

Chapter 2

Impulsive behavior in drug addiction: Clinical, cognitive, and neural correlates

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Introduction

Our ability to exercise self-control and to adjust our behavior when evaluating potential negative consequences of our actions is essential for our overall quality of life, development of healthy habits and achievement of our goals. People who are high in impulsivity exhibit poor self-control and emotional instability, which manifest in behaviors that might be risky and inappropriate, and often lead to negative and undesirable consequences (Gay, Schmidt, & Van der Linden, 2011). Thus, these individuals often feel powerless, weak, and ashamed due to their lack of control over their impulsive behaviors (Grant & Kim, 2003). Furthermore, such individuals often experience heightened anxiety, depressive moods, low self-esteem and increased stress associated with their impulsive behaviors (Grant & Kim, 2003). Impulsivity has been shown to play a significant role in the onset, development, and maintenance of drug addiction (Argyriou, Um, Carron, & Cyders, 2018), the development and maintenance of binge eating problems and binge eating disorder, and a greater degree of gambling severity (Kim et al., 2018). It has been associated with hypersexuality (Bóthe et al., 2018), higher frequency of suicide attempts (Colborn et al., 2017), and higher aggression (Hecht & Latzman, 2015).

Impulsivity is a complex aspect of human behavior. Despite numerous studies investigating the clinical and cognitive aspects of impulsivity, it has yet to be properly classified (Parry & Lindsay, 2003). Definitions describing this phenomenon incorporate “*behaviours that are poorly conceived, premature, inappropriate and that frequently result in unwanted and deleterious outcomes*” (Chamberlain & Sahakian, 2007). Impulsivity has been defined as a “*predisposition towards rapid, unplanned reactions to internal and external stimuli*

without regard to the negative consequences of these reactions to the impulsive individual or to others” (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Impulsivity is also defined as *“acting on the spur of the moment, not focusing on the task at hand, and a lack of planning”* (Stratton, 2006).

Individuals who are high in impulsivity exhibit poor self-control and emotional instability, which manifests in behaviors that might be risky and inappropriate, and that often lead to negative and undesirable consequences (Gay et al., 2011). Thus, these individuals often feel powerless, weak, and ashamed due to their lack of control over their impulsive behaviors (Grant & Kim, 2003). Additionally, these individuals often experience heightened anxiety, depressive moods, low self-esteem and increased stress associated with their impulsive behaviors (Grant & Kim, 2003). Individuals with high impulsivity levels place themselves and people around them at risk. For individuals who experience difficulties in effectively managing their impulsive behaviors, it may turn into a lifelong debilitating condition in both clinical and nonclinical populations. Individuals with impulse control disorders are often unable to work and are at risk of social isolation, increased self-injurious behavior, and suicide. Thus, not only do individuals with impulse control disorders suffer the consequences of this condition, but their families and wider communities do as well. Individuals who experience difficulties controlling their impulsive actions do not often seek treatment due to the negative stigma associated with it. Particular difficulties might be present when self-control is moralized in terms of morally good or bad behavior, which in turn could be another potential barrier for people who might be willing to address their impulse control issues (Mooijman et al., 2017).

The biopsychosocial definition of impulsivity incorporates a non-adaptive fast response as well as a lack of planning (Moeller et al., 2001). Impulsivity has been broadly defined as a *“perseverance to the response that is punished and unrewarded; as well as, preference for small immediate rewards rather than larger delayed rewards and making responses that are immature or as inability to withhold a response”* (Moeller et al., 2001). Furthermore, Moeller and his colleagues (2001) suggested that the following factors should be considered when defining impulsivity in individuals: their decreased sensitivity to negative consequences of their behaviors, rapid, unplanned reactions to stimuli before processing information, and lack of regard for long-term consequences (Moeller et al., 2001).

It has been proposed that the following five dispositions underlie impulsivity: positive urgency, negative urgency, sensation seeking, lack of planning, and lack of perseverance. Positive urgency and negative urgency are based on emotions (Dick et al., 2010). Positive urgency is a tendency to act rapidly when experiencing positive mood and negative urgency is the tendency to act quickly when experiencing negative mood (Dick et al., 2010). Individuals high in urgency might experience difficulty resisting temptations and cravings (Johnson & Kim, 2011). For example, it has been reported that in borderline personality disorder, dysfunctional beliefs are associated with negative urgency, even after controlling

for age, gender, depression, anxiety, and borderline personality disorder symptomatology (Gagnon, Daelman, McDuff, & Kocka, 2013). Negative urgency has been associated with reactive aggression (Gagnon & Rochat, 2017) and binge eating disorder (Fischer, Peterson, & McCarthy, 2013). It has been further shown that adolescents who might be at risk of larger alcohol consumption might act rashly when experiencing positive and negative urgency (Stautz & Cooper, 2013). Negative urgency in particular has been shown to be a predictor of life-long alcohol use and risky substance use behavior (Athenour, 2016) and positive urgency was associated with higher levels of nicotine dependency (Spillane, Smith, & Kahler, 2010). Furthermore, urgency as well as lack of premeditation has been associated with problematic drug use in young people (Thomsen et al., 2018) and adults (Gipson, 2012). Higher urgency trait was observed in young people with conduct disorder (Urban, Suter, Pihet, Straccia, & Stephan, 2015).

The other two dispositions underlying impulsivity are based on deficits in conscientiousness (Johnson & Kim, 2011). They are considered to be lack of planning and lack of perseverance (Johnson & Kim, 2011). Lack of planning (or lack of premeditation) is considered to be the tendency to act without thinking about actions and their consequences (Johnson & Kim, 2011). Individuals experiencing deficits in the area of planning often act without thinking about the effects of their behavior on themselves and others (Johnson & Kim, 2011). It is considered that psychological factors associated with heightened impulsivity are a decreased level of control and a lesser degree of planning in impulsive acts (Parry & Lindsay, 2003).

According to Dick et al. (2010), individuals who have difficulties tolerating boredom and have difficulties staying focused when encountering distractions appear to experience a lack of perseverance. Dick et al. (2010) suggested that a lack of perseverance might be related to “resistance to proactive interference” (Dick et al., 2010). It has been demonstrated that individuals displaying drug use disorders appeared to be low in the conscientiousness trait (Zilberman, Yadid, Efrati, Neumark, & Rassovsky, 2018). Along these lines, one study investigating differences in personality traits among opiate-addicted females and those who had developed alcohol dependency showed that opiate-addicted females scored low on a conscientiousness scale (Raketic et al., 2017). Another study has demonstrated that individuals who develop a behavioral addiction, such as internet addiction, tend to show low levels of extraversion, openness to new experiences and conscientiousness (Hwang et al., 2014). It has been shown that negative urgency and a lack of perseverance appear to be associated with non-suicidal self-injury (Riley, Combs, Jordan, & Smith, 2015). Both predispositions, urgency and lack of perseverance have been considered predictive factors for the development of addiction in young people (Thomsen et al., 2018) and indicative of a more severe substance use problem (Tomko, Prisciandaro, Falls, & Magid, 2016). In other words, individuals who experience difficulties in lack of planning and lack of perseverance might not be able to attend to tasks that are perceived as boring or difficult (Johnson & Kim, 2011).

Thus, it is considered that sensation seeking, the tendency to seek out novel or thrilling stimulation, underlies a lack of perseverance (Dick et al., 2010). Often, such stimulating activities might include fast driving or engaging in fights, activities that put the involved individuals and people close to them at risk. It is interesting to note that sensation seeking does not appear to reflect deficits in executive functioning (Romer, 2010). Sensation seeking is a predicting factor of a vulnerability to drug addiction (Wingo, Nesil, Choi, & Li, 2016) and has been associated with online gaming addiction (Hu, Zhen, Yu, Zhang, & Zhang, 2017). Sensation seeking, however, might provide a barrier against high levels of anxiety and dysfunctional avoidance, such as thought suppression (Gay et al., 2011). As reviewed above, impulsivity is a multidimensional construct with a number of underlying cognitive, behavioral and biological dispositions that can have a significant impact on the individual's functioning and wellbeing. The traits underlying impulsivity are being studied and suggestions for further revisions of definitions, including conceptualization within the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) suggest that some of the facets of impulsivity lack specificity (Griffin, Lynam, & Samuel, 2017).

Behavioral definition of impulsivity

Within the behavioral analysis domain, psychologists have mostly used two themes when providing operational definitions of impulsiveness in laboratory-based research. First, it is believed that impulsive individuals show deficient tolerance of the delay of gratification; second, that they have difficulty in delaying or inhibiting voluntary responding. Impulsiveness is considered to be a preference for smaller sooner rewards over larger later rewards (Tobin & Logue, 1994), which is known as delay discounting. It has been suggested that impulsiveness might arise as a difficulty of delay of gratification (Ainslie, 1975). At times, survival can be dependent on the choice of smaller rewards sooner rather than larger ones later. For example, a starving animal might have to take a small amount of food immediately to ensure its survival, rather than wait for larger prey later (Tobin & Logue, 1994). Similarly, people might learn as well to use smaller rewards sooner rather than larger later; for example, it is possible that in countries torn by war, people experiencing economic and political instability might choose immediate small rewards to ensure their existence, rather than larger ones later, as there is a real possibility that they might be worse off from waiting for larger rewards. In human studies, several factors, such as age or the quality of the reward, might impact the individual's ability to delay gratification (Tobin & Logue, 1994).

Three main factors that neuropsychologists consider in the definition of impulsivity are as follows: "inability to suppress powerful, overwhelming, and urgent response; inability to delay gratification by choosing smaller rewards now over larger later rewards; and inability to sustain attention" (Sharma, Markon, & Clark, 2014). The preference of individuals for obtaining immediate smaller

rewards and discounting larger delayed rewards has been linked to three factors: their failure to recognize the contingency of the reward; their failure to respond to the possibility of the reward (shown by frequent engagement in compulsions or classical conditioning); and difficulties in conceptualizing the delayed rewards (Ainslie, 1975). The inability to delay gratification is referred to as temporal impulsivity and is measured using the delay discounting questionnaires or computerized tasks (Caswell, Morgan, & Duka, 2013). These tasks involve asking participants to make a choice between immediate or sooner smaller rewards or delayed larger rewards. Individuals high in temporal impulsivity tend to choose smaller rewards instantly rather than larger delayed rewards (Caswell et al., 2013).

The degree of delay discounting is considered a main factor in determining the impulsivity or self-control of an individual (Logue, 1998). A tendency to prefer small immediate rewards is considered a key feature in addictive disorders, as individuals who experience difficulties in this domain prefer to use substances in the present (Dick et al., 2010). A recent study has shown that individuals with heroin addiction demonstrated greater delayed discounting as well as decreased sensitivity in making optimal decisions, which is indicative of deficits in decision making (Scherbaum, Haber, Morley, Underhill, & Moustafa, 2018).

An individual's ability to choose delayed over immediate rewards is of great importance, not only in the recovery framework but in helping the individual achieve an optimal lifestyle in the future (Wittmann & Paulus, 2008). The need for immediate gratification is considered to be one of the facets of entitlement; thus, individuals with a high need for immediate gratification often experience emotional distress if they believe that they are entitled to better treatment than they are receiving (Harrington, 2007; Wittmann & Paulus, 2008). However, this is not limited to addictions only; individuals who display disruptive behaviors or are aggressive, and those attempting suicide tend to choose smaller immediate rewards (Dick et al., 2010).

Gratification could be a learnt behavior; thus, children can learn to act immediately to obtain immediate gratification (Moeller et al., 2001). It is possible that delay discounting evolved as an adaptive trait, as the greater the delay of the event the less likely it is to occur (Logue, 1998). This could be the case in those environments where waiting for a larger reward might be more likely to result in disadvantage; for example, in situations where it might threaten existence and minimize the survival rate (Logue, 1998).

Delay discounting is considered to be a cognitive process that allows the comparison of values of immediate and delayed use (Matta, Gonçalves, & Bizarro, 2012). Individuals with heightened impulsivity not only tend to choose smaller sooner rewards rather than delayed larger ones, but also show preference for larger delayed penalties over smaller immediate ones (Farmer & Golden, 2009). For example, a student might choose to deal with the consequences of poor performance during an examination instead of choosing the discomfort of spending a weekend studying.

Delay discounting is not only at the core of many maladaptive behaviors, such as addictive behaviors and gambling as well as poor academic performance and self-care, but it can be predictive of the likelihood of people who smoke and use drugs to relapse when they attempt to cease such behaviors (Odum, 2011). Delay discounting is observed in major forms of addiction, and it has been suggested that the extent of delay discounting is proportional to amount of drug used (Bickel, Moody, Eddy, & Franck, 2017). Delay discounting as a behavioral marker of addiction has been shown to be a predictor of nicotine smoking cessation (Athamneh, Stein, & Bickel, 2017).

Delay discounting plays an important role in the research of impulsiveness, self-control and decision making (Matta et al., 2012). Research on the role of delay of gratification in behavior contributes to the wealth of knowledge in the areas of addictions, obesity and gambling (Odum, 2011).

While delay discounting tasks help measure an individual's preference for immediate small or larger delayed rewards, one of the potential limitations of delay discounting tasks is the measure of hypothetical rewards. It is important to conduct research using real value rewards (Odum, 2011).

Functional and dysfunctional impulsivity

The consequences of impulsive behavior are not always negative (Dickman, 1990). It has been suggested that high impulsiveness when completing simple tasks under time constraints can lead to more accurate results than low impulsiveness (Dickman, 1990). Thus, impulsivity is not always associated with a negative psychological outcome (Johnson & Kim, 2011). While most of the research has been dedicated to studying the negative consequences of impulsivity, also known as negative impulsivity, it is important to note that the tendency to act quickly to achieve a positive outcome has been referred to as functional impulsivity (Winkel, Wyland, Shaffer, & Clason, 2011). Negative impulsivity occurs despite negative consequences; however, positive impulsivity occurs due to the benefits resulting from this type of information processing style (Johnson & Kim, 2011). Thus, functional impulsivity has been associated with enthusiasm, adventurousness and extraversion (Winkel et al., 2011), idea generation and rapid decision making (Di Milia, 2013).

An example of functional impulsivity can be considered in an individual who spontaneously offers a helping hand to their colleague, offering to induct the new employee and show them around the office, or who volunteers to participate in a charitable event. In contrast, dysfunctional impulsivity leads to negative outcomes and is often associated with aggression, violence and conduct disorder (Winkel et al., 2011). It appears that an individual with dysfunctional impulsivity is more likely to disregard facts when making decisions, subsequently leading to increased displaying of behaviors that might boost morale in the office or benefit the whole organization (Winkel et al., 2011). People

who are high in functional impulsivity will act without thinking about the consequences of their behavior when such a cognitive style is optimal; they are thereby considered active, enthusiastic, spontaneous and productive risk takers (Johnson & Kim, 2011). It is considered that enthusiastic and active people are more productive, even though they engage in risk-taking activities like individuals displaying dysfunctional impulsivity (Dickman, 1990).

It appears that an individual with dysfunctional impulsivity is more likely to disregard facts when making decisions, subsequently leading to increased negative outcomes of their impulsive behavior (Dickman, 1990). People high in dysfunctional impulsivity are considered to be inattentive and careless, resulting in planning deficits and inability to delay gratification, which contributes to negative consequences (Johnson & Kim, 2011). Dysfunctional impulsivity is associated with fast but inaccurate decision making, high distractibility and suicidal thoughts (Di Milia, 2013). It is considered that individuals high in dysfunctional impulsivity engage in fast and erroneous decision making due to their inability to use a slower methodical approach (Dickman, 1990). It has been suggested that smokers who are high in dysfunctional impulsivity might require more intensive treatment to address their addiction (Pitts & Leventhal, 2012).

It has been suggested that stressful circumstances might interfere with the individual's ability to engage in a slow and measured approach when making decisions (Dickman, 1990). High dysfunctional impulsivity is associated with higher distractibility while driving and lane crossing (Di Milia, 2013), as well as driving while intoxicated (Eensoo, Paaver, Pulver, Harro, & Harro, 2004) and with high incidents of binge drinking in young males (Adan, 2012).

Dysfunctional impulsivity is also associated with the heightened tendency of individuals diagnosed with schizophrenia to display repetitive violent behavior (Kumari et al., 2009). Dysfunctional impulsivity is considered to be at the core of many psychopathies (Poythress & Hall, 2011). Individuals who scored higher on dysfunctional impulsivity demonstrated poorer responses to treatment for pathological gambling (Maccallum, Blaszczyński, Ladouceur, & Nower, 2007). Furthermore, dysfunctional impulsivity was associated with higher craving as well as smoking without conscious awareness, loss of control, smoking while ill and experiencing difficulties abstaining from non-smoking areas in individuals aiming to cease smoking (Pitts & Leventhal, 2012).

Dickman (1990) has developed an inventory that assesses functional and dysfunctional impulsivity (Dickman, 1990). Both functional and dysfunctional impulsivity correlated positively with extraversion on the Eysenck Personality Questionnaire; however, only functional impulsivity correlated positively with psychoticism and negatively with neuroticism (Brunas-Wagstaff, Bergquist, Richardson, & Connor, 1995). The Dysfunctional scale has been reported to correlate with the Motor Impulsivity subscale of the Barratt Impulsiveness Scale-11 (Caci, Nadalet, Bayle, Robert, & Boyer, 2003).

Impulsivity as a clinical problem

Diagnosis of a psychiatric condition in an individual can have an impact on the manifestation of impulsive behaviors (Parry & Lindsay, 2003). Impulsivity is a prominent feature of many psychiatric and developmental disorders: personality disorders (such as Borderline Personality Disorder [BPD]), eating disorders (such as bulimia), mood disorders (such as bipolar disorder [BD]) and substance addiction (such as drug addiction) (Parry & Lindsay, 2003). The Diagnostic and Statistical Manual of Mental Disorders (DSM-V) addresses a number of Disruptive, Impulse-control and Conduct disorders. It acknowledges problems in self-control of emotions and behavior as a main problem experienced by individuals diagnosed with these disorders (DSM-V). Some of these disorders categorized by DSM-V are Intermittent Explosive Disorder, characterized by “recurrent behavioural outbursts representing a failure to control aggressive impulses” and Kleptomania, characterized by the “recurrent failure to resist impulses to steal items even though they are not needed for personal use or for their monetary value”, (DSM-V). The DSM-IV listed six categories of impulse control disorders characterized by a variety of uncontrolled behaviors. The categories are the following: failure to resist aggressive impulses, failure to resist impulses to steal objects not needed for personal use, deliberate and purposeful fire setting for personal gratification or relief, persistent maladaptive gambling behavior, and recurrent pulling out of one’s hair, and these are the essential features of intermittent explosive disorder, kleptomania, pyromania, pathological gambling and trichotillomania, respectively. The sixth category of “impulse control disorder not otherwise specified” includes any other repeated failure to resist impulses to carry out a particular behavior; for example, compulsive buying, compulsive sexual behavior and repetitive self-mutilation.

It has been shown that there is a strong association between impulsiveness, anger and violence risk in psychiatric patients, impulsiveness and violence risk in the forensic population and suicide and impulsiveness in individuals diagnosed with Post Traumatic Stress Disorder (PTSD) (Parry & Lindsay, 2003).

Generally impulsivity has been associated with self-injurious and suicidal behaviors (Klonsky & May, 2010). It has been reported that impulsivity plays a significant role in individuals diagnosed with BPD, and it is considered an especially important factor in those who attempt self-harm and suicide (Moeller et al., 2001). Thus, it is considered that self-destructive impulsivity is the most challenging aspect of this psychiatric condition. Similarly, individuals diagnosed with Bipolar Disorder (BD) tend to engage in impulsive or risky behaviors that often lead to undesired outcomes (Kathleen et al., 2009). Thus, impulsivity is considered to be a core feature of BD, irrespective of the presence of co-morbid mood states or alcohol abuse history (Kathleen et al., 2009).

Individuals diagnosed with Obsessive Compulsive Disorder (OCD), similarly to individuals with impulsive control disorders, exercise poor control over their behavior, even though it might be considered that in OCD such behaviors

are due to heightened anxiety, whereas in impulsive control disorders individuals it is due to their arousal (Ettelt et al., 2007). At the same time, recent studies have found that individuals with OCD obtained high scores on cognitive impulsiveness, and furthermore the studies found strong associations of cognitive impulsiveness, aggressive obsessions and checking (Ettelt et al., 2007).

Impulsivity has been positively correlated with the intensity and amount of drug use and increased withdrawal (Bankston et al., 2009). With repeated drug or alcohol use, as with many other addictive behaviors, the impulsive system becomes sensitized to the substance and the cues that predict the use of the substance (Wiers & Stacy, 2006). Furthermore, impulsive individuals tend to underestimate the risks and consequences of their health behavior, such as drug use (Ouzir & Errami, 2016). A study evaluating rapid discounting of delayed hypothetical rewards by cocaine-dependent individuals, compared to non-drug using individuals, showed that cocaine-dependent individuals consistently discounted delayed rewards and preferred smaller but immediate rewards (Coffey, Gudleski, Saladin, & Brady, 2003). It is possible as well that this outcome could be due to a “reduction of dopamine receptors in the orbitofrontal lode and cingulate gyrus regions of the brain” in chronic cocaine users (Coffey et al., 2003). Similarly, damage to the prefrontal cortex could be observed as a result of long-term alcohol abuse (Walker, Pena-Oliver, & Stephens, 2011). Thus, impulsivity has been associated with the dependence of drug use and poor cessation rates rather than initial habit formation (Hogarth, 2011). It appears that impulsivity might place an individual at a higher risk of developing addictive behaviors, and at the same time prolonged and repeated engagement in alcohol or drug use might influence individuals by impacting their impulsivity.

It has been suggested that individuals who engage in binge drinking behaviors experience problems associated with difficulties in controlling their impulses (motor impulsivity) and impulsive decision making (cognitive impulsivity) (Field, Schoenmakers, & Wiers, 2008). Thus, such individuals consistently choose rewards that are readily available, despite negative consequences (Field et al., 2008). While the impulsivity trait has been shown to be predictive of alcohol use disorders, at the same time alcohol use can reduce self-control and lead to an increase in impulsive behaviors (Dick et al., 2010). It has been noted that severe impulsiveness was one of the clinical presentations of multiple sclerosis as well (Lopez-Meza, Corona-Vazquez, Ruano-Calderon, & Ramirez-Bermudez, 2005). Furthermore, individuals with frontal lobe injuries have found that it affects their ability to plan and sustain attention, which indicates that impulsivity is more prominent when such injuries are present (Moeller et al., 2001).

Impulsivity, alongside maladaptive coping strategies, hopelessness, cognitive rigidity, problem solving difficulties and hostility, is associated with deliberate self-harm and suicide attempts (Raj, Kumaraiah, & Bhide, 2001). Other factors considered to be in highly impulsive individuals which may lead

to further self-harm are poor self-worth, emotional intolerance, entitlement beliefs, and anger (Harrington, 2007). Negative life events and stress might increase vulnerability attempts (Mehlum, 2001). Impulsivity is related to the severity of gambling behaviors and is indicative of a future development of pathological gambling (Forbush et al., 2008). It has been suggested that impairment in executive control, especially stopping, has been associated with impulse control disorders, such as ADHD, substance abuse and pathological gambling (Verbruggen, Adams, & Chambers, 2012). People recovering from drug addictions might benefit from addressing deficits in impulsivity and executive functioning which interfere with their daily functioning and place them at risk of premature treatment cessation and relapse (Ellis et al., 2016). Therefore, the treatment focus should be on response inhibition, thus addressing relapse prevention (Verbruggen et al., 2012).

It is worth noting that impulsivity becomes a prominent feature of some other physical conditions and one of the consequences of endured traumas. Impulsivity often becomes a prominent feature in individuals who have been deprived of sleep. Those who had orbitofrontal cortex lesions have also been shown to be more impulsive on behavioral tests including delay discounting (Wittmann & Paulus, 2008).

Difficulties with controlling impulses might be noted in people who have a diagnosis of intellectual disability or cognitive impairment (Parry & Lindsay, 2003). They often experience difficulty in impulse control alongside anger management, poor socialization and poor coping strategies (Parry & Lindsay, 2003). Furthermore, impulsivity alongside repetitive behaviors has been associated with increased self-injurious behavior in individuals diagnosed with an intellectual disability (Bigham, Daley, Hastings, & Jones, 2013).

Impulsivity in the nonclinical population

Impulsivity has been associated with lower academic grades, higher aggression, interpersonal violence, impulsive shopping, and stealing in clinical and nonclinical populations (Spinella, 2004). Some other behaviors associated with high impulsivity include maladaptive mobile phone use and internet pornography viewing (Sharma, Kohl, Morgan, & Clark, 2013). Overall, for individuals to maintain a healthy lifestyle, they need to engage in self-control to maintain exercise programs and restrain themselves in their food choices (Sutin, Ferrucci, Zonderman, & Terracciano, 2011). Impulsiveness, especially Sensation Seeking, has been consistently associated with weight gain (Sutin et al., 2011). A study investigating decision making in obese individuals indicated that poor and impulsive decision making has been shown to be prevalent in choosing high immediate gain but larger future losses (Davis, Levitan, Muglia, Bewell, & Kennedy, 2004).

Individuals displaying high levels of impulsivity might not plan their meals or allow time for exercise, and fail to resist urges for unhealthy food choices (Lyke & Spinella, 2004). Findings have shown that motor and intentional

impulsivity might be contributing to young people's impulsive choices related to their food intake (Lyke & Spinella, 2004). Another study investigating delay discounting in obese individuals demonstrated that obese women, when compared to non-obese women, demonstrated greater discount for delayed rewards, thus preferring smaller immediate rewards rather than delayed larger rewards (Weller, Cook, Avsar, & Cox, 2008). Additionally, it has been shown that there is a strong association between high intentional impulsivity and anxiety (Lyke & Spinella, 2004). According to the theory of emotional eating, some individuals who have learnt that eating reduces their anxiety and fear might feel motivated to continue eating as a response to these feelings (Stroebe, van Koningsbruggen, Papies, & Aarts, 2013). It is interesting to note that individuals with high impulsivity demonstrate higher weight gain across their lifespan (Sutin et al., 2011).

Impulsivity, like some other personality traits, is considered to be a trait or characteristic that remains stable regardless of the individual's situation or circumstances (Wells, Parboteeah, & Valacich, 2011). Thus, if an individual tends to engage in impulsive behavior, such as buying online, this behavior can be similarly observed in an offline environment (Wells et al., 2011). Overall, individuals who have difficulties with exercising any one particular self-control area (such as shopping) often have difficulties in other areas as well (such as gambling) (Sharma et al., 2014). In other words, some people act impulsively rarely and usually only in extreme circumstances (impulsiveness state); whereas other people act impulsively persistently—they present with an impulsivity trait (Parry & Lindsay, 2003).

While the initial urge to buy something is very strong for individuals with an impulsivity trait, not all individuals act when they experience an urge to engage in impulsive behavior (Wells et al., 2011). It is interesting to note that the impulsiveness trait in consumerism has been considered from a cultural perspective, studying individuals from both collectivistic (interdependent self-concept) cultures and individualistic (independent self-concept) cultures (Sharma, Sivakumaran, & Marshall, 2011). Individuals with interdependent self-concept were able to differentiate between self-indulgence and involuntary loss of self-control when making decisions regarding purchases, which has not been the same for individuals with independent self-concept (Sharma et al., 2011). The knowledge of the role of impulsivity in consumerism can be used by advertisement and marketing agencies. This can be of benefit to the economy (Arens & Rust, 2012); however, at the same time it might be detrimental to individuals who experience difficulties in controlling their impulses and end up facing the negative consequences of credit card debts, loss of jobs and relationships.

It has been shown that impulsivity facets such as urgency and lack of perseverance, as well as dysfunctional thought control strategies, were linked to insomnia (Schmidt, Gay, Ghisletta, & Van Der Linden, 2010). Thus, lack of perseverance might exacerbate the occurrence of unwanted thoughts and worries and urgency might be linked to the inability to suppress dominant, automatic responses (Schmidt et al., 2010).

Impulsivity varies across ages and gender. A study investigating deviant behaviors among adolescents has shown such behaviors displayed by boys were greater than those displayed by girls (Esteban & Taberero, 2011). Related to age, younger adolescents have been shown to be more impulsive, which resulted in higher instances of disruptive behavior (Esteban & Taberero, 2011). Overall, sensation seeking was detected to be greater in boys aged 14–22 than girls (Romer, 2010). Males in this age group are more likely to take risks, initiate drug use and engage in criminal activity (Romer, 2010). Impulsivity in boys has been considered to place them at a higher risk for substance abuse and behavioral impulsivity (Bankston et al., 2009). It has been found that male substance abusers demonstrate high motor impulsivity and non-planning impulsivity in individuals with substance use issues (Farnell, 2013).

At the same time, it has been suggested that younger individuals are more prone to risk-taking activities and displaying impulsive behaviors, such as “drug use, unintentional injuries and unprotected sexual activities, which might be accounted by still maturing prefrontal cortex” (Romer, 2010). At the same time, youth impulsivity is not considered a universal phenomenon and is considered to be mediated among other factors by the effects of state and peer influence (Romer, 2010). While younger people are considered to be more impulsive than adults, the decision processes that are influenced by sensation seeking are the same as in adults (Romer, 2010).

In particular, negative affect and motivation in school students were predictive of high impulsiveness, whereas positive affect, internal locus of control as well as self-esteem and intrinsic motivation were predicative of non-impulsiveness (Palomo, Beninger, Kostrzewa, & Archer, 2008). It is consistent with the notion of mood-congruency hypothesis: when people are in a negative mood they are more likely to interpret events around them negatively; similarly, when they are in a positive mood they are more likely to interpret events more positively (Rusting, 1998).

It has been shown that acute stress has been contributing to the overestimation of time and might be a contributing factor to exacerbation of impulsive behaviors (Wittmann & Paulus, 2008). Furthermore, stress interacts with impulsiveness, placing individuals at a higher risk for engagement in addictive behaviors (Sheffer et al., 2012). Thus, individuals with high impulsivity who experience heightened stress are more likely to relapse after treatment and initiate smoking again (Sheffer et al., 2012). This might be due to them feeling that they have little control over the main events in their lives, attributing this to luck, destiny and the greater power of other people, thus experiencing heightened stress (Sheffer et al., 2012). Dickman (1990) suggested that stress or stressful circumstances interfere with an individual’s ability to process information slowly and accurately in individuals who display dysfunctional impulsivity (Dickman, 1990).

Thus, there is overwhelming evidence of the impact of dysfunctional impulsivity on people in nonclinical populations. Difficulties in controlling behavior,

ranging from overspending, overeating, controlling anger, poor school performance and others, not only impact the daily functioning of people high in dysfunctional impulsivity, but the severity of these behaviors is exacerbated by stress and in some cases anxiety and negative mood. Therefore, intervention programs will benefit from incorporating psychoeducational materials about dysfunctional impulsivity, stress, negative mood, and anxiety as well as helping participants learn practical strategies to address their mood, anxiety and stress.

Impulsivity and cognitive distortions

It has been suggested that cognitive distortions are associated with impulsive behavior and impulsivity-related psychopathologies (Gagnon et al., 2013). Beck's investigations with his patients led him to believe that when patients experienced depression, certain cognitive schemas may lead to cognitive distortions in those patients; thus, the depressed patient might feel sad and lonely, and mistakenly think that he is abandoned and excluded by others (Weissman & Beck, 1978). Cognitive distortions are not unique in depressive patients; further cognitive distortions can be found in many other psychiatric conditions. Several cognitive distortions have been identified as contributing to people's impulsive behaviors, such as the illusion of control, and have been found to be at the core of pathological gambling. It has been suggested that people who are aiming to address their gambling addiction might benefit from addressing "chasing losses" cognitive distortions (Chamberlain, Stochl, Redden, Odlaug, & Grant, 2017). Cognitive distortions related to substance use disorder have been shown to be related to lack of skill in coping with problems or unpleasant feelings, low tolerance for frustration, sensation-seeking, difficulties tolerating boredom, diminished future time perspective, catastrophizing, blame, punishment, personalization, and all-or-nothing thinking (Ramirez, 2001). People who have developed substance use disorders might experience a cognitive distortion associated with overestimation of a substance they misuse or have been addicted to; for example, smokers tend to overestimate tobacco and experience low response to non-tobacco rewards (Isomura, Suzuki, & Murai, 2014). People with borderline personality disorders are more likely to negatively evaluate the events in their lives due to cognitive distortions. Furthermore, people with comorbid conditions tend to have more cognitive distortions than those with one diagnosis (Gagnon et al., 2013).

Mobini, Pearce, Grant, Mills, and Yeomans (2006) found that highly impulsive individuals present dysfunctional beliefs that impact their ability to interpret events, as well as their inability to make decisions taking into account the long-term consequences of their behavior (Mobini et al., 2006). A recent study demonstrated that negative evaluations of self, world and the future; tendency to overgeneralize, personalize and catastrophize; and selective negative interpretation of stressful events have been shown to be present in youth victims of dating violence who have developed substance use problems (Miller, Williams, Day, & Esposito-Smythers, 2017).

In relation to impulsivity, some cognitive distortions might impact the delay of gratification, such as short-term thinking or confusing needs and wants, while others might impact impulsive decision making (Mobini et al., 2006).

It has been suggested previously that certain cognitive attributes may operate as cognitive processing associated with some subtypes of impulsivity, such as dysfunctional impulsivity, non-planning and cognitive impulsiveness (Mobini, Grant, Kass, & Yeomans, 2007). It has been shown that delay discount rates were positively correlated with both functional and dysfunctional impulsivity (Mobini et al., 2007). Additionally, delay discounting was positively correlated with three cognitive distortions as measured by the Cognitive Distortion Scale, such as “mind reading”, “instant satisfaction” and “short-term thinking” (Mobini et al., 2007). It has been previously suggested that cognitive behavioral interventions might be effective in addressing cognitive distortions specific to impulsivity, thus assisting impulsive people in the effective management of their emotions and behaviors (Mobini et al., 2006).

It has been suggested that individuals tend to be more impulsive if they have an external locus of control; for example, if they tend to believe that luck, fate and the actions of others are responsible for their behaviors (Sheffer et al., 2012). A recent study investigating impulsivity and cognitive distortions among pathological gamblers showed that they demonstrated a higher preference for immediate rewards and the presence of cognitive distortions related to gambling (Michalczuk, Bowden-Jones, Verdejo-Garcia, & Clark, 2011). Similar findings were obtained in another study, confirming a robust relationship between pathological gambling and cognitive distortions. Another recent systematic review study has highlighted that increased impulsivity and dysfunctional decision making appear to be strongly associated with general drug use (Betzler, Viohl, Romanczuk-Seiferth, & Foxe, 2017).

As mentioned previously, Mobini et al. (2006) suggests that cognitive behavioral interventions might be of benefit to highly impulsive individuals (Mobini et al., 2006). It has been demonstrated that cognitive behavioral therapy is effective in treating pathological gambling, especially when incorporating cognitive restructuring and so addressing cognitive distortions (Fortune & Goodie, 2012). Thus, in developing an intervention program for dysfunctional impulsive behavior, we need to focus on understanding the cognitive distortions involved in impulsive behavior and the ways in which we can modify these cognitive distortions (Mobini et al., 2007).

High impulsivity relates to a lack of consideration for negative future consequences, and as a result has been shown to have negative effects on many different aspects of life. Dysfunctional impulsivity can be present in any population and leads to a variety of unhealthy life choices, but those who have high impulsivity (including individuals with drug use disorders) are often reluctant to seek treatment for this issue due to social stigma. In particular, impulsivity has been consistently shown to be a factor in the development of a number of psychiatric conditions, particularly addictive and compulsive behaviors.

Those with drug use disorders are often deficient in the ability to employ delay discounting and delay of gratification, both of which are directly related to high impulsivity. In some cases, immediate gratification may be a learned behavior if a person has lived in conditions of scarcity. The extended use of substances can have negative effects on the areas of the brain related to reward centers and executive function, which further decreases self-control and increases impulsivity. Due to this, high impulsivity is also correlated with longer periods of substance abuse and high risk of relapse.

Cognitive distortions contribute to high levels of impulsivity; those with substance use disorders commonly lack strategies to cope with negative emotions and are prone to short-term thinking. These cognitive distortions often correlate with the deficits in delay discounting and delay of gratification seen in people with drug use disorders. However, it has been shown that addressing these cognitive distortions can have positive effects on those suffering from a pathological addiction or compulsion. From this basis, treatments can be developed for those with drug use disorders that modify the cognitive distortions related to high impulsivity. Such treatments are likely to address many of the underlying causes of impulsivity and prevent relapse in those with substance abuse disorders.

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