



# Childhood and Adolescent Pathways to Substance Use Disorders

## The Issue

People with drug and alcohol use disorders commonly have other problems and these problems typically began early in life. Recent research has identified some of these early precursors, improving our understanding and opening the door to developing protective interventions for our youth. This report highlights the role that parents, educators, health professionals and caregivers, among others, can play in identifying risk factors in children and taking steps to address them early.<sup>1</sup>

## Genetics and Neurobiology

Individuals can inherit a vulnerability to use drugs, but this vulnerability can be increased or diminished by early experiences, including family life, peers, stress, trauma and coping skills learned or lost. These factors can interact. For example, inherited genes can influence how an individual perceives a situation<sup>2,3</sup> and, conversely, the environment can influence the extent to which a given gene is expressed. Stressors such as physical or emotional child abuse, neglect and maltreatment early in life can change gene expression and brain development. These biological changes can result in a greater risk for substance abuse and mental health problems.<sup>4,5,6,7</sup> On the other hand, protective factors such as parental nurturing and school connectedness promote resilience in a child and help prevent poor outcomes, including substance abuse.<sup>8</sup>

Early in life, emotional impulses are strong, leading youths to focus on immediate rewards and to take risks. During adolescence, the frontal lobes, responsible for organization and planning, begin to exert control over emotional impulses. This brain development continues throughout the teenage years and the brain is not fully developed until young adulthood. While it is developing, the brain is vulnerable to negative events. If a trauma occurs or an individual uses substances during adolescence and early adulthood, brain development can be disturbed. Disturbances in brain development can result in reduced cognitive control over behaviour and the increasing dominance of emotional responses. While this shift in brain development can be caused by substance use, it can also lead to substance use and indicate a greater risk for mental health problems.

## Developmental Pathways

Substance use disorders (SUDs) in adulthood can be linked to mental health issues that begin in childhood. These mental health concerns can be grouped into two broad categories: externalizing behaviours, which are exhibited outwardly (e.g., aggression), and internalizing problems, which are expressed inwardly (e.g., anxiety). These categorizations correspond to developmental pathways that predict increased risk for SUDs. The distinction between these pathways also corresponds to different emotional processes in the brain. Specifically, externalizers seem to be most responsive to drug activation of the reward cue system, while internalizers appear to use drugs to control their hyper-responsive fear-anxiety system. Identifying these differences allows for substance use prevention and treatment efforts to be tailored to the specific psychological needs of an individual.



## Externalizing Behaviours

Externalizing behaviours are expressed in youth as aggression, impulsivity and risk taking. Impulsive behaviours early in life can be adaptive as they promote exploration, which can foster new learning.<sup>9</sup> However, as children age, most learn that they sometimes need to delay gratification. Children and youths who are unable to postpone their impulses for pleasure are more susceptible to disruptive behaviours and SUDs.<sup>10,11,12,13</sup> Exceptionally high levels of impulsivity, fidgeting and irritability in preschoolers can lead to diagnoses of oppositional defiant disorder, which can lead to conduct disorders in mid-childhood and adolescence, and antisocial personality disorders and SUDs in emerging adulthood,<sup>11,12,14,15</sup> although not all individuals proceed through all stages of this pathway.<sup>16</sup> Those with a disruptive behavioural disorder in childhood have double the risk of abusing tobacco, triple the risk of abusing alcohol and five times the risk of abusing illicit drugs compared to those who did not exhibit a disruptive behavioural disorder in childhood.<sup>17,18</sup>

Within the brain, the best-studied system implicated in these impulsive reward seeking and substance use behaviours is the dopamine system. Altered responses in the dopamine system have been correlated with the personality traits of novelty seeking and impulsivity.<sup>19,20,21</sup> The dopamine system sends a signal that something is worth getting. As high-risk individuals develop substance use problems, they might develop periods of excessive dopamine activity alternating with periods of diminished dopamine activity, leading to a progressive narrowing of interests and setting the stage for an SUD.<sup>16</sup>

Critically, though, not all who start on this pathway reach the worst outcome. Whether these behaviours are expressed, aggravated or restrained depends on various social-environmental factors. This variability in outcome highlights that there are opportunities to intervene and help.

## Internalizing Behaviours

Internalizing behaviours are seen when mental health concerns are manifested inwardly in such states as anxiety or depression. These outcomes can occur because of the experience of negative events in childhood or because of hormonal and physical changes during adolescence. A heightened inclination to experience negative emotions can be observed in children as young as two years old and the tendency can remain stable over time. Internalizing behaviours and SUDs often co-occur, and individuals with mood or anxiety disorders have up to four times the risk of developing an addiction to alcohol.

Individuals with internalizing behaviours might use substances to dampen fear responses. Fear is processed by the amygdala, a brain structure that indicates when there is danger in a situation. These feelings can be overridden by rational thought derived from other brain structures, such as the hippocampus and prefrontal cortex. However, in some individuals, the fear system is overly active because of genetic and environmental factors, differences in brain development, and negative early life experiences. Individuals with an overly active fear system might use drugs to reduce their fear response and regulate negative emotions. This calming effect could reinforce the use of drugs in future events where an individual experiences negative emotions or anxiety.

Substance use as a result of anxiety might only occur later in an individual's development, as anxiety experienced earlier in life could prevent early engagement in risky behaviours.<sup>22</sup> It could also be that those who experience anxiety withdraw from social contact and so avoid exposure to peers experimenting with alcohol and drugs.<sup>23</sup> Like externalizing behaviours, the relation between internalizing traits and SUDs is dependent on many factors, including parenting, peers and developmental stage. Some people struggle with internalizing and externalizing tendencies together.



## Family and Peer Influence

Family plays a critical role in the development of children and adolescents, contributing to genetic risk and shaping the environment in which they grow up.<sup>24,25</sup> Sensitive parental responses are vital to establishing secure attachment<sup>26</sup> and emotional regulation in youth,<sup>27</sup> which allows for secure relationships later in life. Adolescents in supportive families have fewer depressive symptoms and lower future alcohol consumption.<sup>28,29,30</sup> In contrast, when parents themselves have substance use and other mental health problems, parenting can be inadequate, leading to neglect, abuse and trauma, and resulting in disruptions to a youth's emotional regulation system. Parents with other problems might reject or be overly strict with their children, inadvertently promoting self-critical perfectionism, a trait that has been linked to symptoms of depression, as well as dangerous alcohol consumption in young adults.<sup>31</sup> Parental modelling of abuse and neglect can also teach a child poor social behaviours such as aggression and withdrawal.<sup>32</sup>

Like family, peers are part of the environment that influences the child. The peer group plays a large part in shaping youth experiences and can be especially important for those who use “hangout coping” to compensate for negative life experiences or a lack of close family relationships.<sup>33</sup> The influence of peers can be mutually reinforcing with at-risk children choosing to spend time with peers who exhibit the same antisocial behaviours as they do,<sup>34</sup> and peers influencing youth by modelling and encouraging delinquent or disruptive behaviours<sup>35</sup> and promoting substance use.<sup>36</sup> Further, peers can create experiences of trauma through bullying, which is related to both internalizing and externalizing behaviours. Early life social difficulties can lead to negative self-perceptions and the internalizing behaviours of depression.

## Prevention, Early Intervention and Treatment

A youth's biology and social circumstances change during each phase of development. These changes present risks, but also opportunities for promoting resilience. A greater understanding of the markers of SUD risk would allow for the identification of youths requiring intervention and an index of the specific behaviours that should be addressed at each developmental stage to prevent substance use.

As substance use usually begins in early adolescence,<sup>37</sup> prevention efforts typically begin at this stage. However, a greater opportunity to intervene actually exists in elementary school where certain traits that represent risk factors can be seen in young children. This period could be a more optimal one during which to provide prevention and early intervention programs. Indeed, timely prevention and intervention efforts are critical; often, the earlier in age children show externalizing behaviours, the worse the outcomes can be.

Certain initiatives to deter adolescent drug use are ineffective as they deliver the same messages to all youths regardless of their stage of development and individual circumstances.<sup>38</sup> Recognizing and assessing externalizing and internalizing behaviours allows for programs to be tailored to the specific characteristics of at-risk youth.<sup>39</sup> For example, the Preventure program, implemented in schools, teaches high-risk youths the skills to deal with real-life scenarios that their personality type suggests will likely occur. This program has slowed the progression of young people to drinking and other risky behaviours.<sup>40</sup>

Other programs in Canada have also demonstrated good results. They each have addressed different factors that can contribute to risk, such as sensitivity and nurturance (the Attachment and Biobehavioral Catch-up Program),<sup>41,42</sup> an understanding of parental and child mental states during stressful times (the Mothers and Toddlers program), and effective communication among families (the



Strengthening Families Program).<sup>43</sup> These programs have demonstrated reductions in substance use and depression among parents and youths, and have shown improvements in attachment, stress reactions, and internalizing and externalizing behaviours. Broad interventions that engage members of the community, that are evidence based and that can be tailored to a specific context have also shown significant reductions in health and behavioural problems among youths (Communities that Care).<sup>44</sup> Ultimately, interventions need to be personalized to an individual's developmental stage and psychological state to ensure efficacy. Initiatives can also be enhanced when family, school and community efforts are implemented alongside one another, as recommended by the Canadian Standards Portfolio for Youth Substance Abuse Prevention.<sup>454647</sup>

## Call to Action

The pathways to SUDs are complex. As we learn more, it becomes possible to inform the development of flexible interventions that can accommodate the unique situation of each individual. A variety of stakeholders need to collaborate to test and implement these programs. A long-term commitment to multi-layered, evidence-based interventions is needed and could result in great improvements in the well-being of youths. Research has indicated that the best approach is a multifaceted one, as demonstrated by the programs referred to above.

School systems have an opportunity to address a broad range of social and academic difficulties that impact susceptibility to SUDs later in life. A classification system of early behavioural warning signs would help people working with youths to be informed of all relevant risk factors and to focus their efforts on promoting resilience accordingly. These biobehavioural risk markers could help identify those in need of intervention and suggest the specific components of interventions that would be most successful.

As SUDs often result from a steady accumulation of risk factors, a methodology for identifying and measuring a child's exposure to risks should be developed so that less intensive early interventions can be implemented as early as possible, potentially reducing the severity of behavioural disorders and the need for more involved treatment. Furthermore, a greater understanding of factors related to resiliency is needed because not only risk factors, but also the absence of protective factors, play a role in the development of substance abuse.<sup>8</sup> Internalizing and externalizing behaviours provide an opportunity to identify youths who require the greatest support and who require early intervention to help prevent long-term detrimental effects.

Many individuals have a role to play in ensuring the well-being of children. Parents, peers, educators, community members and health professionals all contribute. Implementing a personalized and developmental perspective can lead to significant improvement in a single child's life and more positive health, family and socio-economic outcomes for the broader society.

## Additional Resources

This report is a companion to the previous issue of the Substance Abuse in Canada series, which examined *Licit and Illicit Drug Use during Pregnancy: Maternal, Neonatal and Early Childhood Consequences*.

*Stronger Together: Canadian Standards for Community-Based Youth Substance Abuse Prevention* speaks to the success that can be achieved when schools, families and organizations are all involved in prevention efforts.



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<sup>1</sup> This report in short is based on a full technical report, *Childhood and Adolescent Pathways to Substance Use Disorders*, available on the CCSA website.

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