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Curr Addict Rep. Author manuscript; available in PMC 2021 June 01.

Published in final edited form as:

Curr Addict Rep. 2020 June ; 7(2): 117–124. doi:10.1007/s40429-020-00302-2.

Addictive Behavior Change and Mindfulness-Based Interventions: Current Research and Future Directions

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Abstract

Purpose—Addictive behaviors are difficult to change and result in high rates of relapse following change attempts. A number of effective treatment approaches have been developed to treat addictive behaviors (e.g., cognitive behavioral therapies). More recently, there has been an increase in the development and evaluation of mindfulness-based interventions for addictive behaviors. This article discusses the history of mindfulness-based interventions for addictive behaviors and recent advances in treatment.

Recent findings—Mindfulness-based interventions are as effective as existing evidence-based treatments for addictive behaviors. Further understanding of the neurobiological changes that occur could help identify the components of mindfulness-based interventions that are most helpful and which individuals may benefit most from mindfulness-based intervention.

Summary—Additional large scale randomized controlled trials are needed for a better understanding of the effectiveness of mindfulness-based interventions. Future research should look at optimizing mindfulness-based interventions for specific settings and patient populations, as well as dissemination and implementation.

Keywords

mindfulness; mindfulness-based interventions; addictive behavior; behavior change

Introduction

Over the last few decades, secularized meditation practices have been introduced and integrated in a number of forms and into a number of settings in traditional Western healthcare practices. Mindfulness has been described as paying attention in the present moment in a particular way: on purpose and without judgement [1]. The practice of

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mindfulness has traditionally been associated with reductions in suffering and fostering well-being [2]. Bishop operationally defined a two-component model of mindfulness: (1) self-regulation of attention that is maintained on direct experience of the present moment, and (2) an open curiosity of one's own experience [3]. This definition highlights the importance of present-moment experience and the non-judgmental lens through which that present moment is being viewed. These two major facets of secularized mindfulness meditation are considered key components to its benefits in health care settings. Specifically, the non-judgmental experience of one's own immediate encounter with the world and the associated potential cessation or minimization of repetitive negative thoughts regarding one's experience may be the reason for its positive impacts in clinical settings.

The integration of mindfulness-based practices into Western mental health settings began with the development of the Mindfulness Based Stress Reduction program (MBSR) in the early 1980s [4,5]. MBSR was developed as an intervention to help individuals suffering from chronic pain and other medical conditions. Significant reductions were observed in measures of pain, negative body image, mood disturbance, anxiety, and depression [4-6]. The success of MBSR encouraged the creation of a number of mindfulness-based interventions (MBIs) in the mental health community such as Mindfulness Based Cognitive Therapy (MBCT) [7] and other third-wave therapies with mindfulness components such as Dialectical Behavior Therapy (DBT) [8], and Acceptance and Commitment Therapy (ACT) [9]. These programs have taken the techniques of mindfulness meditation and integrated them into more traditional behavioral health models.

Treatments for Addictive Behaviors

Addictive behaviors are considered to be relatively difficult to change given the high rates of relapse (i.e., return to the addictive behavior following a change attempt) in addictive behaviors (e.g., 40-60% of individuals relapse within one year of substance use disorder treatment) [10]. A variety of effective treatment approaches have been developed for addictive behaviors (e.g., cognitive behavioral treatment, contingency management, twelve-step facilitation, motivational interviewing) and most treatments are equally effective. Yet, there is often not a clear rationale for choosing one treatment approach instead of another. Perhaps unsurprisingly, a number of MBIs specific to addictive behavior have been developed since the creation of MBSR. Such interventions include Mindfulness Based Relapse Prevention (MBRP) [11,12], Mindfulness-Based Relapse Prevention for Alcohol Dependence (MBRP-A) [13], Mindfulness Training for Smokers (MTS) [14], Mindfulness-Oriented Recovery Enhancement (MORE) [15], and other adaptations designed to aid in the treatment of addictive behaviors.

The impact of mindfulness in the treatment of addictive behaviors is delivered in part by promoting non-judgmental observation of thoughts and behavioral urges (e.g., cravings). By separating individuals from behavioral urges to engage in addictive behavior, individuals can observe cravings without giving in to them [16]. Addictive behavior may also be linked to the familiarity and comfort that one finds from indulging in an addictive behavior. A common pattern of behavior includes engaging in familiar, habitual actions, or acting on

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"autopilot" [17]. Breaking the chain of autopilot by bringing a deliberate, focused attention to the present moment, may be a protective mechanism for addictive behavior.

For example, the core goals of MBRP are to: cultivate awareness of internal (e.g., emotions) and external (e.g., environmental) cues related to substance use in order to create opportunities to address triggering situations rather than instinctively reacting to them in potentially harmful ways; and to practice (both imaginally and in-vivo) remaining with unpleasant affective, cognitive, or physical experiences without automatically seeking to escape or avoid the situation [11,12]. MBRP courses typically begin with a focus on experiential exercises designed to introduce the rationale for mindfulness by examining the role that "autopilot" plays in daily life and contrasting it with mindful awareness of experiences. Bodily sensations such as taste and smell are initially the focus of practice before shifting to other aspects such as sight and sound in sessions two and three. Clients are encouraged to practice exercises throughout the day to encourage exiting "autopilot" and increasing mindfulness. Mindfulness of thoughts and emotions are introduced in sessions four through six. Harmful patterns of behavior and common antecedents to relapse are identified and clients are taught to notice thoughts, sensations, or emotions that might arise. Clients are instructed to remain mindful of the present moment despite the unpleasant sensation as a method of allowing time and space to make a less-impulsive, well thought-out decision. Sessions seven and eight focus on generalizing learned practices to facilitate creating and maintaining an environment and life that can support continued practice of mindfulness and changes made to substance use.

A number of reviews and meta-analyses have explored the effects of MBIs on addictive behavior. In a meta-analysis of 42 studies that examined the effects of different mindfulness treatments of addictive behavior, Li and colleagues [18] found that mindfulness treatments were associated with superior substance misuse treatment outcomes at post-treatment and follow-up assessments compared to control conditions. More specifically, it was found that MBIs were more effective at reducing the frequency and amount of alcohol and drug use, number of drug related problems, level of craving for substance use, and an increased rate of abstinence as compared to control conditions (e.g., treatment as usual, relapse prevention treatment, cognitive behavioral therapy, support group) [18]. Additionally, a review of 19 studies that used MBIs to treat binge eating disorder found that those interventions were associated with effects of large or medium-large magnitude and can be considered effective [19]. In a 2018 meta-analysis of MBIs, the effects of mindfulness on addiction were mixed [20]. Overall, mindfulness was superior to minimal treatment, non-specific active controls (e.g., psychological placebo groups), and specific active controls (other psychological treatments), but performed on par with no treatment control groups [20]. These mixed results may be due to the small sample size of the five studies that examined the effects of MBIs on addictive behavior but offer support for continued research into this field of study. While MBIs are increasingly applied in therapeutic settings, there remains a limited amount of research into the effects of mindfulness on addictive behavior.

In the following sections, we begin by reviewing how neuroscience may help explain the effectiveness of MBIs for addictive behaviors. We then examine results of MBIs targeted for general substance use disorder as well as individual substances and other types of addictive

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behavior (e.g., disordered gambling and eating), and conclude by discussing future directions for the field.

MBIs and Neuroadaptations in Addictive Behaviors

In an effort to better understand the impact of mindfulness-based interventions (MBIs) on addictive behaviors, considerable effort has been directed to understanding the underlying neurobiological changes that help support addictive behavior change. Many addictive substances and behaviors act in a similar way, they increase synaptic dopamine in the ventral striatum and increase the effects of reward-based learning [21], These substances and behaviors enhance a positive feedback loop that reinforce continued use because of heterogeneous neuroadaptations caused by engaging in addictive behavior. As this process becomes more and more automatic, the more habitual and frequently it occurs.

Mindfulness may be beneficial at disrupting this feedback loop. One of the key tenets of mindfulness is consciously deciding what intero- and exteroceptive stimuli to engage with [22]. Meditation may serve to disrupt the automatic response that can lead to engaging in addictive behavior. There tends to be a bottom-up habitual response to learned behavioral cues or antecedents such as stress and environment, and mindfulness may be beneficial in decreasing or eliminating habitual responses. The practice of mindfulness may broaden an individual's focus of attention from the limited cues that triggered addictive behavior to the broader experience of interoceptive information that was previously unnoticed [23]. The focused attention required to engage in a mindfulness practice may help rectify dysfunctional habit behaviors and craving by strengthening connectivity within the prefrontal cortex, anterior cingulate cortex, and parietal networks, and between the attentional control network and the habit and craving circuits [23]. In short, mindfulness may be a tool that has the ability to break the neurobiologically-mediated behavioral feedback loop of addictive behavior and may be beneficial in correcting dysregulated networks that have adapted to repeated engagement in addictive behavior. Further research is needed in order to determine exactly which neural networks are affected by contemplative practices.

MBIs for Substance Use Disorder

A number of studies have investigated the use of mindfulness-based interventions (MBIs) for various diagnoses of substance use disorder. Recent studies have investigated MBIs as stand-alone interventions as well as combining MBIs with existing interventions. One study of 180 male participants with co-occurring substance use and psychiatric disorders found that individuals randomized to the Mindfulness-Oriented Recovery Enhancement (MORE) condition reported significantly less craving than individuals in the treatment-as-usual (TAU) condition [24]. In addition to a reduction in cravings, participants in the MORE condition had significant improvements in trait mindfulness and overall mental health [24]. Himelstein and colleagues [25] conducted a study with 44 incarcerated adolescents residing in a detention camp that had been referred to a substance use treatment program. Results indicated improvements in mental health outcomes and a significantly greater increase from pre- to post-intervention in self-esteem among those in the MBI condition versus those in the

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TAU condition [25]. Both studies [21,22] suggest continued research on the use of MBIs for substance use disorder given the observed improvements in mental well-being.

Alizadehgoradel and colleagues [26] conducted an RCT of mindfulness-based substance abuse treatment (MBSAT)—translated and adapted for use in Iran—compared against waitlist control with 40 Iranian adolescents. Participants receiving the MBI reported significantly improved response inhibition, risky decision-making, working memory, and cognitive flexibility relative to control. Davis and colleagues [27] conducted an RCT comparing rolling group MBRP for young adults receiving inpatient substance use disorder treatment (n = 45) and treatment as usual plus 12 step/self-help (n = 34). Participants in the MBRP condition reported reductions in facets of trait impulsivity, although only positive and negative urgency mediated the relationship between condition and substance use.

Combining mindfulness interventions with other treatment modalities may help enhance outcomes and increase the ease of integrating mindfulness into clinical settings. Valls-Serrano and colleagues [28] combined Mindfulness Meditation with Goal Management Training to see if the combination of interventions improved outcomes for individuals with polysubstance use disorder already enrolled in a substance use disorder treatment program. They found individuals in the combined intervention showed improvements in working memory and reflection-impulsivity/decision-making [28]. Although the study did not formally assess substance use, the results demonstrate the potential for integrating mindfulness techniques with existing interventions.

MBIs for Smoking

Mindfulness approaches have been used as both monotherapy and an adjunct to existing smoking cessation treatment. Studies have found that mindfulness training is helpful for individuals attempting to decrease smoking or achieve smoking abstinence [29,30]. More recently, Davis et al., [31] found that among low socioeconomic status smokers (n=198), abstinence rates were significantly higher for participants receiving an MBI, Mindfulness Training for Smokers (MTS), than participants in the control condition (telephonic quit line) at six-month follow-up. Davis et al., [32] followed up this study by comparing MTS against a time/intensity matched control—the American Lung Association's Freedom from Smoking (FFS), smoking cessation protocol. Participants (n=175) were recruited from a low socioeconomic status area. Abstinence rates between groups were nearly identical four weeks post-quit. Twenty-four weeks post-quit, MTS trended toward higher abstinence rates but were not statistically significant. However, MTS participants demonstrated a significantly larger decrease in urge intensity from baseline to post-quit, and significantly larger decreases in stress and experiential avoidance at 24-weeks post-quit. Kober and colleagues [33] conducted functional magnetic resonance imaging (fMRI) on 23 participants that completed either mindfulness training or the FFS smoking cessation protocol. Stress reactivity in several brain regions was found to be related to reductions in smoking post-treatment and at three-month follow-up. Participants in the mindfulness training condition showed lower stress-reactivity compared to the FFS condition.

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Ruscio et al., [34] compared a brief MBI to a “sham meditation” control in an ecological momentary assessment study. Participants (n=44) reported significantly reduced negative affect, reduced craving immediately post-meditation, and reduced cigarettes smoked per day over time in the mindfulness intervention condition relative to control. Singh et al., [35] conducted a randomized controlled trial (RCT) to extend previous findings comparing a three-component MBI for smoking cessation to a treatment as usual control condition among individuals with mild intellectual disabilities (n=51). Participants in the MBI condition reported significantly higher abstinence rates at post-treatment and significantly fewer mean cigarettes smoked at one-year follow-up.

However, not all studies of MBIs for smoking cessation have found positive results. Vidrine et al., [36] did not find significant differences in treatment effects on smoking abstinence rates between an MBI and a Cognitive Behavioral Treatment (CBT) among 412 participants. The study reported similar abstinence rates relative to other MBIs [e.g., 31,32], however, abstinence rates in this study were higher than those seen in the Davis studies. Maglione and colleagues [37], conducted a systematic review and meta-analysis on the efficacy of mindfulness meditation for smoking cessation. They identified a number of study limitations and did not find a significant difference between the studies reviewed and control conditions. While the data indicates that the MBIs appeared to be as effective as the standard of care control, the studies were not designed to test for effectiveness equivalence. The authors go on to suggest that further rigorous, well-designed, and large RCTs are needed to develop a larger evidence base to provide more accurate estimates of effectiveness.

MBIs for Alcohol

Much of the early research on MBIs for addictive behavior in the United States has focused on alcohol use [e.g., 38]. Recent studies have started to dig deeper into the effects of MBIs using specific types of interventions (e.g., brief interventions) and antecedents to drinking (e.g., craving). A pilot study of 76 undergraduate binge drinkers found that engaging in a brief MBI (two, 10-20 minute guided mediations and a consultation with a therapist who provided a handout briefly explaining mindfulness) predicted a more than two times decrease in having a binge drinking episode relative to control [39]. The study offers preliminary support to suggest that brief engagement in MBIs may help decrease heavy drinking. The researchers suggest that participation in the mindfulness group led to more awareness of craving cues, and that these techniques are compatible with a harm reduction approach to alcohol consumption [39].

Szeto, Shoenmakers, de Mheen, and Snelleman [40] conducted an ecological momentary assessment study that looked at the effects of mindfulness on cravings. Participants were recruited from three outpatient substance use disorder treatment facilities in the Netherlands (n=43). The study found an association between participant mindfulness and craving, such that as mindfulness increased craving decreased, suggesting that mindfulness may help reduce cravings which in turn may reduce the number of drinking episodes [40,41]. Despite the early research emphasis on MBIs and alcohol, many studies conducted have been on a small scale. While the findings appear to be positive, they highlight the need to conduct large scale trials to learn more about the impact of MBIs on alcohol use.

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MBIs for Opioids

Imani and colleague [42] conducted an RCT of mindfulness-based relapse prevention (MBRP; using a protocol translated into Farsi) compared to treatment as usual among adults with opioid dependence (DSM-IV-TR criteria) in Iran (n=30). Participants in the MBRP condition reported significantly less opioid use than the control condition at post-treatment. Unfortunately, the study did not conduct any follow-up beyond posttreatment.

More recent pilot studies have examined the effectiveness of MBIs for individuals with chronic pain and opioid use disorder (OUD). Garland and colleagues [43] found that 8 weeks of MORE was more effective than TAU in reducing craving, pain unpleasantness, and stress, as well as significantly greater positive affect among 30 patients enrolled in a methadone maintenance program. Vowles and colleagues [44] studied 37 Veterans with chronic pain and hazardous opioid use who were enrolled in a co-occurring disorders medical clinic and found that 12 weeks of MBRP combined with Acceptance and Commitment Therapy was more effective than TAU in reducing opioid misuse, pain interference, and pain behavior at 6-months following treatment. Although both of these studies were small, they demonstrate the potential effectiveness of MBIs for targeting both chronic pain and OUD, which is a significant public health crisis [45].

MBIs for Disordered Eating

There is a growing body of evidence that suggests that an addictive process may play a role in certain types of disordered eating (e.g., food addiction) [46,47]. MBIs have been applied Kristeller and colleagues [48] developed Mindfulness-Based Eating Awareness Training (MB-EAT), a 12-session group therapy, for binge eating disorder. They conducted an RCT (n=150) and participants were randomly assigned to the MB-EAT condition, a psychoeducational/cognitive behavioral therapy, or wait list control. Participants in the intervention conditions reported fewer binge days per month and lower levels of depression relative to control at the one- and four-month follow-ups. At four-month follow-up, 95% of MB-EAT participants no longer met criteria for binge eating disorder and binges that occurred were likely to be significantly smaller. Additionally, amount of mindfulness practice was related to improvements on the Binge Eating Scale, disinhibition ratings, and weight. However, the study faced high participant dropout rates and was not compared against “gold standard” manualized treatments.

Levoy and colleagues [49] conducted an exploratory study of mindfulness-based stress reduction (MBSR) for emotional eating. 348 participants completed the MBSR intervention and participants reported significantly improved emotional eating scores and the scores were related to changes in self-reported mindfulness. However, the study lacked a control group. Katterman et al., [50] conducted a systematic review of MBIs for a variety of subclinical eating problems. The results suggested that MBIs are effective treatments for binge eating and emotional eating. However, only two of the studies included a comparison condition and those studies did not find a significant difference between MBI and control.

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MBIs for Gambling

McIntosh and colleagues [51] conducted a seven-week RCT comparing manualized cognitive behavioral therapy (CBT) and a problem gambling MBI to case-formulated CBT for problem gamblers in Australia (n=77). All three interventions resulted in large effect sizes at posttreatment and three- and six-month follow-up. However, the study results are somewhat confounded due to three of the seven intervention weeks being psychoeducation that was received by all participants, regardless of condition.

Toneatto et al., [52] compared a five-week mindfulness-enhanced cognitive behavioral therapy (ME-CBT) to wait list control among problem gamblers (n=18). Participants in the ME- CBT condition reported fewer problem gambling symptoms and gambling urges at post-treatment and three-month follow-up. However, the study was limited by a modest sample size and use of wait list control.

Shead et al., [53] compared daily audio-guided mindfulness meditation to an audiobook recording control among gamblers (n=39). Participants in the MBI condition reported significantly fewer cravings than participants in the control condition. However, the MBI did not decrease delay discounting (another construct of interest). The study was limited by most participants not meeting criteria for problem gambling and it also lacked a follow-up.

Maynard and colleagues [54] conducted a meta-analysis of MBIs in the treatment of disordered gambling. Reviewing studies dating back to 1980, they found that the MBIs had moderate to large effects for gambling behavior/symptoms and financial outcomes. However, they found similar results as to what is reported above suggesting that further studies, RCTs, and a clearer definition of mindfulness would be helpful for drawing conclusions regarding the effectiveness of MBIs for problem gambling.

MBIs for Internet Gaming Disorder

With the rise of affordable computers and high-speed internet, rates of individuals playing video games on the internet and offline are increasing with an estimated 4-12% of adolescents and adults exhibiting problematic gaming behaviors [55]. Rates of internet gaming disorder (IGD) are on the rise and IGD has been found to be associated with a range of negative consequences (e.g., impaired physical health [56] and loss of employment and relationships [57]). Li and colleagues [58] conducted an eight-week RCT comparing group-based Mindfulness-Oriented Recovery Enhancement (MORE) for IGD to a support group control. Participants in the MORE condition reported a greater decrease in DSM-5 symptoms, video game craving, and maladaptive gaming cognitions at post-treatment and three-month follow-up. Li and colleagues [59] used the same sample to investigate the effect of potential mediators. They found that the effects of MORE on IGD was mediated through pre-to-posttreatment reductions in maladaptive gaming cognitions. Yao and colleagues [60] conducted a non-RCT, six-week group-based intervention blending reality therapy and mindfulness meditation for individuals with IGD (n = 25). After completing the MBI participants reported decreased delay discounting rate and IGD severity. Participants were not randomly assigned to the control condition, preventing us from drawing conclusions

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across conditions. Overall, these results provide initial support for continued investigation of the effectiveness MBIs for IGD.

Conclusions and Future Directions

The growing field of mindfulness-based interventions (MBIs) for substance use disorders has yielded mixed results. While some studies have yielded positive results, others have found that MBIs perform no better than existing treatments or control conditions. However, there are a number of study limitations and confounds that make it difficult to draw firm conclusions. As a result, there is a pressing need for large scale, RCTs with equivalent control conditions and appropriate follow-ups. Many of the existing studies have small sample sizes, lack equivalent time/effort controls, and the results of the studies have small effect sizes with large confidence intervals. Conducting large RCTs may help provide a clearer picture of the effectiveness of MBIs. It is also important to begin to study whether MBIs may be more or less effective for particular patients with substance use disorders and in what settings. Based on existing results, it seems likely that MBIs are at least equivalent in effectiveness to existing treatments for addictive behaviors, in general, and may be more effective for individuals with more severe comorbid negative affect and substance use disorder symptoms [61]. When reviewing treatment outcomes for addictive behaviors, it is clear there is no “one size fits all” treatment. This suggests developing a better understanding of what factors predict the best MBI outcomes, consistent with a precision medicine approach.

The fact that mindfulness has been used for centuries in some form to help with the fleeting and sometimes difficult nature of the human mind appears to have inspired researchers to determine what benefits this ancient practice may have in clinical settings. A majority of the MBIs reviewed have been adapted from existing practices of MBIs focused on other areas of dysfunction. The results seem to indicate that the underlying concept of mindfulness appears to be a viable intervention option for addictive behaviors. We are hopeful that continued research will shine light on the best role mindfulness can play in the treatment of addictive behaviors, and will also help develop the most beneficial and effective way to integrate mindfulness into existing addiction programs. Interest in mindfulness and its benefits in the clinical setting are continuously growing, and the results from future research will show us the best contexts and settings for its use.

Acknowledgments

FJS was supported by a training grant (T32AA018108) from the National Institute on Alcohol Abuse & Alcoholism (NIAAA).

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