Depression as a Mediator of Interoceptive Sensibility and Adolescent Cannabis Use

Frequency

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Author Note

I have no conflicts of interest to disclose.

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Acknowledgments

Reflecting on this dissertation process, I am incredibly grateful for all of the support and encouragement I have received.

First, thank you, Dr. Jenny Harris. Your formal titles were dissertation chair and research supervisor, but you've been so much more. You offered me grace, structure, and humor at the times I needed it most. You also showed me how to be a researcher, clinician, and a congruent human.

I would also like to acknowledge my dissertation committee, Dr. Cherri Kelly Seese and Dr. Amy Ford. You both have helped me grow in understanding and ability to conduct research, and your insight and feedback were fundamental throughout this process. Thank you both so much.

Thank you to my fellow Project READY interventionists: Matt Arnold, Monica Dyer, Maddie Guizar, Kassie Means, Lindsey Mendoza, Haley Miller-Boren, Heather Natterstad, Irina Owen, Alissa Sarbiewski, April Sherman, Jennifer Walker, Jennifer Webb, and Brittany Wilson. I am deeply grateful for your hard work supporting READY, making a meaningful difference with our youth, and helping in collecting data for my dissertation.

Saving the best for last, Wes, words cannot express the deep love and gratitude I have for you. Your undying support, belief in me, patience, and playfulness have helped me in immeasurable ways throughout this dissertation and graduate school process. You are my best friend and favorite husband.

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Abstract

Adolescence is a dynamic and critical period of development that can be become disrupted by cannabis use and symptoms of depression. Interoception has been connected to depression in adolescents, as well as substance use in adolescents, though the literature regarding co-occurring disorders for this age group is sparse. The first aim of this study was to determine if interoception was predictive of cannabis use frequency in adolescents. The second aim was to determine if interoception was predictive of depression. Next, this research sought to examine if depression was predictive of the frequency of cannabis used. Lastly, the overall model of depression serving as a mediator between interoception and cannabis use frequency was explored. Survey data were collected from 93 adolescents between the ages of 15 and 20:11 years from across the United States. Results indicated that low interoception was a strong predictor of increased depression. Higher scores of depression were predictive of increased cannabis use. No significant relationship between interoception and cannabis use, though interoception indirectly influenced cannabis use through depression. These findings suggest that managing symptoms of depression is essential in addressing cannabis use management in adolescents, and that interoception has an important, though indirect, role.

Chapter 1

Problem Statement

Adolescence is an exciting time of growth and transition. Built upon the foundation of childhood and one's biology, this stage of development serves as a catalyst into adulthood. This is truly a critical period, in which the substance-related and psychological problems that youth experience can have long-lasting impacts (Brown, 2004; Das et al., 2016). Many adults with chronic substance use problems began using as adolescents and experience a range of difficulties. Substance use during this stage of development affects the ways in which teens are able to make and sustain behavioral changes (Brown, 2004). Use during adolescence greatly influences an individual's profile of substance engagement and the pervasiveness of their substance-related problems as adults (Brown, 2004; Felton et al., 2015). In addition to problems with drugs and alcohol, teens are at increased risk of experiencing depression. Substance use disorders (SUDs) during adolescence often co-occur with a mood disorder, such as depression (Substance Abuse and Mental Health Services Administration [SAMHSA], 2017). In 2017, approximately 345,000 adolescents experienced a major depressive episode and also experienced a substance use problem (SAMHSA, 2017). This co-occurrence makes teens more likely to use cannabis or other drugs (Felton et al., 2015; SAMHSA, 2017). The onset of such behaviors during this period of development affects immediate health and can also lead to further problems throughout the lifespan (Boger et al., 2014; Das et al., 2016). Providing adolescent-specific treatment that considers the impact of co-occurring disorders on developmental trajectory is essential in providing efficacious treatment.

Interoception is the recognition, interpretation, and integration of sensations originating from inside of the body (Mehling et al., 2018; Price & Hooven, 2018). Interoceptive processes are disrupted in individuals with substance use problems as well as with depression (Price & Hooven, 2018). There is a small but growing body of research that has evaluated the treatment implications for interoception in adults (Paulus & Stein, 2010; Paulus et al., 2013; Price & Hooven, 2018). Treatment interventions are most effective if one can first identify problematic sensations, thinking, and behaviors before taking action (Vago & Silbersweig, 2012). There is limited research regarding interoceptive awareness and co-occurring substance use and depressive disorders, and none to date of co-occurring disorders in adolescents. The current research is informed by the neurobehavioral disinhibition theory (Tarter et al., 2003), the cognitive-behavioral relapse model (Marlatt & Gordon, 1985), and the youth addiction relapse model (Brown, 2004). The research focused on adolescents, substance use, depression, co-occurring disorders, mindfulness, and interoception informed the conceptualization of this study. The aim of the current research is to examine the predictive potential of interoception and depression on cannabis use in adolescents.

Literature Review

Neurobehavioral Disinhibition Theory

Neurobehavioral disinhibition is an important model for understanding early age predictors of substance use (Harris et al., 2017; Lester et al., 2012; Tarter et al., 2003). This theory observes that genes and their interaction with the environment can shape their expression in a way that impacts later substance use (Tarter et al., 1999; Tarter et al., 2003). Specifically, somatic and neurological developmental deviations that exist in

adverse environments can predispose a child to behavioral and affective dysregulation (Tarter et al., 1999). This affective dysregulation increases an individual's likelihood of using illicit substances (Tarter et al., 1999).

These disturbances in affective modulation and behavioral control can be indicative of depression, anxiety, impulse control and disruptive behavior problems, and cognitive impairment (Conradt et al., 2014; Lester et al., 2012). Childhood behavior and emotion control problems of neurobehavioral disinhibition increase susceptibility and serve as predictors for the development of SUDs in adolescents and into adulthood (Harris et al., 2017; Tarter et al., 2003).

Psychological Dysregulation. Harris and colleagues (2017) evaluated the ways psychological dysregulation interacted with the relationship between the amount of alcohol that adolescents consumed and subsequent negative consequences. The researchers hypothesized that binge drinking would predict consequences, and that psychological dysregulation would mediate the relationship between binge drinking and consequences. Participants were 123 students attending five schools in the surrounding area of Seattle; ages ranged from 13-18 years old. The student-participants completed questionnaires that captured the quantity of alcohol they had consumed, psychological dysregulation, and the consequences of their drinking. Conditional process was used to perform mediation analysis. The researchers found that binge drinking significantly predicted alcohol-related consequences; thus, the consequences of consuming alcohol increased in relation to the amount the adolescents were drinking. Psychological dysregulation also served as a significant mediator between the quantity of alcohol consumed and the alcohol-related consequences. These results indicate that the more an

adolescent consumes, the more consequences they have as the result of psychological dysregulation (affective, cognitive, and behavioral dysregulation). Dysregulation and/or irritability could actually maintain binge-drinking in adolescents, as it serves as a trigger for future use.

Murphy et al. (2012) asserted that drug addiction is defined by emotion dysregulation with specific implications related to neurological stress circuitry, reward circuitry, reinforcements, and motivation. The authors reported there is evidence that suggests the emotional characteristics of someone's personality may put them at higher risk for substance dependencies. Emotion dysregulation, such as feeling hopeless, is suggested to contribute to the problems with decision-making noted in individuals living with substance use. Emotional processing can greatly impair the thought process in substance dependence and have clinically significant effects on treatment outcomes.

Felton and colleagues (2015) sought to understand the processes linked to the development of polysubstance use and co-occurring depression. Previous research had examined this phenomenon through cross-sectional studies. This study tested three competing models of co-occurring disorders in an accelerated longitudinal/cohort sequential model. The results of this study supported a transactional model that triggers a *developmental cascade*. They defined a developmental cascade as the process in which early polysubstance use initiates early depressive symptoms, which increases the risk of further polysubstance use over time and further perpetuates depressive symptoms. Thus, understanding the roles of both psychological dysregulation and substance use is of great importance.

Cognitive Behavioral Model of Relapse Prevention

Witkiewitz and Marlatt (2004) viewed substance use as a condition of chronic relapse. Thus, an essential component of effective substance use treatment is relapse prevention (Larimer et al., 1999). The cognitive behavioral model of relapse prevention is established on principles of psychological social-cognitive theory (Marlatt & Gordon, 1985). This model integrates a theoretical model of relapse with cognitive and behavioral methods to limit or even prevent a relapse episode. This model posits that a core component in the relapse process is first, being in high-risk situations (Marlatt & Gordon, 1985). Next, a person's subsequent response of either effective or ineffective coping takes place (Larimer et al., 1999; Marlatt & Gordon, 1985). Individuals with effective coping responses demonstrate increased self-efficacy and have a reduction in the probability of relapse (Larimer et al., 1999; Marlatt & Gordon, 1985). Inversely, individuals who practice ineffective coping responses demonstrate decreased self-efficacy and may experience the expectation that substance use will make them feel better, which can lead to a substance lapse (Larimer et al., 1999; Marlatt & Gordon, 1985). This lapse may culminate in an abstinence violation effect and then increase the likelihood of relapse (Larimer et al., 1999; Marlatt & Gordon, 1985).

Similar to adults, adolescents are at risk for substance use relapse. Cognitive components such as coping self-efficacy and situational context of the cognitive behavioral model of relapse are relevant to adolescent relapse, but do not address the significant distinction in content and process of relapse in adolescence as compared to that in adulthood (Brown, 2004; Ramo & Brown, 2008).

Figure 1

Cognitive Behavioral Model of Relapse
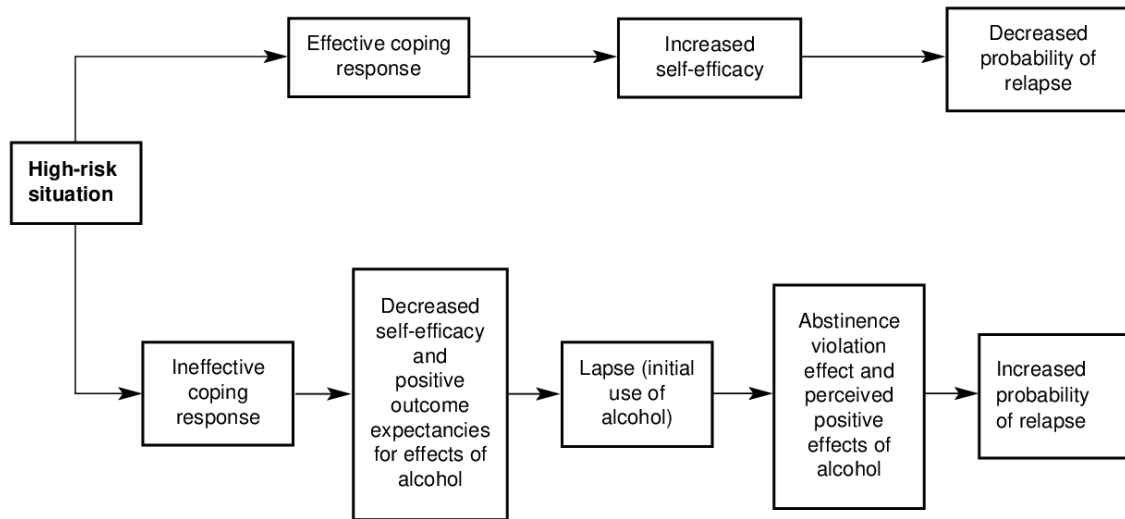
Note. Diagram of the cognitive behavioral model of relapse (Larimer et al., 1999; Marlatt & Gordon, 1985; Witkiewitz & Marlatt, 2004).

Youth Addiction Relapse Model

The youth addiction relapse model incorporates interpersonal and developmental factors into the Witkiewitz and Marlatt (2004) cognitive behavioral model of relapse to better understand substance use relapse in adolescents (Brown, 2004; Ramo et al., 2005). Brown proposed that relapse in adolescence is contingent on the affective disturbances they experience during the high-risk situations previously identified in the cognitive-behavioral model of relapse prevention.

The youth addiction relapse model suggests that relapse is more likely to occur in adolescents when they are in a high-risk situation and experience concurrent mood disturbances (Brown, 2004). Brown posited that mood disturbances can also impact the

situations in which adults and adolescents end up, which could make them more likely to relapse. Contextual factors of high-risk situations such as cognitive processes, physical withdrawal, affective state, coping behavior, and situation were identified (Anderson et al., 2007; Brown, 2004; Brown et al., 1989). This model also accounts for other risk factors that could predispose youth to be at increased vulnerability, such as family history, social supports, and substance dependence (Brown, 2004).

Ramo and Brown (2008) evaluated precursors to substance use relapse in adults and adolescents. They found that it was more probable that adults would relapse when experiencing both social pressures and urges to use. Adults were also more likely to use when experiencing a concurrent negative mood plus urges. In comparison, most adolescents who relapsed were amongst peers and sought to enhance a positive affective state. A smaller subset of teens used when experiencing complex circumstances made up of interpersonal conflict, experiencing negative emotions, and attempting to manage urges all within a social context.

Ramo et al. (2010) found that self-efficacy played a role in both adult and adolescent relapse, but in differing ways. For adolescents, self-efficacy was found to fully mediate the relationship between depression and duration of abstinence from substances. In adults, coping self-efficacy was not a mediator but was predictive of length of abstinence.

Figure 2

Youth Addiction Relapse Model
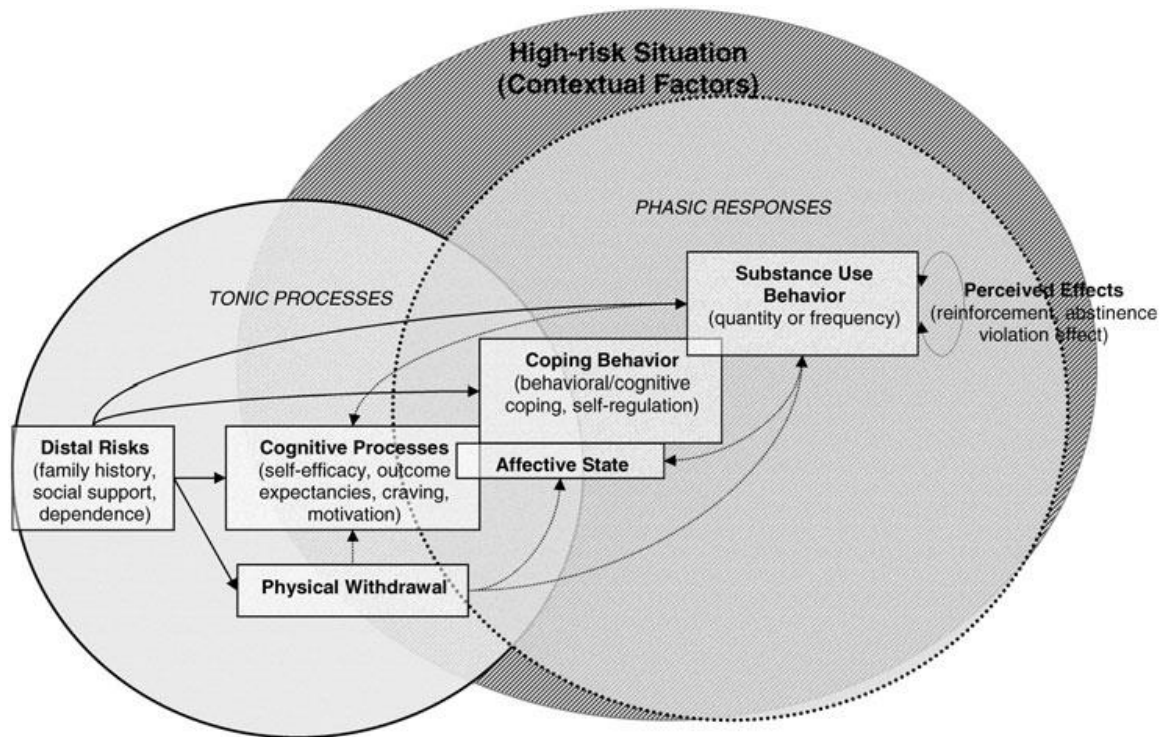
Note. From Brown (2004).

Interoception

At its core, interoception is the conscious recognition of one's physiological state (Kiken et al., 2017; Hanley et al., 2017; Mehling et al., 2018; Paulus & Stein, 2010). Mehling and colleagues indicated that interoception provides a moment-to-moment internal calibration of one's body. Specifically, this process is comprised of the nervous system's ability to sense, process and interpret, and integrate internal body signals (Mehling et al., 2018; Paulus et al., 2013). Signals relating to blood sugar levels, heart rate, hunger, and temperature are interoceptive (Murphy et al., 2017). Interoception also has an interactive relationship with emotions and cognition (Garfinkle et al., 2015). These

internal signals of interoception may also serve as motivators for action (Garfinkle et al., 2015).

Garfinkle et al. (2015) conceptualized three dimensions of interoception: (a) interoceptive accuracy, (b) interoceptive sensibility, and (c) interoceptive awareness. Interoceptive accuracy refers to the objective process of precisely detecting one's physical sensations, such as counting heartbeats (Garfinkle et al., 2015; Hanley et al., 2017). Interoceptive sensibility described as the subjective account of how an individual experience their internal sensations (Garfinkle et al., 2015; Hanley et al., 2017). Interoceptive sensibility can be measured by self-report questionnaires and through subjective descriptions offered by the individual (Garfinkle et al., 2015; Hanley et al., 2017; Mehling et al., 2018). Interoceptive awareness is the metacognitive process that describes the correspondence between the subjective and the objective dimensions of interoception (Garfinkle et al., 2015).

Interoception differs from exteroception, as exteroception is the ability to make sense of the external environment (Garfinkle et al., 2015). Interoception is also dissimilar to proprioception, as proprioception is the act of reflecting on body position in space (Garfinkle et al., 2015).

Interoception and Mindfulness. Interoception is related to, but separate from, mindfulness (Hanley et al., 2017). Mindfulness has been described in Western literature as the purposeful and nonjudgmental attending to the present moment (Hanley et al., 2017). Hanley and colleagues state that self-reflection is fundamental to mindfulness and interoception, as both involve the ability to focus attention on an internal experience. Some mindfulness practices, such as yoga and the body scan components of mindfulness-

based stress reduction, can bolster the awareness of internal body sensations that foster improved interoceptive sensibility (Hanley et al., 2017). Mindfulness practices can also include exteroception, proprioception, and thoughts as the object of attention, while interoception remains internally focused (Hanley et al., 2017).

***Mindfulness-Based Relapse Prevention*.** Mindfulness-based relapse prevention is an eight-week group intervention for suds rooted in the cognitive behavioral model of relapse prevention and mindfulness practices (Witkiewitz & Bowen, 2010; Witkiewitz et al., 2013). Mindfulness-based relapse prevention was developed to help individuals manage substance cravings and negative affect, as these factors are strong predictors of drug and alcohol relapse (Witkiewitz & Bowen, 2010). Individuals develop an awareness of things from their environment that activate them along with their own affective, cognitive, and physiological reactions in mindfulness-based relapse prevention (Witkiewitz et al., 2013).

Avoidance as Coping. Avoidance and withdrawal are ways for an adolescent to provide distance and distraction from a stressor (Herman-Stahl et al., 1994). In their research, Herman-Stahl and colleagues examined the structure of adolescent coping behaviors, and the possible relationships different coping styles have with depressive symptoms. They found that youth who use this approach as a method of coping reported the least symptoms of depression. On the contrary, individuals who used avoidance as their main method of coping experienced the most symptoms of depression. Additionally, over one year, the adolescents who used avoidant coping demonstrated an increase in depression. Notably, participants who changed their coping styles from avoidant to approach demonstrated a significant reduction in depressive symptoms.

Model of Interoception and Emotion Regulation

Interoceptive ability fosters emotional awareness and emotion regulation (Price & Hooven, 2018). Adaptive emotion regulation and interoception both require the capacity to notice, access, interpret, and respond appropriately to the body's internal signaling (Craig, 2015; Price & Hooven, 2018). Responsiveness to interoceptive signals allows for early emotion cue detection that can help one manage stressful events. Stress in the environment can lead to emotion dysregulation as well as dysregulation in the stress response system (Price & Hooven, 2018). Undue stress impacts interoception by affecting the intensity, perception, and interpretation of internal cues (Schultz & Vogel, 2015). The physiological facets of emotion regulation propose body-based interventions for emotion regulation, especially for those experiencing stress and psychological pain (Price & Hooven, 2018). In this model, the interoceptive facets of identifying, accessing, and appraising are designed to improve the body's response to environmental demands (Price & Hooven, 2018).

Interoception and Substance Use

Substance use during adolescents is frequently associated with critical health, legal, and social risks (Center for Disease Control and Prevention, 2012; SAMHSA, 2012; Stewart, 2016). Nevertheless, adolescent substance use is often left untreated. Only nine percent of youth, ages 12-17 years, who need substance use treatment services receive care (National Household Survey on Drug Use and Health, 2014; Stewart, 2016).

Disrupted Interoception. Sönmez et al., (2017) hypothesized that patients with substance addiction would demonstrate disturbed interoceptive awareness processes. They measured interoceptive awareness with the heartbeat perception task, the Toronto

Alexithymia Scale to measure alexithymia, and the Addiction Profile Index to evaluate

the severity of substance use problems. The participants of this study were 84 males

receiving inpatient substance use treatment. When compared to healthy individuals, the

addicted population demonstrated lower interoceptive awareness. These results supported

the hypothesis that interoceptive awareness was disturbed in individuals with addiction.

Price and Smith-Di Julio (2016) sought to understand interoceptive awareness

training when used in substance use disorder treatment. Results of their randomized

control trial suggested that interoceptive awareness was beneficial for participant

emotional awareness, regulation, and relapse prevention. Their findings supported the

future development of interoceptive awareness training for women in substance use

disorder treatment to help aid in relapse prevention.

Magliorini et al. (2013) aimed to evaluate the role of interoceptive sensitivity in

adolescent substance use and insular and striatal functioning. The authors explain the role

of neuroimaging and adolescent substance use, as cannabis and alcohol use can lead to

structural changes in the insular cortex and striatum. They indicate that substance use in

youths impact reward processing, which could alter interoceptive regulation. The

researchers used fMRI to evaluate brain activation in youth with a current marijuana or

alcohol use disorder. During fMRI scanning, the youth participants engaged in a

continuous performance task integrated with "soft touch" on the arm and hand as an

interoceptive stimulus. The authors correctly predicted that substance use attenuated

activation in the insula during the interoceptive stimulation. These results suggest that

adolescent substance users may have altered the ability to consciously process feeling

states, experience heightened sensitivity in brain regions related to reward value, and have blunted somatovisceral experiences.

Wetherill and colleagues (2014) sought to examine if subliminal cannabis cues could stimulate neural reward circuitry in cannabis-dependent men. The researchers found that reward circuitry, particularly in the left anterior insula, left ventral striatum/amygdala, and right ventral striatum was activated by cannabis-related cues presented outside of a participants' awareness. The authors cite the role of the anterior insula as part of the bottom-up ability to detect drug stimulus and cravings.

Berk et al. (2015) sought to determine if substance-using adolescents demonstrate dysfunctional aversive interoception. This study used fMRIs to review insula activation in teens with cannabis and alcohol use disorders. They speculated that adolescents with clinically significant substance use would demonstrate greater insular activation when engaged in a breathing load activity and have more anterior cingulate cortex and prefrontal cortex activity when compared to the healthy control group. The researchers found that youth with SUDs demonstrated increased activation in the insula during breathing load than that of the control group. The SUD group also demonstrated greater breathing load activation than the control group in the middle frontal gyrus as well as the right inferior frontal gyrus. The substance use group only demonstrated consistent modulation of the frontal regions. Lastly, the SUD group rated the breathing load as less pleasant than the control group. Thus, the researchers reported that the insula of adolescent substance users was found to be hypersensitive to unpleasant stimuli. This research suggested that adolescent substance users may be unable to accurately predict physiological body changes.

Substance Use Treatment. Interoception has substance use treatment

implications, as it has been found to promote relapse prevention in women with SUDs

(Price & Hooven, 2018; Price & Smith-DiJulio, 2016).

Wetherill and Tapert (2013) evaluated the neurodevelopmental processes and

implications that cognitive behavior therapy (CBT) and mindfulness interventions had on

the brain mechanisms of adolescent substance users. The authors suggested that the

literature on adolescent substance use treatment supported both CBT and mindfulness

treatments, as they addressed the psychosocial and developmental needs of substance-

using adolescents. They posited that CBT operated from a top-down orientation, while

mindfulness worked from the bottom-up and helped individuals focus on internal drug

caving responses rather than actively avoiding it. Therefore, they suggested that mindful

attention to internal physiological responses fostered attention to the present experience,

altered substance-related incentive motivation, and thus reduced the subjective craving

for substances.

Researchers Harris et al. (2016) identified strong cravings to drink alcohol as a

common predictor of adolescent relapse and sought to address this by teaching youth a

mindfulness coping skill. Specifically, the researchers explored the utility of a

mindfulness coping strategy called urge surfing as an after-care treatment for adolescents

who had previously participated in a school-based drug and alcohol intervention. Urge

surfing is a mindfulness skill that integrates behavioral and cognitive strategies. During

this activity, the participant intentionally focused on their breathing, thoughts, emotions,

and physiological sensations in the context of urge cravings. Urge surfing as after-care

improved the effectiveness of alcohol outcomes, as participants demonstrated reductions

in the quantity and frequency of alcohol consumption, but not that of cannabis use outcomes.

Interoception and Depression

Depression is one of the most common mental health diagnoses that occur during adolescence (Kuo et al., 2015; Stoep et al., 2005). Approximately one-quarter of adolescents in the United States endorse mild or greater symptoms of depression (Stewart et al., 2015). This disorder affects many aspects of life (Paulus & Murray, 2010). Symptoms of adolescent depression may lead to concentration difficulties, low motivation, anhedonia, social withdrawal and isolation, and low self-esteem (Beck & Alford, 2009; Frojd et al., 2008; Garvik et al., 2016; Kirkcaldy & Siefen, 1998; Kovacs & Goldston, 1991). As these are formative years, developmental disruption such as this can lead to persistent problems into adulthood (Felton et al., 2015).

Cognitive behavior therapy is a treatment intervention with empirical support to address adolescent depression (Beck, 2011; Bickman et al., 2011; Clarke et al., 2015; Emslie et al., 2015; Garvik et al., 2013; Hooke et al., 2018; Lewandowski et al., 2013; Ng et al., 2016). Therapy using CBT can be offered to youth individually and/or in group therapy settings (Beck, 2011). The model is manualized, but there is some variance across implementation and practice (Garvik et al., 2013). The literature consistently highlights themes of this intervention as psychoeducation (Beck), behavioral activation (Dimidjian et al., 2014; Ng et al., 2016), cognitive restructuring (Garvik et al, 2013; Ng et al., 2016), and learning relaxation techniques as a way to facilitate emotion regulation (Beck, 2011). There is also efficacy in the use of mindfulness-based cognitive therapy (MBCT) to treat adolescents with depression (Racey et al., 2018).

Interoceptive impairment has been linked to major depressive disorder (Eggart et al., 2019). Eggart et al. (2019) carried out a systematic review of scientific literature using the PRISMA protocol and found that moderately depressed adult participants demonstrated the largest deficits in interoception when compared to healthy peers. Low interoceptive accuracy was found to be correlated with low affective intensity and struggles with making decisions. The authors assert that interoceptive treatments may help to alleviate depressive symptoms and help manage relapse by focusing on the interoceptive nervous system.

Furman and colleagues (2013) sought out to analyze the connection between symptoms of depression and interoceptive awareness. The researchers controlled for co-occurring symptoms of anxiety. Depression was conceptualized through affective intensity as well as decision-making abilities. Results suggested that women with depression demonstrated poorer interoceptive skills than that of the control group. The researchers concluded that individuals with depression experience less positive arousal and struggle to incorporate interoceptive awareness when making decisions.

Dunn et al. (2010) used a dimensional approach to explore the interaction effects of interoception that specific depression (anhedonia) and anxiety (arousal) symptoms had on cognitive-affective processes to help better conceptualize the different affective constructs. The authors reported that distinct symptom dimensions, rather than global measures, may offer improved explanatory power. Specifically, they found that as anhedonia became more severe, the strength of the relationship between interoception and arousal decreased. The authors indicated that mechanisms of interoception may

impact cognitive-affective operations of depression, which could be a useful implication for body-focused treatments.

Pollatos and colleagues (2009) investigated the relationships between interoceptive awareness, depression, and anxiety in healthy college students. Anxiety was found to be positively correlated with heartbeat perception, and negatively correlated with depression as it can be linked to poorer ability to perceive visceral signals.

Paulus and Stein (2010) conducted a literature review on interoception and its relationships with depression as well as anxiety. Within this context, the authors specifically looked at the role of beliefs and alloesthesia. Lower interoceptive awareness was found to be linked to depressive symptoms.

Georgiou et al. (2018) reported that the ability to read facial expressions was a common way in which individuals use emotions to understand and interpret social interactions. Georgiou et al. sought to better understand the function that interoceptive accuracy played in emotion processing by reading the facial expressions of others. It was hypothesized that adolescents with higher interoceptive accuracy on a heartbeat perception task, self-report questionnaire, and EEG would also demonstrate improved emotion face recognition. The authors specifically identified the adolescent population for this study because the developmental factors of identity development, social skills, and social roles are important during this stage. Fifty-four non-clinical adolescents participated in the study. Contradictory to the hypothesis, adolescents with lower interoceptive accuracy were better at recognizing fearful and sad faces. The teens who had strong interoceptive accuracy used less attentional resources during the times they were to recognize sadness and fear, which may be indicative of attention being paid to the

more general unpleasantness of the stimulus. Adolescents with high interoceptive

accuracy demonstrated high sensitivity to negative emotions (though they were less able

to differentiated fear and sadness). This research supports mind-body integration in

shaping emotion recognition in adolescents and has implications for environmental and

contextual cues surrounding substance relapse.

Interoception with Co-Occurring Disorders

Co-occurring disorders are the simultaneous presentation of two clinical disorders

and are often associated with chronic and severe psychopathology (Hides, 2010).

Behavioral therapies are efficacious for the treatment of co-occurring substance use and

mood disorders (Carroll, 2004). These therapies can include motivational approaches,

cognitive-behavioral treatment, and contingency management (Carroll, 2004).

Motivational approaches to treatment are brief and make use of the transtheoretical model

of change to help individuals change problem behaviors such as substance use (Carroll,

2004; Prochaska et al., 1982). Cognitive-behavioral treatment assists individuals in

learning new strategies to reduce problem behaviors and thoughts through modeling,

practice, and out-of-session homework (Carroll, 2004). Contingency management is used

to reduce substance use through incentives for demonstrating measurable behaviors

(Carroll, 2004).

There is a strong relationship between depression and substance relapse

(Witkiewitz & Bowen, 2010). Turner and colleagues (2004) suggest that the majority of

youth referred to substance use treatment services also experience a co-occurring mental

health disorder. Nearly 75% of teens with current alcohol and/or substance use also meet

diagnostic criteria for anxiety, conduct, and mood disorders (Boger et al., 2014; Kandel et

al., 1999). These formative years are critical in the development of neurological, social, affective, and cognitive development (Boger et al., 2014; Brown, 2004). The combination of psychiatric and substance-related difficulties can substantially disrupt healthy development and is linked to poor prognosis in domains of education, legal problems, psychosocial functioning, and suicide (Boger et al., 2014). Additionally, depressive symptoms have been connected to the re-initiation of substance use after a period of sobriety (Curran et al., 2007; Witkiewitz & Villarroel, 2009; Witkiewitz & Bowen, 2010). Youth diagnosed with co-occurring disorders are at an even higher risk of negative consequences than those with unipolar depressive disorder.

Brewer et al. (2010) offered a neurobiological perspective of co-occurring substance use and depressive disorders and the implications for mindfulness-based treatment interventions in adults. The authors reported that mindfulness interventions previously demonstrated promising results for both major depressive disorder and SUDs. In the current study, the researchers examined shared behavioral and neurobiological dysfunctions across disorders. They suggested that mindfulness training may help dual diagnosis individuals tolerate withdrawal, unpleasant emotional states, reduce avoidance, and address maladaptive behaviors such as rumination.

Yoshimasu et al. (2016) researched the mediating and moderating effects of a variety of clinical disorders and adolescent substance use. The researchers found that the relationship between attention-deficit/hyperactivity disorder and substance use, was in part, mediated by psychiatric disorders such as depression and conduct disorder. The study suggested that depression and behavioral disorders were important precursors of adolescent substance abuse/dependence.

Operational Definitions

Adolescence. Adolescence is designated as the stage of development that starts at the beginning of puberty and ends with an accepted adult identity and behavior (Sacks et al., 2003).

Interoception. Interoception is the recognition, interpretation, and integration of sensations originating from inside of the body (Mehling, 2018; Price & Hooven, 2018). It is the degree of awareness one demonstrates with its varying facets that are likely able to be self-described (Mehling, 2018). In the current research, the word interoception is used interchangeably with the term interoceptive sensibility.

Substance Use Disorders. Substance use disorders are defined as a group of physiological, behavioral, and cognitive symptoms indicative of continued substance use despite significant substance-related consequences (American Psychiatric Association, 2013).

Depression. Depression is operationalized in this study by the American Psychiatric Association (2013) as, "the presence of sad, empty or irritable mood, accompanied by somatic and cognitive changes that significantly impact an individual's ability to function" (p. 155).

Co-Occurring Disorder. Co-occurring disorders are the simultaneous presentation of two clinical disorders and are often associated with chronic and severe psychopathology (Hides, 2010). In this study, comorbid depression and cannabis use are explored.

Purpose of the Study

The current body of literature regarding adolescents with co-occurring disorders is growing and consistently highlights this as a critical period of affective, behavioral, and cognitive development. The presence of both depressive symptoms and substance use complicates and increases risk factors for teens. Problems with depression and substance use that begin in adolescence are likely to become pervasive and recurring problems in adulthood. Because of the longitudinal outcomes of these problems, current research and treatment must focus specifically on adolescent needs.

The research measuring interoception and co-occurring disorders in adolescence are sparse. Because interoception is a process of internal self-awareness that is disturbed in both substance-using adolescents and those with depression, it may be a transdiagnostic way to better understand and improve youth treatment outcomes. Several studies exploring co-occurring disorders and/or substance use with psychological dysregulation identified mediator variables based on the neurobehavioral disinhibition theory. The literature supports the predictive potential of interoception on depression, and interoception on substance use integrating neurobehavioral disinhibition, cognitive behavioral model of relapse, and the youth relapse model. Data for this study was collected through online surveys and Project READY (Reducing the Effects of Alcohol and Drugs on Youth). Project READY is an ongoing research program at Northwest University that offers free substance use intervention, informed by motivational interviewing (MI) and cognitive behavior therapy (CBT), to area high school students. Project READY is based on theories of neurobehavioral disinhibition, the cognitive behavioral model of relapse, and the youth addiction relapse model.

Hypotheses

Adolescence is a period of development characterized by many changes (Brown, 2004). Psychological changes, such as self-awareness, self-reflection, cognitive flexibility, and the ability to think strategically develop during this time (Blakemore & Choudhury, 2006; Murphy et al., 2017; Rutter & Rutter, 1993). Additionally, this period is also when the onset of psychiatric disorders occur, which can impact mental and physical health into adulthood (Kessler et al., 2005; Murphy et al., 2017; Stewart et al., 2011). The basis for emotional feeling states and perception of bodily physiology is well conceptualized through interoception (Garfinkle et al., 2015; Mehling et al., 2018). The interoceptive process can be examined through neurocognitive development (Garfinkle et al., 2015) and is related to the construct of cue reactivity of the youth addition relapse model (Brown, 2004; Ramos et al., 2010). The neurobehavioral disinhibition theory suggests that psychological dysregulation in youth impacts the substance use of adolescents (Harris et al., 2017; Tarter et al., 2003).

This study seeks to understand the relationships between interoception, cannabis use, and depression in adolescents through mediational analysis with four hypotheses. Hypothesis one is interoception will be predictive of the frequency of cannabis used by adolescents, in that higher interoception will lead to less frequent use. Hypothesis two is interoception will be predictive of depressive symptoms in adolescents. Specifically, higher interoception will result in lower depressive symptoms. Hypothesis three higher depression will be predictive of higher cannabis frequency by adolescents. Hypothesis four is that depression will mediate the relationship between interoception and the frequency of cannabis used. The model for the proposed hypotheses is in Figure 3.

Figure 3

Model of hypotheses
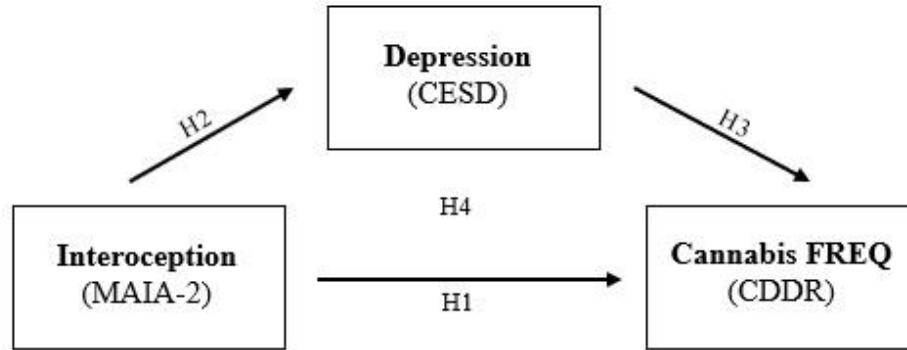
Chapter 2

This study aimed to evaluate interoception as a predictive variable of the quantity and frequency of cannabis used by adolescents, proposed that interoception was predictive of depression, that depression was predictive of cannabis quantity and frequency used by youth, and that depression mediated the relationship between interoception and cannabis use.

Survey data for adolescent substance use and mental health symptoms are common practices in the research field. For this study, survey data was collected through a school-based drug and alcohol intervention called Project READY and also collected by online measures.

Participants

Participants in this study consisted of 93 adolescents between the ages of 15.00 and 20.83 years ($M = 19.01$, $SD = 1.30$) recruited through a school-based drug and alcohol program called Project READY and through online survey collection. Gender demographics consisted of 61.3% who identified as female, 36.6% who identified as male, and 2.2% preferred not to share. Ethnic demographics consisted of 75.3% Caucasian, 5.4% Asian/Pacific Islander, 5.4% Black/African American, 5.5% Hispanic, 2.2% Native American/Alaska Native, and 6.5% as Other.

A statistical power analysis was performed for sample size estimation. A modest anticipated effect size of 0.15 was selected to help reduce the likelihood of Type I errors as it increases the expected sample size. Two predictors, interoception and depression, were entered into the power analysis. With an $\alpha = .05$ and power $= 0.80$, the projected sample size needed with this effect size was approximately $N = 107$.

Project READY Participants

Eligible participants for this study were high school students in the greater Seattle

area (i.e., Northshore School District, Marysville School District). Schools were recruited

through existing Project READY relationships with Northwest University, email

introduction to school districts, school counselors, and school administrators. Participants

ranged in age from 13 to 19 years of age. Participants were referred by school

administrators, teachers, health service workers, other school staff, parents or legal

guardians, self-referral, and other staff to receive a school-based drug and alcohol

intervention. Participant identity was kept confidential consistent with state and federal

laws, and each participant is assigned an identification number. A signed release of

information was required to share any substance history or other information about a

participant with a third party which includes staff at their school. The only information

offered to schools without a signed release of information was participant attendance and

intervention completion. All participation in Project READY intervention and research

was voluntary, and students were able to withdraw at any time without consequence. If a

participant withdrew from the study, their data was destroyed. The researchers also

reserved the right to end participation at any time. The students were given the option to

participate in the READY intervention without having their data considered in research.

The youth participants were informed of the procedure and manualized Project READY

intervention. The intervention took place in private school counseling offices and

occurred during the school day. Participants were informed of the purpose of the ongoing

data collection and studies. Participants under the age of 18 years were provided

informed consent for READY services, assent for research participation and their parents

or legal guardians were provided with a research consent form. Participants age 18 years and older completed treatment and research consent forms. There was no deception used during the recruitment and intervention process. There was minimal risk to participants. Sometimes individuals may have become upset when answering questions about their problems, as such interventionists were trained to provide support and make any referrals for student participants who need additional help. Participants were debriefed at the end of their time as a research participant that include a review of their personalized data and any changes in their use, as well as overall project outcomes to date. Participants did not receive compensation.

Online Survey Participants

Inclusion criteria to participate in this survey required that all participants be between the ages of 18 years to 20 years, 11 months of age. Participants under the age of 18 and age 21 years or over were excluded from the study. The sample size consisted of participants in the general public and college settings. Recruitment strategies included postings on social media with a shareable link to the secure Qualtrics survey and emailed recruitment letters to college and university program directors that asked them to share the survey with the student body. This survey was anonymous and no personally-identifying information as collected from the participants. Participants were informed of the study purpose before completing the online research consent form. Participation was completely voluntary and participants were allowed to decline or leave the survey at any time. No deception was used in the study. The survey was estimated to take 20 to 25 minutes. There was minimal risk for participants and no compensation was offered.

Measures

Interoception

Interoception was measured by the Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2; Mehling et al., 2018). The MAIA-2 is a 37-item self-report questionnaire that measures interoceptive awareness. It has eight scales for noticing, not-distracting, not-worrying, attention regulation, emotional awareness, self-regulation, body listening, and trusting. A total score that represents body awareness is offered. This instrument was validated mostly with adults. Daly et al. (2015) found this measure to be reliable amongst a sample of high school ($\alpha = .88$). The MAIA was found to be valid and reliable with both adolescents and adults with eating disorders (Brown et al., 2017).

Depression

Depression was measured with the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item self-report questionnaire commonly used to measure symptoms of depression. Using a four-point Likert scale ranging from zero (rarely or none of the time) to three (most of the time), participants rate how often they have experienced particular feelings over the past week. The composite scale score ranges from zero to 60; a score of 16 and higher are indicative of clinically significant depression.

The CES-D is a valid and reliable measure of adult depression, with internal consistency for the community ($\alpha = .85$) and clinical population ($\alpha = .90$). Most measures of test-retest reliability from two weeks to 12 months are moderate (.45-.70); though Radloff described moderate test-retest estimates to be consistent with the CES-D design

to capture current affective states that vary between administrations. The overall

composite score will be used in this research study.

Cannabis Use

The Customary Drinking and Drug Use Record (CDDR; Brown et al., 1998) was

used to measure the quantity and frequency of cannabis used. The CDDR is a 101-

question, structured clinical interview designed to assess current and recent substance use

for the three months preceding evaluation. The CDDR contains four domains: drug and

alcohol use, withdrawal, psychological and behavioral dependence, and consequences.

The CDDR has been found to have good internal consistency in each domain.

Alpha coefficients for drug psychological and behavioral dependence were strong for the

abusing ($\alpha = .72$) and community ($\alpha = .85$) for adolescents. Internal consistencies for

drug withdrawal symptoms were also high with abusing ($\alpha = .94$) and community ($\alpha =$

.90). The CDDR also has high test-retest reliability (drug use $r = .92$, drug dependence r

$= .76$, and drug withdrawal $r = .85$). When compared with like measures, the CDDR

demonstrated high convergent validity. Questions that identify youth quantity and

frequency of cannabis use will be used in the current research.

Study Procedures

Project READY Procedures

Adolescent participants were recruited for this study based on referral for

participation in Project READY, a school-based drug and alcohol intervention that uses

cognitive-behavioral and mindfulness strategies. Participants were randomly assigned to

a control treatment group and an experimental treatment group per READY protocol,

though this has no impact on the data collected for this study. At this time, participants also received a participant identification number.

At time one, students were introduced to the Project READY intervention, discussed reasons they believe they were referred to READY, received information about the limits of confidentiality, and completed paper treatment consent. For students under age 18 years, students completed research assent forms and were provided with paper research consent forms for their parents. For students 18 years of age or older, they completed a paper research consent form. The signed paper forms did not list the participant identification number.

The interventionist collected data for this study through a secure Qualtrics survey, with a link specific to each participant identification number. The participant's name was not included in any Qualtrics survey information or documents. Interventionists asked participants to provide a brief family and social history information that they entered into the secure electronic platform; the interventionist used MI skills to establish rapport during this time. Next, the interventionist oriented the participant to the assessment measures collected during this session and explained the purpose, which included providing individualized feedback for the participant during the second session. Measures that were collected electronically through Qualtrics for this study were a demographic questionnaire, CES-D, CDDR, and MAIA-2.

Additional Project READY Intervention. This study proposed (and was approved) to add one additional screening instrument to the already IRB approved Project READY research at Northwest University. Additional READY procedures are described here.

Other measures of this initial, time one, battery per the standard READY protocol included the Alcohol and Drug Use Consequences Questionnaire, the Stages Of Change Readiness and Eagerness Scale, Inventory of Drug-Taking Situations, and the Dysregulation Inventory. Once all instrumentation was collected and saved in Qualtrics, a Project READY diary card was presented and reviewed with the participant. Participants selected one or two substances to monitor, how to rate urges to use on a scale of zero to five, and review the list of coping skills at the bottom of the diary card. Barriers to diary card completion were reviewed with the participant, and the participant was instructed to bring the diary card to the next session. This first session lasted approximately 60 to 90 minutes, with most other sessions lasting around 60 minutes.

Interventionists. Interventionists consisted of 14 doctoral students in their second, third, and fourth year of Northwest University's Psy.D. Program. The interventionists had a range of clinical experiences, ranging from one to nine years. Training for the interventionists included the administration, scoring, interpretation, and providing feedback on the assessment measures. Additionally, interventionists were trained in the Project READY model and protocol, MI, and urge surfing. Dr. Jennifer S. Harris, a licensed psychologist, supervised initial training, and the ongoing weekly two-hour group supervision.

Online Survey Procedures

Institutional Review Board approval was sought and attained from Northwest University's IRB. Convenience sampling was used to invite participants to visit the online survey site via email, LinkedIn, and Facebook. Participants who clicked on the link were first prompted to review the research consent form and select, "I agree" or "I

disagree." Participants who did not agree to the informed consent or were not between

the age of 18-20 years, 11-months old were automatically exited from the survey. All

participants who agreed to the informed consent and indicated they were between the

ages of 18-20 years, 11-months were directed to the demographics questionnaire. The

demographics questionnaire asked participants to provide information regarding their

age, gender, and ethnicity. Following demographic information, participants then

received the remaining measures in this order: CDDR, CES-D, and MAIA-2. Once

participants completed the study, they were thanked and presented with an information

page that included resources for mental health and substance use services. The resources

they received included information to contact the primary researcher, supervisor, and

chair of the IRB. In addition, the participants were given substance use service

information and the contact information for a national 24/7 crisis hotline, website, and

text line. All resources presented in the debriefing were also be included in the consent

form. There were minimal risks involved in participating in the survey.

Chapter 3

This chapter presents the data used to examine the four hypotheses initially proposed in this study. Specifically, data collected here aimed to examine the mediational relationship of depression on interoception and cannabis use frequency.

Descriptive Statistics

Table 1 presents the means and standard deviations for each variable measured. Table 2 presents bivariate correlation coefficients between all variables.

Table 1

Descriptive Statistics for Study Variables

Variables	Mean	SD
Cannabis Frequency	5.70 (Mdn = 13.5)	9.46
Interoception	2.61	.71
Depression	21.76	12.60

Table 2

Bivariate Correlations for Interoception, Depression, and Cannabis Use

Variable	Depression (CES-D)	Cannabis Frequency (CDDR)
Interoception (MAIA-2)	-.394**	.102
Noticing	.18	.21*
Not-Distracting	-.36**	-.09
Not Worrying	-.26*	-.03
Attention Regulation	-.33**	.04
Emotional Awareness	-.05	.13
Self Regulation	-.30**	.20
Trusting	-.49**	-.08
Body Listening	-.20	.18
Depression (CES-D)	--	.174

Note. ** $p < .01$, * $p < .05$

Mediation Analysis Procedure

A mediation analysis known as *conditional process modeling* (Hayes, 2017) was used to enhance the estimation of the effects of linear regression analysis. Conditional processing (Hayes, 2017; Hayes, 2018; Hayes & Rockwood, 2020) offers information regarding the contingency of the independent variable's (interoception) direct and indirect effect on the dependent variable (cannabis use) through a mediator (depression). It was selected over a hierarchal multiple regression as it allows for greater parsimony and accuracy in model specifications that increase statistical power and reduces the likelihood of Type I errors.

Mediation Model

From a simple mediation analysis using PROCESS Model 4, interoception indirectly influenced cannabis use frequency through its effect on symptoms of depression. As can be seen in Figures 4 and 5, as well as in Table 3, participants with higher levels of interoception were less depressed (a = -6.989), and participants who were more depressed used cannabis more frequently (b = 0.190). There was no evidence that interoception predicted the frequency of cannabis use independent of depression. A bootstrap confidence interval for the indirect effect (ab = -1.326) based on 5,000 bootstrap samples was entirely below zero (-2.830 to -.095). The following section explores the findings for each hypothesis proposed.

Figure 4

Model of Hypotheses, Significance
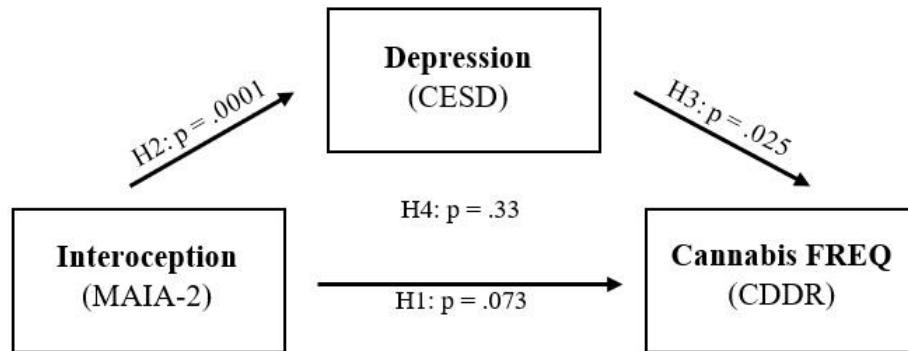
Figure 5

Model of Hypotheses, Magnitude
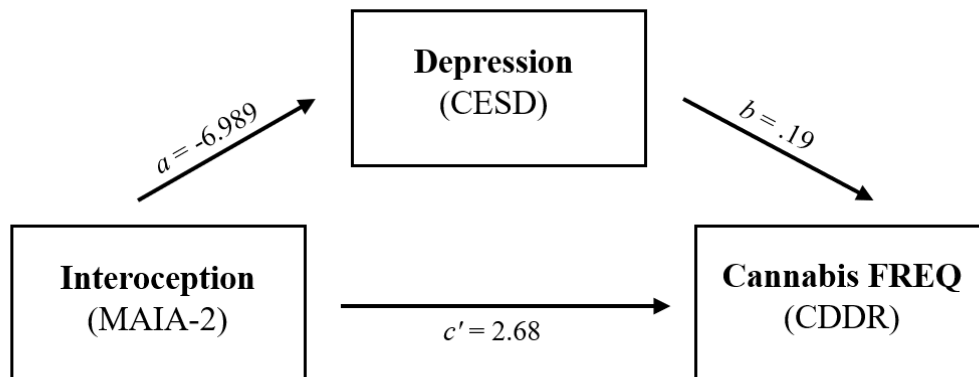
Table 3

Model Coefficients

		M (CES-D)				Y (FREQ)		
Antecedent		Coeff.	SE	p		Coeff.	SE	p
X (INT)	a	-6.99	1.71	.0001	c'	2.68	1.48	.073
M (CESD)		--	--	--	b	.19	.08	.025
Constant	i_M	40.01	4.62	.0000	i_Y	-4.44	4.96	.276
	$R^2 = .15, F(1, 91) = 16.69, p < .0001$				$R^2 = .06, F(2, 90) = 3.10, p < .05$			

(Note: the "Consequent" heading spans M (CES-D) and Y (FREQ).)

Interoception Predicts the Frequency of Cannabis Use (H1). It was
hypothesized that interoception would predict the frequency of cannabis used.
Specifically, adolescents with higher rates of interoception would use cannabis less
frequently. Results of this analysis found no significant effect, $R^2 = .01$, $F(1, 91) = .33$, p
$= .073$, and the hypothesis was not supported.

Interoception Predicts Depression (H2). It was hypothesized that adolescents
with higher scores of interoception would have fewer symptoms of depression.
Correlation analysis between MAIA-2 and CES-D scores were significant and were
supported by regression analysis, $R^2 = .15$, $F(1, 91) = 16.69$, $p < .0001$. This suggests that
adolescents with higher interoception have lower symptoms of depression, and those with
lower interoception have increased symptoms of depression.

Depression Predicts Frequency of Cannabis Use (H3). It was hypothesized that
adolescents with higher scores in depression would have increased frequency of cannabis
use. Regression analysis were significant, $R^2 = .06$, $F(2, 90) = 3.10$, $p = .025$, and suggest
that as adolescents experience an increase depression the frequency of cannabis use also
increases.

Depression as a Mediator of Interoception and Frequency of Cannabis Use

(H4). The overall model, that depression would mediate the relationship between interoception and cannabis use was hypothesized. However, no significant relationship was found between the direct relationship of depression and cannabis use frequency. The overall model was not found to be significant $R^2 = .01$, $F(1, 91) = .95$, $p = .33$, and is not supported.

Chapter 4

The purpose of this study was to examine the mediational relationship of depression between interoception and cannabis use frequency through four hypotheses. First, it was anticipated that interoception would negatively predict cannabis use. Second, it was predicted that higher interoception would yield lower symptoms of depression. Third, higher levels of depression were anticipated to predict increased cannabis use frequency. Lastly, in the overall model, it was predicted that depression would fully mediate the relationship between interoception and cannabis use.

Interoception and Cannabis Use

The first hypothesis, that lower interoception would be predict increased cannabis use frequency, was not supported. Research on these constructs is varied. The current results are inconsistent with previous research that suggested adolescent that use cannabis and alcohol may have more difficulties consciously make sense of feeling states (Magliorini, 2013), and that adolescent substance users are less accurate in predicting physiological body changes (Berk et al., 2015). There are several possibilities as to why there was no association between interoception and cannabis use. This study specifically looked at cannabis use frequency, and other facets of use such as cannabis quantity could yield a different relationship. Harris et al. (2016) found that an urge surfing aftercare intervention reduced the alcohol frequency and quantity used by adolescents, but it did not demonstrate significant results for cannabis use. Due to neurological age differences, the mechanisms of interoception quantified in the MAIA-2 may not fully capture the manifestation of interoception in adolescent cannabis users as it does with adults.

Processes of interoception may also differ, in that some awareness is present but the ability to self-implement and regulate is limited.

Only the noticing subscale of the MAIA-2 was significantly correlated with cannabis use frequency. The construct of noticing in interoception refers to the awareness of body sensation that is neutral, comfortable, and uncomfortable (Mehling, 2018), and the significant positive results from the current research may suggest that increased noticing led to increased cannabis use. These results may be related to heightened sensitivity and a low tolerance for discomfort, consistent research from Berk et al. (2015) in which adolescent cannabis users were hypersensitive to aversive stimuli during breathing exercises. This suggests that cannabis use increases sensitivity to physical discomfort, which may increase the need for symptom management, and in this case maladaptively through more cannabis use.

Interoception and Depression

The second hypothesis sought to determine if interoception was predictive of depression; specifically, that lower interoception would be predictive of higher symptoms of depression. This hypothesis was supported and interoception scores negatively predicted depression scores. This means that symptoms of depression increased as a function of interoception. The specific facets of interoception that elicited a response from depression included not-distracting, not worrying, attention regulation, self-regulation, and trusting. Noticing, emotional awareness, and body listening were not significantly correlated with depression, though emotional awareness and body listening demonstrated negative correlations with depression. According to this mediation model, noticing, emotional awareness, and body listening were important when combined with

the other subscales of interoception. These results are consistent with the literature that

suggest interoceptive impairment is associated with major depressive disorder (Eggart et

al., 2019), women with depression have significantly lower interoceptive skills compared

to non-depressed counterparts and have difficulty using interoceptive awareness in

decision making (Furman, 2013), and that as symptoms of anhedonia became more

severe, the association between interoception and arousal decreased (Dunn et al., 2010).

Depression and Cannabis Use

The third hypothesis, that depression would predict cannabis use frequency

suggests a significant interaction, was also supported in the current study. Youth who had

higher symptoms of depression used cannabis more often. This means the frequency of

cannabis used increases as a function of depression. This is consistent with previous

studies that report how a significant number of youths referred to substance use treatment

have a co-occurring mental health disorder (Turner et al., 2004). These results indicate

that depression management is of great importance to support sobriety. There are also

implications for this co-occurrence and substance relapse in the literature, as symptoms

of depression have been connected to relapse following a period of sobriety (Curan et al.,

2007; Witkiewitz & Villarroel, 2009; Witkiewitz & Bowen, 2010). Treating substance

use symptoms alone and ignoring symptoms of depression will likely lead to relapse.

Effective treatment modalities for this co-occurrence could include the simultaneous

treatment of both disorders and/or a transdiagnostic modality. Depression must be

managed to prevent relapse and maintain sobriety.

Depression as a Mediator of Interoception and Cannabis Use

Lastly, the overall model of depression mediating the relationship between interoception and cannabis use was investigated. It was hypothesized that the strength of interoception on the frequency of cannabis use would be explained by symptoms of depression. The overall model was not supported as the direct relationship between interoception and cannabis use was not significant. It is also possible that other facets of cannabis use, such as quantity and method of consumption, may have been other outcome variables to consider.

Contribution to the Literature

This is the first study known to the author that examines interoception and co-occurring depression and cannabis use in adolescents. The results of this study add to the sparse literature of interoception and co-occurring disorders specific to adolescents. Results offer evidence that interoception was found to be predictive of depression in an adolescent population. These findings aid research by identifying important variables specifically related to adolescent pathology. The predictive nature of interoception on depression highlights the importance of awareness of mood and symptom regulation. This alludes to the possible benefit of incorporating interoceptive training in clinical interventions for depressed youth as well as in prevention efforts for non-depressed youth. Interoception was also found to indirectly affect cannabis use through symptoms of depression, which has implications for substance use relapse mitigation. Because adolescents who use cannabis are more likely to become depressed, which in turn makes them more likely to use (Felton et al., 2015), it may prove useful to incorporate interoceptive training into treatment modalities. The current study is consistent with the

youth addiction relapse model (Brown, 2004), as the affective state of depression was

found to have a significant relationship with substance use behavior; and neurobehavioral

disinhibition theory (Tarter et al., 1993) as depression appears to serve as a facet of

psychological dysregulation that predisposes adolescents to substance use (Harris et al.,

2017). The role of depression was necessary for explaining the indirect relationship

between interoception and cannabis use. This is consistent with and supports the

literature that offers insight into the precipitating factors of adolescent psychopathology,

but specifically identifies interoception as an important variable to consider and address.

Strengths and Limitations

There were several strengths in this study. First, this study used psychometrically

sound measures. For participants who received the school-based intervention, the Project

READY interventionists were well trained in test administration and MI. Data collected

from participants who engaged in the online survey were from various parts of the United

States and had the additional protection of providing information anonymously. This data

set consists of teens and young adults who are in the vulnerable launching period**.**

There were several limitations of this research. First, the small sample size may

have affected the strengths of relationships between some variables, threaten external

validity, as well as threaten the validity of statistical conclusions. There was limited

diversity represented, as over 75% of participants identified as Caucasian. Additionally,

COVID-19 disrupted data collection procedures and may have impacted the presentation

of each variable. It is possible that adolescents could have increased depression due, less

access to cannabis, and disrupted interoception. Additionally, the pandemic may also

have affected the availability of cannabis to underage youth due to social distancing and

stay at home orders. Obtaining parental consent for participants under age 18 years for

participants with data collected from Project READY may have limited participation and

honesty about substance use. Project READY participants may have not wanted their

parents to find out about their treatment and/or substance use difficulties or may have

been apprehensive about the amount of information shared with their parents should they

have decided to participate. Lastly, the accuracy and truthfulness of data collected from

self-report surveys is also a limitation. It is possible that offering information about

sensitive topics or information about deviating from prosocial behavior is impacted by

the participants' perceived social response.

Future Directions

This research sought to examine the mediating effects of depression between

interoception and cannabis use frequency in an adolescent population. The overall model

was not supported. However, the study did provide some significant results in that

interoception was predictive of depression, and depression was predictive of cannabis use

frequency. Future research could examine the various facets of interoception and their

relationship with cannabis use frequency. It may also be useful to adjust the statistical

model where cannabis use would mediate the relationship between interoception and

depression. This adjusted model may better align with Felton and colleagues' (2015)

research regarding how the initial use of substances triggers a developmental cascade of

ongoing use and depression. Additionally, the variable of cannabis use could be expanded

to include the quantity and method of consumption. There is also a strong body of

literature regarding adolescent alcohol use concerning depression, and it may be useful to

include data collection for this and other illicit substances. The current study did not

gather data regarding participants' history of or current mindfulness or meditation practices that could impact their level of interoception, and future research may want to control for this variable.

Conclusion

Adolescents with co-occurring mental health and substance use problems are unfortunately commonplace in contemporary society. Problems during this stage of development have been shown to lead to ongoing cognitive, behavioral, and affective problems well across the lifespan. The current study suggests that adolescents with poor interoception are more likely to be depressed, that depressed adolescents use cannabis more often, and that interoception indirectly influences cannabis use through depression. Thus, this study reinforces the current adolescent co-occurring disorder literature identifying the relationship between these constructs and offers insight into possible transdiagnostic treatments.

These results have implications for adolescents, families, and counseling psychologists alike. Regarding efficacious treatment, this study highlights the need for effective, developmentally targeted, treatments that incorporate interoception. Interoception has a powerful influence on symptoms of depression and increasing interoception can reduce, possibly help prevent depression. Depression consistently has a strong relationship with cannabis use in the literature as well as in this study. To help mitigate the risks of adolescent substance use, the current research suggests that treatment for depression would benefit from interventions that include interoception, as managing depression reduces the frequency and likelihood of using cannabis.

While this study did not find a direct relationship between interoception and cannabis use, the demonstrated indirect effect suggests that enhancing an adolescent's awareness of internal body signals could reduce the likelihood of affect-related substance relapse, depression, and disrupt the developmental cascade of co-occurring symptomatology. This is especially important for all stakeholders, as it may maximize time in treatment by simultaneously addressing both disorders. The adolescent circumstance is often constrained by a schedule already required to accommodate educational and employment needs, finances, clinical availability and scheduling, transportation, as well as the agenda of other family members. Thus, interventions that occur onsite at high schools and colleges remove such barriers and increase access to treatment. Parents and other family members of adolescents can use this information to incorporate interoceptive skills training in the home which may be a good preventative measure against depression and/or cannabis use. Additionally, the results of this study may also help parents by providing early warning signs so the need for clinical intervention is identified early which could reduce the length and severity of problems related to substance and mood disturbances.

The association of cannabis use frequency and the noticing construct of interoception may be an important clinical area to target. Previous research identified increased sensitivity and difficulty predicting physiological changes with substance-using adolescents (Berk et al., 2015) and that strong cravings were predictive of adolescent alcohol relapse (Harris et al., 2016). Without meaningful coping skills to manage urges (Ramo & Brown, 2008), this low tolerance for discomfort appears to lead to the use and reinforcement of the developmental cascade with depression. Increasing interoceptive

skills through mindfulness and CBT clinical models may enhance already existing

treatment modalities.

The longitudinal impacts of early substance use and presentation of depression are

fundamental in understanding and helping adolescents launch healthily into adulthood.

The literature regarding interoception specific to adolescent co-occurring disorders is

limited but growing. The current study suggests that interventions that improve

interoception have the potential to reduce depression and subsequent cannabis use in

adolescents. Such treatment could help address the growing number of affected

adolescents and improve long-term outcomes.

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Appendix A

Demographics Questionnaire

Demographic Questionnaire

DOB: _____ Age: _____ Grade: _____ Gender: _____

Ethnicity: Check ALL that apply
- ☐ Asian or Pacific Islander
- ☐ Black/African-American
- ☐ Hispanic (Latino or Spanish)
- ☐ Native American or Alaskan Native
- ☐ White

How many days have you missed school in the past 3 months due to...

Intake	Skipping: _____	Discipline: _____	Sick/Excused: _____
4th Week	Skipping: _____	Discipline: _____	Sick/Excused: _____
8th Week	Skipping: _____	Discipline: _____	Sick/Excused: _____
12th Week	Skipping: _____	Discipline: _____	Sick/Excused: _____
16th Week	Skipping: _____	Discipline: _____	Sick/Excused: _____

How many times in the past three months have you attended any groups, counseling, or therapy for alcohol or drug abuse?

Intake	Yes: _____	No: _____	If yes, how many times in the past 3 months: _____
4th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____
8th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____
12th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____
16th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____

How many times in the past three months have you attended any groups, counseling, or therapy for other reasons?

Intake	Yes: _____	No: _____	If yes, how many times in the past 3 months: _____
4th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____
8th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____
12th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____
16th Week	Yes: _____	No: _____	If yes, how many times in the past month: _____

Appendix B

Center for Epidemiologic Studies Depression Scale (CES-D)

Center for Epidemiologic Studies Depression Scale (CES-D), NIMH

Instructions: Below is a lot of the ways you might have felt or behaved. Please tell me how often you have felt this way during the past week, using the scale below.

The * indicates reverse scoring

Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
0	1	2	3

During the Past Week					
	Intake	Week 4	Week 8	Week 12	Week 16
1. I was bothered by things that usually don't bother me					
2. I did not feel like eating; my appetite was poor.					
3. I felt that I could not shake off the blues even with help from my family or friends.					
4. I felt I was just as good as other people. *					
5. I had trouble keeping my mind on what I was doing.					
6. I felt depressed.					
7. I felt that everything I did was an effort.					
8. I felt hopeful about the future. *					
9. I thought my life had been a failure.					
10. I felt fearful.					
11. My sleep was restless.					
12. I was happy. *					
13. I talked less than usual.					
14. I felt lonely.					
15. People were unfriendly.					
16. I enjoyed life. *					
17. I had crying spells.					
18. I felt sad.					
19. I felt that people dislike me.					
20. I could not get "going".					

Appendix C

The Multidimensional Assessment of Interoceptive Awareness, Version 2

Below you will find a list of statements. Please indicate how often each statement applies to you generally in daily life.

	Circle one number on each line					
	Never					Always
1. When I am tense I notice where the tension is located in my body.	0	1	2	3	4	5
2. I notice when I am uncomfortable in my body.	0	1	2	3	4	5
3. I notice where in my body I am comfortable.	0	1	2	3	4	5
4. I notice changes in my breathing, such as whether it slows down or speeds up.	0	1	2	3	4	5
5. I ignore physical tension or discomfort until they become more severe.	0	1	2	3	4	5
6. I distract myself from sensations of discomfort.	0	1	2	3	4	5
7. When I feel pain or discomfort, I try to power through it.	0	1	2	3	4	5
8. I try to ignore pain	0	1	2	3	4	5
9. I push feelings of discomfort away by focusing on something	0	1	2	3	4	5
10. When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.	0	1	2	3	4	5
11. When I feel physical pain, I become upset.	0	1	2	3	4	5
12. I start to worry that something is wrong if I feel any discomfort.	0	1	2	3	4	5
13. I can notice an unpleasant body sensation without worrying about it.	0	1	2	3	4	5
14. I can stay calm and not worry when I have feelings of discomfort or pain.	0	1	2	3	4	5
15. When I am in discomfort or pain I can't get it out of my mind	0	1	2	3	4	5
16. I can pay attention to my breath without being distracted by things happening around me.	0	1	2	3	4	5
17. I can maintain awareness of my inner bodily sensations even when there is a lot going on around me.	0	1	2	3	4	5
18. When I am in conversation with someone, I can pay attention to my posture.	0	1	2	3	4	5

How often does each statement apply to you generally in daily life? Circle one number on each line

	Never				Always	
19. I can return awareness to my body if I am distracted.	0	1	2	3	4	5
20. I can refocus my attention from thinking to sensing my body.	0	1	2	3	4	5
21. I can maintain awareness of my whole body even when a part of me is in pain or discomfort.	0	1	2	3	4	5
22. I am able to consciously focus on my body as a whole.	0	1	2	3	4	5
23. I notice how my body changes when I am angry.	0	1	2	3	4	5
24. When something is wrong in my life I can feel it in my body.	0	1	2	3	4	5
25. I notice that my body feels different after a peaceful experience.	0	1	2	3	4	5
26. I notice that my breathing becomes free and easy when I feel comfortable.	0	1	2	3	4	5
27. I notice how my body changes when I feel happy / joyful.	0	1	2	3	4	5
28. When I feel overwhelmed I can find a calm place inside.	0	1	2	3	4	5
29. When I bring awareness to my body I feel a sense of calm.	0	1	2	3	4	5
30. I can use my breath to reduce tension.	0	1	2	3	4	5
31. When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.	0	1	2	3	4	5
32. I listen for information from my body about my emotional state.	0	1	2	3	4	5
33. When I am upset, I take time to explore how my body feels.	0	1	2	3	4	5
34. I listen to my body to inform me about what to do.	0	1	2	3	4	5
35. I am at home in my body.	0	1	2	3	4	5
36. I feel my body is a safe place.	0	1	2	3	4	5
37. I trust my body sensations.	0	1	2	3	4	5

Appendix D

Customary Drinking and Drug Use Record

Customary Drinking and Drug Use Record (CDDR)

Instructions: The following are questions concerning your experience using alcohol. We are interested in your experiences other than a taste or a sip.

1. How old were you when you first began drinking alcohol (beer, wine, or hard liquor)?	Age: _____
2. How old were you when you first began drinking alcohol regularly (at least once per week)?	Age: _____
3. In your lifetime, how many times have you drank alcohol? (If more than 200 times, just write 200+)	Number of times: _____

	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
4. During the last 3 months (prior to intervention), how many days per month did you drink alcohol? *For F/U: In the last month, how many days? (Code Number of Days 0-30)					
5. Over the last 3 months, in the average 24-hour period you were drinking, how many _____ did you drink? For F/U: In the last month, how many days? (Code Number of Drinks - *Enter 0 if no use*)					
6. When was the last time you drank _____? (Code Number of Days, or date if last drink was more than 3 months ago).					
7. How many _____ did you drink on that occasion?					
8. In the last 3 months, when you are drinking any type of alcohol, what is the typical amount of time it takes you to finish drinking. I.E. duration of drinking? *For F/U: In the last month?					
9. In the last 3 months, what is the largest amount of alcohol you have consumed during one-time period? *For F/U: In the last month, what was the largest amount?					

In the last 3 months, when you cut down or stopped using alcohol, how many times did you experience the following problems within 2 days of cutting back? (Record number of times in the past 3 months). For weeks 4-16, use only the past month as reference.

	Number of Times in Past 3 Months				
	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
10. Shaking the morning after (hands, tongue, or eyelids)?					
11. Stomach upset nausea, and vomiting?					
12. Muscle aches, pains, or weaknesses?					
13. Heart racing, sweating, rapid breathing, high blood pressure?					
14. Depressed or irritable?					
15. Felt weak or faint when you sat up or stood up?					
16. Heard things that were not actually there and felt anxious and upset about it?					
17. Headaches?					
18. Insomnia?					
19. Felt anxious or nervous?					

The following are questions concerning your experiences using drugs other than alcohol.

20. How old were you when you first began using Marijuana? Skip to Question 26 if the individual does not use marijuana	Age: _____				
21. How old were you when you started using marijuana regularly/at least once per week?	Age: _____				
22. In your lifetime, how many times have you used marijuana?	Number of times: _____				
23. How many days per month did you use marijuana during the 3 months before this intervention? For follow up: In the last month, how many days did you use marijuana?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
24. When was the last time you used marijuana? (If under 3 months, record exact number of days) For follow-up: In the last month, how many days did you use marijuana?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
25. Over the last 3 months, in the average 24-hour period that you were using marijuana, how much marijuana did you use? (Example: Number of joints)	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks

26. How old were you when you first began using **Amphetamines** (Crystal Meth, uppers, speed, ecstasy, diet pills, etc)? **Skip to Question 32 if the individual has not used amphetamines.**	Age: _____				
27. How old were you when you started using amphetamines regularly/at least once per week?	Age: _____				
28. How many times in your lifetime have you used amphetamines?	Number of times: _____				
29. How many days per month did you use amphetamines during the 3 months before this intervention?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
30. When was the last time you used amphetamines? (If under 3 months, record exact number of days)	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
31. Over the last 3 months, in the average 24-hour period you were using amphetamines, how much amphetamines did you use? *For F/U: During the last month?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
32. How old were you when you first began using **Barbiturates** (Downers, Quaaludes, sleeping pills) **Skip to Question 38 if the individual has not used barbiturates.**	Age: _____				
33. How old were you when you started using barbiturates regularly/at least once per week?	Age: _____				
34. How many times in your lifetime have you used barbiturates?	Number of times: _____				
35. How many days per month did you use barbiturates during the 3 months before this intervention?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
36. When was the last time you used barbiturates? (If under 3 months, record exact number of days)	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks

37. Over the last 3 months, in the average 24-hour period you were using barbiturates, how much barbiturates did you use? *For F/U: During the last month?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
38. How old were you when you first began using **Hallucinogens?** (PCP, LSD, Mushrooms, peyote, mescaline) **Skip to Question 44 if the individual has not used hallucinogens.**	Age: _____				
39. How old were you when you started using hallucinogens regularly/at least once per week?	Age: _____				
40. How many times in your lifetime have you used hallucinogens?	Number of times: _____				
41. How many days per month did you use hallucinogens during the 3 months before this intervention?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
42. When was the last time you used hallucinogens? (If under 3 months, record exact number of days)	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
43. Over the last 3 months, in the average 24-hour period you were using hallucinogens, how much hallucinogens did you use? *For F/U: During the last month?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
44. How old were you when you first began using **Cocaine** (or crack)? **Skip to Question 50 if the individual has not used Cocaine (or crack).**	Age: _____				
45. How old were you when you started using cocaine (or crack) regularly/at least once per week?	Age: _____				
46. How many times in your lifetime have you used cocaine (or crack)?	Number of times: _____				
47. How many days per month did you use cocaine (or crack) during the 3 months before this intervention?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks

	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
48. When was the last time you used cocaine (or crack)? (If under 3 months, record exact number of days)					
49. Over the last 3 months, in the average 24-hour period you were using cocaine (or crack), how much cocaine (or crack) did you use? *For F/U: During the last month?					
50. How old were you when you first began using **Inhalants?** (Solvents, glue, gasoline, amyl nitrates, nitrous oxide, white out, etc) **Skip to Question 56 if the individual has not used Inhalants.**	Age: _____				
51. How old were you when you started using inhalants regularly/at least once per week?	Age: _____				
52. How many times in your lifetime have you used inhalants?	Number of times: _____				
53. How many days per month did you use inhalants during the 3 months before this intervention?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
54. When was the last time you used inhalants? (If under 3 months, record exact number of days)	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
55. Over the last 3 months, in the average 24-hour period you were using inhalants, how much inhalants did you use? *For F/U: During the last month?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
56. How old were you when you first began using **Opiates?** **Skip to Question 62 if the individual has not used Opiates.**	Age: _____				
57. How old were you when you started using opiates regularly/at least once per week?	Age: _____				
58. How many times in your lifetime have you used opiates?	Number of times: _____				

	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
59. How many days per month did you use opiates during the 3 months before this intervention?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
60. When was the last time you used opiates? (If under 3 months, record exact number of days)	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
61. Over the last 3 months, in the average 24-hour period you were using opiates, how much opaites did you use? *For F/U: During the last month?	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
62. What other drugs have you used that I did not already mention? (Tranquillizers, Valium, Librium, Atavan, cough syrup, etc).	Circle One: No Yes Name of Drug (if any): _____				
63. What is your drug of choice?	Drug of Choice:_____				
64. In your lifetime, how many times have you been drunk (drank more than you should)?	Number of times: _____				
65. In your lifetime, how many times have you been stoned/high from drugs?	Number of times: _____				
66. In your lifetime, how many times have you used drugs intravenously (with a needle)?	Number of times: _____				
67. How important is it for you to not drink alcohol? (Pick a number from 1-10) 1= Not Important 5 = Somewhat Important 10 = Very Important	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
68. How likely is it that you will drink alcohol in the future? (Pick a number from 1-10) 1 = Not Important 5 = Somewhat Important 10 = Very Important	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks

In the last 3 months, how many times did you experience the following symptoms when you cut down or stopped using drugs? (record number of days in past 3 months)

	Number of Times in Past 3 Months				
	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
69. Stomach upset, nausea, or vomiting?					
70. Diarrhea (frequent and watery bowels)?					
71. Muscle aches, pains, or weaknesses?					
72. Hair standing up?					
73. Eyes dilated					
74. Runny nose?					
75. Teary eyes?					
76. Fever?					
77. Quick or rapid breathing, heart racing or pounding?					
78. Decreased blood pressure; feeling weak or faint when you stood up?					
79. Fatigue, excessive yawning?					
80. Feeling anxious or nervous?					
81. Excessive/heavy sweating?					
82. Feeling angry, hostile, or acting aggressive?					
83. Thoughts that someone was after you or out to get you (felt paranoid)?					
84. Thought you were a very important person (delusion)?					
85. Shaking hands, tongue, or eyelids?					
86. Confusion (difficulty understanding what people are saying or getting directions mixed up)?					
87. Confused about who you are, where you are, or what time/date/year it is? (disoriented)					
88. Forgetfulness, difficulty remembering things?					
89. Difficulty sleeping, such as taking more than 30 minutes to fall asleep, waking up during the night (other than to go to the bathroom) and taking more than 30 minutes to fall back asleep, waking up earlier than usual and not being able to fall back asleep?					
90. Increased dreaming?					
91. Loss of appetite?					
92. Feeling depressed?					
93. Feeling irritable?					
94. Convulsions/seizures?					

	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
95. Hearing or seeing things that do not exist (hallucinations)?					
96. What other problems have you had that I did not already mention when you cut down or stopped using drugs? (List symptoms with days)					
97. When you drink, how often do you get drunk? **(Number the box appropriately)** 0 – Don't drink 1 – Stop before getting drunk 2 – Almost always stop before getting drunk 3 – Stop before getting drunk more than half the time 4 – Get drunk more than half the time 5 – Usually get drunk					
98. When you use drugs, how often do you get high or stoned? **(Number the box appropriately)** 0 – Don't use drugs 1 – Stop before getting high/stoned 2 – Almost always stop before getting high/stoned 3 – Stop before getting high/stoned more than half the time 4 – Get high/stoned more than half the time 5 – Usually get high/stoned					
99. Where do you usually drink/use? **(Number the box appropriately with all that apply)** 0 – Nowhere (do not drink or use) 1 – Car/vehicle/motorcycle 2 – Home 3 – Friend's house 4 – Party or social event 5 – Park or bench 6 – Shopping mall, Rec Center 7 – School 8 – Work 9 – Anywhere and everywhere 10 – Restaurant/Bar 11 – Other (Specify Place)					

	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
100. Who do you drink/use with? **(Number the box appropriately with all that apply)** 0 – Not applicable, don't drink or use 1 – Alone 2 – Casual acquaintances 3 – Friends 4 – Partner/boyfriend/girlfriend 5 – Family members					
101. How important is it for you to not use drugs? (Pick a number from 1 to 10) 1 = Not Important 5 = Somewhat Important 10 = Very Important					
102. How likely is it that you will use drugs in the future? (Pick a number from 1 to 10) 1 = Not Important 5 = Somewhat Important 10 = Very Important					
103. What is your height?					
104. What is your weight?					

For Interviewer Only

	Intake	4 Weeks	8 Weeks	12 Weeks	16 Weeks
105. **Interviewer:** Rate current drinking pattern **(Number the box appropriately)** 0 – Nondrinker 1 – Infrequent, occasional, or light drinker 2 – Moderate social drinker 3 – Frequent or heavy social drinker 4 – Problem drinker, alcoholic 5 – Former alcoholic, currently abstaining					
106. **Interviewer:** Rate current drug use pattern **(Number the box appropriately)** 0 – Nonuser 1 – Infrequent, occasional, or light user 2 – Moderate social user 3 – Frequent or heavy social user 4 – Problem user, addict 5 – Former addict, currently abstaining					