cues, particularly emotion. The antisocial-only focused package was designed to improve inhibitory control and enhance the regulation of affect. Results demonstrated that only the group that received the etiology-matched training improved on trained and non-trained tasks. Moreover, there was evidence of iatrogenic effects of training if antisocial individuals received training that did not target their underlying etiology.

Similarly, for youth, treatment may be more effective when personalized based on the level of CU traits [52]. For example, for youth with CD, parent-based treatments that give children opportunities to stop and reflect (e.g., time out) are beneficial by targeting the affective and impulsive nature of CD [53]. By contrast, for youth with CU traits, promising treatments focus more on positive reinforcement to target these children's goal-oriented focus in an adaptive way [54].

Conclusions

Recent advances in understanding the unique cognitive-affective underpinnings of antisocial behavior suggest homotypic continuity across development in antisocial versus psychopathic antisocial subtypes. Each subtype's cognitive-affective deficits promote the pathogenesis of SUDs and antisocial behavior in unique ways. Integrating research on these divergent cognitive-affective deficits with the development of treatments provides an opportunity to implement more effective targeted treatments that address these costly behavior problems and their comorbid SUDs.

Conflict of interest statement

Nothing declared.

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