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The Effect of Cognitive Behavioral Therapy on Impulsivity in Addictive Disorders: a Narrative Review

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Abstract

Purpose of Review—Impulsivity is considered an important construct in the cycle of addiction, yet the effect of evidence-based treatments on impulsivity is unclear. The goal of this paper was to review the evidence regarding the effect of cognitive behavioral therapy (CBT), one of the most studied psychotherapies for addiction, on measures of impulsivity in addictive disorders.

Recent Findings—There is a robust literature implicating impulsivity as risk factor for development of a range of addictions and poorer treatment outcomes. However, this review identified only four randomized controlled trials evaluating CBT for an addictive behavior that included repeated assessment of impulsivity. All four were studies targeting substance use.

Summary—There is limited evidence that CBT has a direct effect on change in measures of impulsivity among individuals being treated for substance use. Future clinical trials should include repeated measurement of impulsivity to examine CBT's effect on the underlying characteristics of addiction.

Keywords

Impulsivity; Addiction; Cognitive behavioral therapy; Substance use; Gambling; Internet addiction

Introduction

Addiction is conceptualized as a cycle of excessive reward anticipation (preoccupation/anticipation stage), consummatory activities (binge/intoxication stage), and negative emotionality (withdrawal/negative affect stage) [1]. Impulsivity, broadly defined as rapid unplanned reactions to internal or external stimuli without regard for negative consequences [2], has been considered an important construct in the addiction cycle. Both increased reward sensitivity and decreased inhibitory control have been used to describe impulsivity, although some prefer to align impulsivity more closely with one facet over the other [3, 4]. Impulsivity is typically conceptualized as a relatively stable characteristic, but more recent evidence suggests that facets of impulsivity can exhibit daily and hourly fluctuations [5, 6].

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Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

The malleability of impulsivity during daily time scales suggests that reward sensitivity and inhibitory control processes may be targeted by treatments for addictive behaviors. Although there is a robust literature regarding the relationship between impulsivity and addictive disorders [7, 8], less is known about the effect of treatment on impulsivity.

Cognitive behavioral therapy (CBT), one of the most heavily researched psychotherapies for psychiatric disorders, is an evidence-based treatment for a range of addictive disorders (both substance and non-substance) [9–11]. Although the unique mechanisms are not entirely clear, CBT is purported to work in part by conveying generalizable skills to exert greater cognitive and behavioral control over habitual patterns of behavior, including skills for reducing impulsive responding [12]. However, little research has directly examined whether CBT influences impulsivity, especially within addictive disorders. A meta-analysis of randomized and non-randomized psychotherapy trials for substance use found small reductions in facets of impulsivity from pre-treatment to post-treatment [13]. Yet, a more precise review of the effect of CBT on impulsivity during treatment for addiction has not been explored. Thus, the purpose of this review was to examine the available evidence to determine whether CBT has an effect on measures of impulsivity in addictive disorders.

Measures of Impulsivity

As impulsivity is a multidimensional construct, a variety of methods for assessing impulsivity have been developed across different research domains. Self-report measures of impulsivity have been developed to correspond with differing methods for conceptualizing personality traits. Those who favor statistical dimension reduction techniques based upon human self-report data developed questionnaires that map onto the Five Factor Model of personality, such as the Urgency, Premeditation, Perseverance, and Sensation seeking (UPPS) Impulsive Behavior Scale [14]. In the UPPS model, impulsivity is characterized by urgency, (lack of) premeditation, (lack of) perseverance, and sensation seeking. The original UPPS model was later updated to include positive urgency as a fifth factor (UPPS-P) [15]. Alternatively, those who prioritize biological and behaviorist theories of motivation developed questionnaires which map onto two or three factors, such as the Barratt Impulsiveness Scale (BIS-11), Eysenck's impulsiveness scale, and the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) [16–18]. These models emphasize measuring theory-driven and biologically based mechanisms of motivation, such as behavioral activation and inhibition systems [3, 19]. Others have focused on impulsivity's functional relevance to personality disorders, such as the Difficulties in Emotion Regulation Scale (DERS) [20]. The DERS Impulse Control subscale measures impulsivity in terms of difficulty with engaging in goal-directed behaviors and inhibiting impulsive behaviors when experiencing negative emotions. Studies that have included more than one of these impulsivity measures find that they are moderately to strongly correlated with each other, supporting their common goal of measuring impulsivity traits [21–23].

A similar approach to measuring facets of impulsivity comes from the domain of behavioral economics. The construct of delay discounting describes an excessive preference for smaller, immediate rewards over larger, delayed rewards [24, 25]. A delay discounting task typically asks participants to choose between hypothetically receiving a smaller monetary reward

today versus a larger monetary reward at a discrete point in the future. Using repeated trials that change the amount of the monetary rewards and time of the delays, a mathematical function can be applied to generate a curve that describes each participant's rate of delay discounting. Self-report forms have been developed to assess delay discounting in a structured and easily reproducible format, such as the Monetary-Choice Questionnaire [26]. Other forms of discounting have been assessed, such as probabilistic discounting measured with the Probabilistic Discounting Questionnaire [27]. In the Experiential Discounting Task, participants actually receive rewards based on their choices between immediate rewards that are certain versus delayed rewards that are probabilistic [28]. Similar tasks have been designed to assess risky decision-making under varying degrees of uncertainty about rewards and punishments, such as the Iowa gambling task and the balloon analogue risk task [29, 30]. Scores on these discounting and risky decision-making measures have been modestly correlated with self-report measures of impulsivity traits, suggesting both common and unique coverage of the impulsivity construct [22, 23, 30].

Other behavioral measures of impulsivity assess sustained attention and/or inhibitory control over prepotent actions [22, 31, 32]. These measures typically require participants to engage in several serial trials wherein they rapidly identify and respond to target stimuli. The Stroop color-word task requires responses to target features of a stimulus while ignoring other salient features of the stimulus that interfere with processing of the target features [33]. In the stop-signal paradigm, a learned response to a stimulus must be inhibited when a separate stimulus signals that the learned response should stop [34]. Similar tasks, including the go/no-go task and the Connor's continuous performance task, also require participants to differentially respond to various stimuli based upon prespecified rules [22, 35]. Performance on these behavioral tasks correlate moderately with each other, although they are weakly associated with the measures of self-reported impulsivity traits, discounting, and risky decision-making [22, 32, 36].

Relatively recent advances in genetics and neurobiology have identified components that may form the biological substrate of impulsivity. Neuroimaging, genetic, pharmacology, and brain lesion studies have found associations between biological assays and self-report/behavioral measures of impulsivity [23, 35, 37, 38]. Genetic loci, such as *DRD2*, *DAT1*, *CACNA1I*, and *CADM2*, have been linked to the development of impulsive personality traits [23, 38]. Impulsivity has also been associated with dysregulation in dopamine, GABA, serotonin, and norepinephrine circuits among cortical and limbic regions [35, 37]. More recent studies, including clinical trials of CBT for addictive behaviors, have evaluated these neurobiological correlates of impulsivity as outcomes and/or predictors of outcomes during psychotherapy [39–42].

Despite the multitude of approaches and instruments for measuring impulsivity, some of which are considered stable traits whereas others more malleable, the evidence regarding the effect of CBT on impulsivity in addictive disorders is unclear. The current review sought to directly address this issue.

Review Methods

A literature search was conducted in PubMed and APA PsycInfo databases in January to February 2023 to identify studies for the current review. The first step involved a title, abstract, keyword, and subject search by intervention ("cognitive behavioral" OR "cognitive-behavioral" OR "cognitive behavior" OR "cognitive-behavior" OR "cognitive behavioural" OR "cognitive-behavioural" OR "cognitive behaviour" OR "cognitive-behaviour" OR "coping skills training" OR "relapse prevention") AND study ("clinical trial" OR "efficacy" OR "randomized clinical trial" OR "randomized controlled trial") AND addictive behavior (addicti* OR "alcohol" OR "cannabis" OR "cocaine" OR "dual diagnosis" OR "dual disorder" OR "heroin" OR "illicit drug*" OR "marijuana" OR "methamphetamine" OR "opiate*" OR "opioid*" OR "polysubstance" OR 'stimulant*" OR "substance*" OR "gambling" OR "behavioral addiction*" OR "tobacco" OR "cigarette*" OR "nicotine") AND impulsivity (impuls*). Additionally, we limited our search to full text and peer-reviewed resources.

The initial search resulted in 246 articles, after removing duplicates across databases. Two raters (JML and BB) screened all 246 abstracts for inclusion in this narrative review based on the following criteria: (1) published in English, (2) peer-reviewed journal, (3) included repeated administration of impulsivity assessment (e.g., pre- and post-treatment), and (4) randomized controlled trials (RCT) that included a treatment condition labeled as CBT. Studies were excluded if the CBT condition was combined with pharmacotherapy and did not include a CBT-only condition, as we aimed to examine the effects of CBT without pharmacological influences on impulsivity. After initial screening, 25 articles were identified as potentially meeting inclusion criteria and were reviewed in depth by all three authors to evaluate their inclusion in this review, with subsequent discussion until consensus was achieved. This process resulted in four studies that met all inclusion criteria [43•, 44•, 45•, 46•].

Summary of Studies Included in Review

Table 1 provides a summary of these four studies, which describes the sample, CBT intervention, measures used to assess impulsivity, and main findings concerning impulsivity. All four studies examined CBT effects on impulsivity in samples of individuals with substance use: one study on general substance use among adolescents [43•], one on cocaine use disorder [44•], one on adolescent alcohol use [45•], and one on cannabis use disorder [46•].

Defayette and colleagues [43•] conducted a secondary analysis of data from a clinical trial comparing CBT to enhanced standard care to investigate the degree to which trajectories of change in different facets of emotion regulation and depressive symptoms remained correlated over the course of 12 months. Participants were 110 adolescents (M_{age} = 15.7 years) with co-occurring mental health and substance use concerns enrolled in an intensive outpatient, home-based program. After completing the baseline assessment, participants were randomized to CBT or treatment as usual (TAU) condition. The CBT condition included individual sessions, parent training sessions, and family sessions. Few details were provided regarding the number of sessions or length of treatment. The DERS,

which assessed for difficulties with emotion regulation, includes a six-item subscale for "Impulse Control Difficulties," and follow-up assessments were at 3-, 6-, and 12-months post-baseline.

Results—Descriptive statistics indicated that the Impulse Control subscale scores reduced over time from baseline to month 12; however, analyses did not examine differences by treatment condition. Bivariate correlations did not show a significant relationship between treatment group and Impulse Control subscale scores at any time point. Furthermore, the growth curves of impulse control difficulties and depressive symptoms were related, suggesting those who showed a greater rate of decline in impulse control difficulties also showed a greater rate of decline in depressive symptoms over 12 months. However, there was no direct test of whether CBT had a greater effect on reduction in impulse control difficulties compared to TAU.

Nuijten and colleagues [44•] reported secondary findings from an open-label RCT that investigated the effect of combining CBT with modafinil on treatment outcomes for cocaine use disorder. Participants were adults diagnosed as cocaine dependent according to DSM-IV criteria and reported using crack-cocaine on at least 8 days in the previous month. Sixty-five participants were randomly assigned to receive CBT alone ($n = 35$) or CBT with modafinil ($n = 30$). The CBT protocol consisted of 12 weeks of weekly individual, outpatient treatment for cocaine use disorder provided by a trained therapist. Trait-level impulsivity was measured only at baseline using the BIS-11. Impulsivity was also assessed at baseline and at post-treatment using the Stop-Signal task to measure response inhibition and the Stroop color-word task to measure cognitive interference.

Results—There were no statistically significant changes in response inhibition from baseline to post-treatment. In both treatment conditions, there were small improvements in cognitive interference scores, but these improvements were not related to treatment retention or to cocaine use.

Patton and colleagues [45•] examined the effects of a CBT-based alcohol use prevention intervention among adolescents. A total of 468 participants in grade 9 or 10 ($M_{age} = 14.99$ years) from six Australian high schools were randomized into one of the three conditions: CBT with progressive muscle relaxation (PMR), CBT with mindful breathing exercises (MM), or a control condition. In addition to an introduction on the cognitive model, CBT was composed of skills to identify, challenge, and change unhelpful thoughts. Both interventions were delivered by one or two facilitators to groups of eight to 23 students over three sessions (average duration of 173 min). Two assessments measured impulsivity —reward drive, assessed with the 10-item shortened Sensitivity to Reward Scale (SR-S) [47], and rash impulsiveness, assessed with the eight-item Barratt Impulsiveness Scale-Brief (BIS-B) [48] —across four timepoints (prior to intervention completion, immediately following intervention completion, 3 months and 6 months after intervention completion).

Results—Participants in either CBT intervention group had significantly higher reward drive than those in the control group at baseline, and these results did not change over

time, nor were they moderated by condition. Rash impulsiveness increased over the four timepoints, and the change was not moderated by intervention condition.

Peters and colleagues [46•] reported secondary findings from a RCT that investigated various combinations of contingency management (CM) and CBT for cannabis dependence. Participants were adults who met criteria for current cannabis dependence according to DSM-IV criteria. Participants were randomized into one of four treatment conditions: (1) CBT-only, (2) CM for abstinence alone, (3) CBT plus CM for abstinence, or (4) CBT plus CM for adherence. Treatment was administered weekly for 12 weeks. The CBT protocol consisted of individual, outpatient treatment focused on functional analysis, coping strategies, and cognitive restructuring. Of the original 127 participants enrolled, 61 who completed the impulsivity measures at baseline and post-treatment were included in the analyses. Trait impulsivity was assessed at baseline only using the BIS-11. Additionally, impulsivity was measured using the Experiential Discounting Task at pre-treatment and post-treatment.

Results—Unexpectedly, delay discounting rates increased from pre-treatment to post-treatment in the CBT-only condition but did not change over time in the other conditions.

Summary of Notable Studies Not Included in Review

There were eight studies that did not meet our specified criteria for inclusion in this review (e.g., RCT design, CBT-only condition) but were otherwise notable, as they included repeated assessment of impulsivity in the context of CBT treatment for addictive behaviors. For instance, two studies [39, 49] used neuroimaging techniques to examine brain changes following CBT treatment. In a clinical trial designed to identify diagnostic neuroimaging biomarkers during CBT for internet addiction [39], 27 adult participants with internet addiction received 8 weeks of weekly CBT sessions. fMRI scans were used at pre-treatment and post-treatment to measure functional connectivity in neural systems associated with impulsivity (premotor cortex; cerebellum), response inhibition (superior, middle, and inferior frontal cortex; angular gyrus), and reward awareness (orbitofrontal cortex; middle cingulate cortex). Results indicated that reduced connectivity in the impulsivity system and enhanced connectivity in the response inhibition system were associated with reductions in internet addiction severity from pre- to post-treatment. Although these results suggest brain-based measures of impulsivity changed following treatment with CBT, the study did not include a control condition, and self-report/behavioral measures of impulsivity were not reported. A second study used MR spectroscopy to examine neurotransmitter changes between adolescents with internet and smartphone addiction who received CBT treatment versus healthy controls [49]. A modified CBT for internet gaming addiction was administered to participants with internet and smartphone addiction who agreed to participate in therapy (i.e., non-randomized design). Impulsivity was assessed with the BIS, which was administered as part of the psychological test battery at baseline and again post-treatment. Participants underwent MR imaging within an hour after administration of the psychological tests at baseline and again 1 or 2 days after finishing the 9-week CBT program. Of the 12 participants who agreed to participate in CBT, BIS scores did not significantly change after therapy.

Three other studies included CBT as a treatment condition but did not involve random assignment, thereby raising questions regarding the internal validity and potential for bias. For example, Han and colleagues [50] compared CBT for internet gaming disorder (IGD) versus supportive therapy, with participants allowed to select which therapy they preferred to complete. Impulsivity was assessed before and after treatment with the Behavioral Inhibition System/Behavioral Activation System (BIS/BAS) Scale [19]. Results indicated that BIS/BAS scores of those who completed CBT for IGD decreased more from pre- to post-treatment compared to those who completed supportive treatment. In another study, participants were admitted into either outpatient or inpatient treatment for addiction based on clinical impressions of the therapeutic team in the *Proyecto Hombre de Navarra* addiction treatment program in Spain [51]. There were 75 participants who received CBT in the outpatient treatment arm, whereas the inpatient treatment arm did not explicitly involve CBT. Impulsivity was assessed with the BIS-10 [52] before treatment assignment and again at a 6-month follow-up after treatment completion. Results indicated that impulsivity scores among participants receiving outpatient treatment did not significantly change from pre- to post-treatment. Lastly, a pilot study examined the effectiveness of a CBT-type treatment program for alcohol-related violence called Control of Violence for Angry Impulsive Drinkers (COVAID) [53] among six participants without a comparison condition. Impulsivity was assessed with the BIS-11 [54] and the impulsivity subscale of the Conflict Resolution, Impulsivity and Aggression Questionnaire (CRIAQ) [55]. Other assessments administered also measured impulsivity in the context of problem-solving (Impulsivity/Carelessness Style scale of the Social Problem-Solving Inventory-Revised [SPSI-R]) [56] and alcohol-related aggression (a subscale of increased irritability and impulsivity of the Alcohol-Related Aggression Questionnaire [ARAQ]) [57]. Each measure of impulsivity was administered before and after the COVAID intervention. BIS-11 scores decreased from pre- to post-treatment for two of the six participants and the scores of the impulsivity subscale of the CRIAQ decreased for two-thirds of the participants. Additionally, the scores of the Impulsivity/Carelessness Style scale of the SPSI-R decreased for five participants. However, due to the small sample size, the authors did not use statistical tests to examine the data.

In two other studies, CBT was combined with another treatment, which limited an evaluation of the specific impact of CBT on impulsivity. In one, a quasi-experimental study examined a combination of motivational interviewing (the first phase of treatment) with CBT (the second phase of treatment) for problem gambling in the Pathological Gambling and Behavioral Addictions Unit in Spain [58]. Eighteen adult participants who achieved the therapeutic goal of gambling abstinence were included in analyses examining changes in impulsivity (assessed with the UPPS-P) pre- and post-treatment. Results found significant reductions for negative urgency, positive urgency, lack of premeditation, and lack of perseverance and no significant changes in sensation seeking. In another study, multi-component CBT had been combined with eight weeks of nicotine replacement therapy (4 weeks of 21 mg, 2 weeks of 14 mg, and 2 weeks of 7-mg patches) to treat cigarette smoking [59]. Impulsivity was assessed with a monetary delay discounting task, with changes in impulsivity indicated by changes in delay discounting rates from pre-treatment to 7 weeks and 27 weeks after the smoking quit date. Results indicated no statistically significant changes in delay discount rates.

Lastly, a study by Petry [60] examined delay and probability discounting in a sample of 226 adult participants drawn from a randomized trial evaluating the efficacy of psychological treatments for pathological gambling [61]. Although the trial included CBT, random assignment, and repeated assessment of impulsivity, the author did not report analyses of pre- to post-treatment changes in the impulsivity measure.

Discussion

This is the first known study to review the available evidence regarding the effect of CBT on impulsivity among individuals with addictive disorders. A comprehensive literature search of studies published through February 2023 produced only four studies that met inclusion criteria for review. The identified studies included individuals who were randomly assigned to receive CBT for substance use and measured a facet of impulsivity before and after treatment. Three of the four studies were secondary analyses of data from clinical trials that targeted reduction in substance use, and the remaining study aimed to prevent future alcohol use among adolescents. Overall, results from these four studies did not provide evidence that CBT was associated with change in measures of impulsivity. However, due to the relatively sparce literature for directly addressing the question, the effect of CBT on reducing impulsivity in addictive disorders remains uncertain.

The inclusion criteria for this review were selected to identify studies that provided a direct test of CBT's effect on impulsivity. Studies published in English language were chosen to ensure they could be accurately reviewed by raters and the requirement regarding publication in peer-reviewed journals was intended to uphold confidence in the scientific integrity of findings. Additionally, to evaluate an effect on impulsivity, we required studies to include repeated administration of an assessment of impulsivity. This excluded many published studies from the current review, as impulsivity is frequently examined as a predictor or risk factor for substance use or moderator of treatment outcomes, rather than as an outcome itself [3, 62–64]. Likewise, the inclusion criterion requiring a RCT design with a CBT treatment condition further limited the number of included studies. Random assignment was considered an essential study method to strengthen the internal validity and eliminate sources of bias in results, yet we found several studies of CBT that included a non-randomized design. Additionally, we sought studies with an exclusive CBT condition to reduce potential to attribute effects to another intervention. Despite CBT being the prevailing evidence-based treatment approach for addictive disorders for the past several decades, it is also a widely used platform for pharmacotherapy trials and frequently combined with other interventions [12].

Regardless of these arguably restrictive inclusion/exclusion criteria, it is striking that so few published RCTs of CBT for addictive behaviors evaluated impulsivity as an outcome. Impaired self-control and deficits in executive function pertaining to risky decision-making are facets of impulsivity that make up the foundation of addictive disorders [63, 65], suggesting impulsivity may be considered an indicator of treatment benefit. Furthermore, the diagnostic criteria for addictive disorders include impairments in domains of cognitive and behavioral control that reflect features of impulsivity, offering potential value in including impulsivity as an outcome in addiction treatment studies, particularly those of CBT. The

absence of impulsivity as an outcome in RCTs may be due to impulsivity being traditionally viewed as a stable personality trait, and therefore unlikely to change over the course of a few months of treatment. Also, as one of the primary elements of CBT is skills training designed to enhance cognitive and behavioral control, it is surprising that impulsivity was not more frequently evaluated as an outcome. Though CBT does not directly target impulsivity in the same manner as other cognitive enhancing interventions, such as cognitive remediation [66], there is recent evidence of CBT-specific increases in connectivity between brain regions involved in cognitive control [67]. While more work is needed before impulsivity should be considered a priority outcome for addiction treatment studies, CBT trials should consider measures of impulsivity as at minimum a secondary endpoint and/or mediator of treatment outcomes.

Limitations and Future Directions

The small number of studies included in this review limits the conclusions that can be drawn from the literature. A common assessment measure for impulsivity was not present across the included studies so results could not be combined in a meaningful way. Also, because this was a narrative review rather than a systematic review or meta-analysis, we did not evaluate risk of bias or calculate effect sizes. Lastly, we did not attempt to contact study authors to inquire about unpublished results of analyses on impulsivity measures, as we relied solely on information provided in the published reports.

Nevertheless, this review points to the need for rigorous clinical trials to include repeated measurement of impulsivity (and its many facets), including through extended follow-up periods, to examine delayed emergence of CBT treatment effects [68]. We did not find any studies in non-substance addictive disorders that met our inclusion criteria; further research on the effect of CBT on impulsivity in gambling disorder, for instance, is needed. Also, although translational research must determine the degree of interchangeability between biological assays and impulsivity measures, it is likely that evaluating CBT's influence on the substrate of impulsivity will advance research on addiction treatment mechanisms.

Conclusion

The available evidence from RCTs evaluating CBT for addictive disorders does not suggest an effect on impulsivity. However, few trials directly tested the effect of CBT on measures of impulsivity, emphasizing a need for more comprehensive examination of treatment effects on the underlying characteristics of addictive disorders.

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Table 1

Summary of studies meeting inclusion criteria for review

Study (first author, date)	Country	Sample (type of addiction, setting)	*N*	Age, *M* (*SD*)	% Female	Duration of intervention (sessions)	Comparison condition	Impulsivity measures	Main findings (summary)
Defayette, 2021	United States	Adolescents in intensive outpatient, home-based program for co-occurring substance use and mental health	110	15.7 (1.2)	43%	Not reported	Treatment as usual	DERS, impulse control difficulties subscale	Reduction in impulse control subscale associated with reduction in depressive symptoms over 12-month period; did not directly test effect of CBT on reduction in impulse control
Nuijten, 2016	Netherlands	Adults with cocaine dependence enrolled in outpatient addiction treatment centers	65	46.1 (8.1)	17%	12 weekly sessions	CBT + modafinil	BIS-11; stop-signal task; Stroop color-word task	No statistically significant changes in response inhibition from baseline to post-treatment. In both treatment conditions, there were small improvements in cognitive interference scores. Findings provide mixed evidence for CBT improving impulsivity over time
Patton, 2019	Australia	Adolescent high school students in either grade 9 or 10; alcohol use prevention	404	14.9	62%	3 sessions	Assessment-only control	SR-S; BIS-B	Participants in either CBT intervention group had significantly higher reward drive than those in the control group at baseline, but did not change over time, nor were they moderated by condition
Peters, 2013	United States	Adults with current cannabis dependence enrolled in an outpatient addiction treatment clinic	127	26.1 (7.5)	14%	12 weekly sessions	CBT + CM adherence; CBT + CM abstinence; CM for abstinence only	BIS-11; EDT	Delay discounting rates (k) increased from pre-treatment to post-treatment in the CBT-only condition. There was no evidence suggesting that the CBT or CM treatments improved impulsivity over time

BIS-11 Barratt Impulsiveness Scale; *BIS-B* Barratt Impulsiveness Scale-Brief; *CBT* cognitive behavioral therapy; *CM* contingency management; *DERS* Difficulties in Emotion Regulation Scale; *EDT* Experiential Discounting Task; *SR-S* Sensitivity to Reward Scale