

# **Mindfulness-Based Interventions and Opioid Use Disorders: A Systematic Literature Review**

Elizabeth Ketterer

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David Masuda  
Ian Painter

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Elizabeth Ketterer

University of Washington

**Abstract**

Mindfulness-Based Interventions and Opioid Use Disorders: A Systematic Literature Review

Elizabeth Ketterer

Chair of the Supervisory Committee:

David Masuda

Department of Biomedical Informatics and Medical Education

*Objective:* Mindfulness based interventions have been found useful for substance use disorders, smoking, and alcohol use disorders. As the opioid epidemic grows each year in the United States, the need for research on the effectiveness of a broad range of interventions is urgently needed. The aim of this review is to clarify and summarize what is known about the effectiveness of mindfulness as an intervention for opioid use disorders.

*Methods:* A systematic review was conducted of mindfulness-based interventions (MBIs) and opioid use disorders (OUDs). The search utilized PubMed for peer reviewed journal articles and subsequently, articles listed in the bibliographies of the original articles. All articles found in the searches that were published to date, in English, and on studies conducted in the United States were considered.

*Results:* Five studies used for the review included a randomized controlled trial, a feasibility trial, and cross-sectional analysis of three studies. Mindfulness-Orientation Recovery Enhancement (MORE) treatments were reported to significantly reduce pain severity, increase non-reactivity and reinterpretation of pain sensations, lower stress arousal and desire for opioids after treatment. Mindfulness-based relapse prevention (MBRP) treatments showed a statistically significant decrease in depression, craving and trauma symptoms, with feasibility and acceptability reported by study participants. Significant association was found between dispositional mindfulness and attention to positive information. The studies reviewed also showed contradicting conclusions for an association between opioid craving and misuse.

*Conclusions:* The review of these studies did not provide sufficient evidence to determine MBIs would be an effective treatment option for OUDs. Insufficient evidence was found to indicate the frequency and duration required for effective treatment. Further research with larger sample sizes, utilizing tools to measure more consistent results with less room for reporting bias is needed.

## **Introduction**

### *The Opioid Epidemic*

Opioid misuse has risen dramatically in the United States. An average of 130 Americans die every day from opioid overdose (Centers for Disease Control and Prevention [CDC], n.d.a). In 2017, the U.S. Department of Human and Health Service declared the opioid epidemic as a public health emergency, due to a sharp rise in the number of deaths from opioid misuse. This declaration stated a public health intervention strategy was urgently needed (United States Department of Health and Human Services [HHS], n.d.).

The epidemic began in the 1990's when opioid-based prescription drug use was on the rise. In 2010, deaths from heroin overdose began to rise. Death rates climbed again in 2013 with the appearance of fentanyl (CDC, n.d., a). In the U.S. almost 48,000 people died in 2017 from opioid overdose.

Over 100 million Americans are affected by chronic pain (Zeidan & Vago, 2016). 11.4 million of these patients using opioids to manage pain are misusing opioids (CDC, n.d.a). Chronic lower back pain is the most common condition for which opioids are prescribed. While opioids can be useful in managing pain, they are not to be prescribed for long periods of time and the lowest needed dose should be used. Not all physicians prescribing opioids are adhering to safe, reasonable limits. The average number of opioid prescriptions per person is 3.4 and the average number of days of supply per prescription was 18.3. In 2006, the average days of supply per prescription was 13.3 days - an increase of 37.6% over 10 years (CDC, 2018). Campaigns to educate physicians and monitor the prescription of opioids have been part of the strategy by public health (CDC, n.d.b). Still, patients receiving opioid prescriptions continue to become addicted.

Another dangerous issue affecting American society when patients are prescribed too many opioids is that these drugs are not properly disposed after needed use has ceased. Patients and their family, including children and youth, then have access to a dangerous and profitable commodity. The sale of opioids in schools and within communities contributes to the rapid rise of opioid misuse. The population with the highest rate of opioid misuse is Caucasian males, age 18 to 34, living in large metropolitan areas in the Southern USA (CDC, 2018).

Treatments currently used for OUDs include drug substitutes such as naloxone, buprenorphine, and methadone. Other treatments include abstinence-based therapy (inpatient or intensive outpatient), behavioral therapy, support groups and mindfulness.

One of the most common treatments is the use of the drug buprenorphine. Buprenorphine has been shown to decrease cravings and reduce withdrawal symptoms. It is relatively easily available (Substance Abuse and Mental Health Services Administration [SAMHSA], n.d). Buprenorphine has also been shown to create a significantly more difficult detox experience for patients than that of opioids. Cravings are a side-effect of treatment with Buprenorphine (SAMHSA, n.d.), and craving itself is a basis for addiction - specifically what patients with OUD are attempting to overcome. Buprenorphine is known for its long elimination half-life (37 hours)

and can take 8 days to completely be removed from the human body versus a half-life of 2-5 hours for most opioids prescribed for pain relief (Methadone is 24 hours) (Inturrisi, 2002). Furthermore, buprenorphine use must be closely monitored and regulated as it, like prescription opioids, can become addictive for patients. Buprenorphine is dispensed by retail pharmacies which allows for relatively easy access to anyone, including patients who become addicted during treatment (Barocus et al., 2019). Since a large part of the root issue with opioid misuse is medical professionals' and patients' lack of monitoring and regulation of opioid use, utilizing a drug such as buprenorphine for detoxing from OUDs can be risky and put patients at higher risk of addiction to a new substance. Due to the negative aspects of buprenorphine, researching non-drug treatments has become a valuable opportunity.

### *Mindfulness*

Mindfulness is “paying attention in a particular way, on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 1994). Mindfulness was first used by Kabat-Zinn as an intervention to treat chronic pain patients, and called Mindfulness-Based Stress Reduction (MBSR). Mindfulness-Based Cognitive Therapy (MBCT) was subsequently created in the psychiatry field to prevent depression relapse. MBCT combines mindfulness with cognitive-behavioral therapy. Dispositional mindfulness (DM) - also known as trait mindfulness – considers the baseline level mindfulness as a trait, inherent within a person. This baseline can be increased with regular mindfulness practice (Quaglia et al., 2016). Mindfulness-based interventions include focused attention through sitting meditation, focused attention on an object or breath, yoga exercise, walking meditation, and guided meditations (in-person or audio recordings) (Zeidan & Vago, 2016). Research has shown these interventions may decrease pain perception; increase hedonistic thoughts and the capacity for pleasure; lower stress, depression, anxiety; and decrease cravings. Proposed mechanisms for mindfulness therapy effects include greater orbitofrontal cortex (OFC) activation, deactivation of the thalamus, activation of the anterior cingulate cortex (ACC), and increased size in the prefrontal cortex (PFC). OFC activation is associated with reduction in the unpleasantness of pain and enables patients to put into context what they sense in the environment. The thalamus is the gateway between the spinal cord and the brain and can be responsible for reducing the unpleasantness of pain. The ACC governs cognitive control and the regulation of emotions. The OFC and ACC contain numerous opioid receptors. The PFC is the region of the brain responsible for executive function such as planning, reasoning, imaging, highest level of thinking and is associated with ability to relate to people, and have genuine relationships and empathy (Zeidan & Vago, 2016, Zeidan et. al, 2011).

Mindfulness has only been recently considered as a possible treatment for OUDs and little research has been done on the effectiveness, feasibility, and length of treatment needed. Mindfulness has been studied as a successful treatment for other substance use disorders, including alcohol use disorders and smoking.

### *Mindfulness and Substance Use Disorders*

Mindfulness has been studied as a treatment for substance use disorders (SUD). SUDs differ from OUDs in that they involved substances other than opioids. In general, the trials conducted support the use of mindfulness as an effective treatment for SUDs. In a systematic review of 42 studies, the authors found the frequency and severity of substance (alcohol, non-opioid drugs, and tobacco) misuse was reduced with mindfulness treatments (Li, Howard, Garland, McGovern

& Lazar, 2015). These treatments were also found to reduce cravings and stress, likely due to mindfulness altering brain function and cognitive associations with substance-related cues (Holzel et al., 2011, Witkiewitz et al., 2013). Furthermore, the studies revealed mindfulness as an effective treatment which reduced related medical psychological, relationship, and legal problems. Mindfulness skills have been shown to help people identify relapse triggers, increase tolerance for difficult emotions, and prevent relapse by reducing stress. (Garland, Gaylord, Boettiger & Howard, 2010, Bowen et al., 2014).

### *Mindfulness and Smoking*

Smoking is an addiction affecting mental and physical health. Motivation for smoking cessation comes from removing discomfort (Weiss de Souza et al., 2015). Craving and negative affect are key symptoms that require attention in overcoming addiction relapses. This systematic review of smoking assessed 13 controlled studies published from 2002 to 2015. The mindfulness-based stress reduction (MBSR) treatment program included one 2-hour group session per week, for 8 consecutive weeks. Meditation techniques were taught such as sitting and walking meditation, body scan and yoga. Studies in the review found a greater decrease in number of cigarettes smoked in the intervention group compared to the control group at the end of treatment. All but one of the studies showed the decrease to be sustained at follow up. A significant result in this review was that systematic meditation training is required to increase mindfulness. Also, a holistic mindfulness-based program was needed - one which is practiced on a daily basis. Overall, the review found positive effects of MBIs for craving, smoking cessation, and relapse prevention.

### *Mindfulness and Alcohol Use Disorders*

A review of mindfulness interventions in alcohol use disorders (AUD) published in 2019 analyzed 11 studies. The review included RCTs as well as non-randomized controlled studies and uncontrolled studies. Mindfulness and Acceptance and Commitment Therapy (ACT), referred to as one type of third wave therapies, was studied for possible efficacy as treatment for AUDs. Third wave therapies are a good match for treatment of AUDs because they address painful emotions, which are the basis for prolonged AUDs. AUDs have high rates of relapse and are difficult to treat. Individuals often cease participation in treatments, which makes a treatment like mindfulness appealing. Studies find individuals are responsive to mindfulness-based interventions (Byrne et al, 2019). Still, few studies have been conducted to test the effectiveness of mindfulness as a treatment for AUDs, and those studies have involved small sample sizes and limited follow-up.

While studies and reviews have been conducted in the areas of SUDs, smoking and AUDs, very little is known regarding mindfulness based interventions and OUDs. The purpose of this systematic review is to assess what is known about the effectiveness of mindfulness therapies as an intervention for opioid use disorders.

## **Methods**

### *Data Sources and Searches*

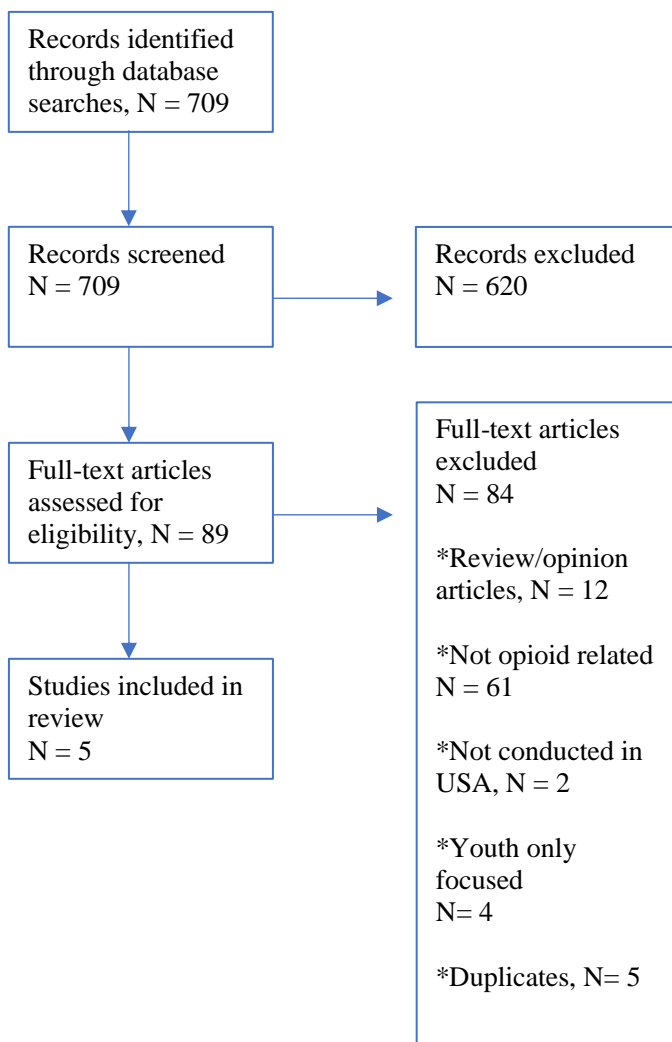
The initial literature search utilized the PubMed and NCBI databases. Search keywords included combinations of: meditation, mindfulness, opioid, OUD, MBI, trials, and pain. Manual searches

were then performed through eJournal databases by journal title to review articles referenced by, or included in the bibliography of, key informative articles related to the topic. No publish date restriction was used. Searches were limited to English language publications.

*Study Selection*

Since there is limited published information in peer-reviewed journals about the efficacy of MBI related to OUD, all types of studies were considered. Articles that analyzed data from trials were also included if they met the inclusion criteria. Abstracts were reviewed if they met the criteria of the topic and included both opioid use disorders and a form of mindfulness in the abstract. If abstracts met the following criteria, the full-text was assessed for eligibility into the review: (1) a trial was discussed in detail and all aspects of the trial were presented, (2) population in trial was made up of adults (participants greater than 18 years of age), and (3) the trial was conducted in the United States. Duplicate articles were excluded. For articles which were similar to one another, the single most applicable abstract was chosen for full review and considered for inclusion. Figure 1 delineates the search and exclusion process.

Fig. 1. PRISMA flow diagram.



### *Data Extraction*

The data extracted from each study included the sample size, characteristics of the sample, treatment of samples, measurement tools, frequency of measurements taken, change reported by measurement tools, and the results reported by study authors. These data are summarized in Table 1.

Table 1. Characteristics and Findings of Included Studies

<i>Study (Year)</i>	<i>Sample Size (n)</i>	<i>Characteristics of Sample</i>	<i>Treatment</i>	<i>Measurement Tools</i>	<i>Measurements Taken</i>	<i>Results</i>	<i>Change Measurements: Mean (Standard Deviation)</i>	<i>Quality Score</i>
<i>Garland et al. (2014)</i>	115	<i>Opioid-treated chronic pain patients; patients of primary care clinics, pain clinics or neurology clinics in Tallahassee, FL; taking prescribed opioid analgesics for at least 5 days/week for past 90 days or more; Age 20-84; Females = 78 (68%), Males = 37(32%); 65% Caucasian, 19% African American, 3% American Indian, 13% Other/Not Responded</i>	<i>1 session/week for 8 weeks of Mindfulness-Oriented Recovery Enhancement (MORE), 2 hours each session, [Control Support Group for 8 weeks; 15-minutes daily home journaling]; daily home guided sessions; mindful breathing prior to medication dosing;</i>	<i>Current Opioid Misuse Measure (COMM), Brief Pain Inventory (BPI), Five Facet Mindfulness Questionnaire (FFMQ), Cognitive Emotional Regulation Questionnaire (CERQ), Calgary Symptoms of Stress Inventory (C-SOSI)</i>	<i>Before treatment, after treatment, 3-month follow up</i>	<i>MORE participants had: reduction in pain severity, increased non-reactivity and reinterpretation of pain sensations; Significantly less stress arousal; Significantly less desire for opioids; Significantly more likely to no longer meet criteria for OUD</i>	<i>Number of individuals with score of 13 or greater on COMM MORE:17.19(7.9) baseline; 11.27 (7.67) post-treatment; 16.44 (8.28) follow-up GP:18.62 (11.24) baseline; 15.68 (9.56) post-treatment; 16.44 (8.28) follow-up</i>	26
<i>Bowen et al. (2017)</i>	15	<i>Methadone Maintenance therapy (MMT) clinic patients; Staff = 5, Clients = 10; Ages 27-65; Female=10 (67%),</i>	<i>1 session/week for 6 weeks, 2 hours each session; each session included a check-in,</i>	<i>Beck Depression Inventory-II, Beck Anxiety Inventory, Penn Alcohol Craving Scale</i>	<i>Before treatment and after treatment</i>	<i>Statistical significance change in depression, craving, trauma symptoms; Feasibility and acceptability shown</i>		21

		<i>Male = 5(33%); 93% Caucasian, 7% Native American;</i>	<i>formal and informal practice, and discussion; home practice assignments</i>	<i>(Adapted), Post-Traumatic Stress Disorder Checklist – Civilian, Acceptance and Action Questionnaire (AAQ), Overall Course Satisfaction Survey (OCSS)</i>				
<i>Priddy et al. (2018)</i>	<i>115</i>	<i>Opioid-treated chronic pain patients; patients of primary care clinics, pain clinics or neurology clinics in Tallahassee, FL; taking prescribed opioid analgesics for at least 5 days/week for past 90 days or more; Age 20-84; Females = 78 (68%), Males = 37(32%)</i>	<i>N/A</i>	<i>Self-reported: Current Opioid Misuse Measure (COMM), Five Facet Mindfulness Questionnaire (FFMQ), Attention to Positive and Negative Information Scale (APNIS), Obsessive-Compulsive Drug Use Scale – Revised (OCDS-R)</i>	<i>Once, at beginning of study</i>	<i>Statistical significance indirect effect of dispositional mindfulness on opioid misuse as mediated by opioid craving; Significant association between dispositional mindfulness and opioid craving, and between opioid craving and misuse</i>	<i>COMM: 17.9 (9.7) FFMQ: 115 (16.1) OCDS-R: 11.8 (8.7)</i>	<i>25</i>

Priddy et al. (2018)	141	Opioid-treated chronic pain patients; Utah, USA; taking prescribed opioid analgesics for at least 5 days/week for past 90 days or more; Age 28-64; Female = 94 (67%), Male = 47 (33%);	N/A	Self-reported: Current Opioid Misuse Measure (COMM), Five Facet Mindfulness Questionnaire (FFMQ), Attention to Positive and Negative Information Scale (APNIS), Visual Analogue Scales (VAS) – for craving	Once, at beginning of study	Significant association between dispositional mindfulness and attention to positive information; significant negative association between attention to positive information and opioid misuse; statistically significant indirect effect of dispositional mindfulness on opioid misuse, mediated by attention to positive information	COMM: 14.6 (9.0) FFMQ: 127 (20.7) API section of APNIS: 42.4 (6.9)	25
Priddy et al. (2018)	44	Opioid-treated chronic pain patients of military hospital specialty pain clinics, a substance abuse treatment program, and primary care clinics; Military service members (Army) in Intermountain West USA; taking prescribed opioid analgesics for at least 5 days/week for past 90 days or more;	N/A	Self-reported: Current Opioid Misuse Measure (COMM), Five Facet Mindfulness Questionnaire (FFMQ), Attention to Positive and Negative Information Scale (APNIS), Visual	Once, at beginning of study	Association between dispositional mindfulness and opioid craving was not statistically significant; Significant, positive association between dispositional mindfulness and attention to positive information; Significant, negative association between attention to positive information and opioid misuse scores	COMM: 11.4 (6.9) FFMQ: 124.3 (16.7) API section of APNIS: 43.5 (6.2) VAS: 19.3 (18.5)	24

		<i>Age 23-41; Males = 39 (89%), Females = 5 (11%); average 9.95 years in military; deployed</i>		<i>Analogue Scales (VAS)</i>				
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## Results

Of the five studies reviewed, one was a randomized controlled trial, one was a feasibility trial, and the last three studies were published in a single article as a cross-sectional analysis. These three studies are being treated as three separate studies in this review because they were conducted separately by different researchers with three different sample groups. In this review, the three studies will be referred to as Priddy 115, Priddy 141 and Priddy 44, referencing the article's first author and the size of the sample used in each study.

### *Characteristics of Samples*

Sample sizes of the studies ranged from 15 to 141 participants. In four of the five studies the sample's participants were all opioid-treated chronic pain patients taking prescribed opioid analgesics for at least 5 days per week for the at least the past 90 days. In the fifth study participants were patients receiving Methadone Maintenance Therapy (MMT) in a clinic. This study and included 5 clinic staff which may or may not have previously received MMT. The opioid-treated chronic pain patients were recruited from primary care clinics, pain clinics, substance abuse treatment programs, and neurology clinics. Extracted health record data for the cross-sectional analysis was obtained through the same types of sources.

The age ranges of the studies were between the twenties to mid-sixties or mid-eighties. One conducted in military personal was the exception, with ages ranging from 23 to 41. The military sample also stood out by including a much smaller percentage of females (11%). The other four studies were female majority samples. All participants in this study had been deployed for active military duty.

The randomized controlled trial and the feasibility trial reported races of the samples. The majority of both samples were Caucasian, with a small percentage of those two samples identifying as African American, Native American, or Other.

### *Treatment*

Treatment in the randomized controlled trial and the feasibility trial consisted of weekly mindfulness group sessions. The randomized controlled trial held 8 consecutive weekly group sessions of two hours each. The program was Mindfulness-Oriented Recovery Enhancement (MORE), with components of daily home guided sessions and use of mindful breathing techniques before each medication dose, in addition to the group sessions. The control group attended 8 consecutive weekly group sessions, two hours each, as a support group. The difference in the two group sessions (treatment vs. control) was the facilitator in the support group used reflective listening techniques but did not make recommendations for change. In addition, 15-minutes of home journaling was part of the control group's program.

The feasibility trial treatment consisted of a 2-hour group session once a week for 6 consecutive weeks. These sessions included check-in, a formal and informal mindfulness practice, a group discussion, and assigned home practice.

### *Measurement*

In the randomized controlled trial, Brief Pain Inventory (BPI), Five Facet Mindfulness Questionnaire (FFMQ), Cognitive Emotional Regulation Questionnaire (CERQ), Calgary Symptoms of Stress Inventory (C-SOSI) and Current Opioid Misuse Measure (COMM) were used as measurement tools. A COMM score of 9 or greater indicates prescription opioid misuse. The other measurement tools were used to assess changes on the scales of the tools between each measurement. Measurements were taken before treatment, after treatment, and at 3-month follow up. The feasibility trial used Beck Depression Inventory-II, Beck Anxiety Inventory, Penn Alcohol Craving Scale (Adapted), Post-Traumatic Stress Disorder Checklist-Civilian, Acceptance and Action Questionnaire (AAQ), and Overall Course Satisfaction Survey (OCSS) to measure the sample before and after treatment.

The three studies in the cross-sectional analysis used a variety of assessment tools to analyze data from each sample. The tools were all self-reported and provided to participants to measure at one point in time. Measurement tools used in all studies were: Current Opioid Misuse Measure (COMM), Five Facet Mindfulness Questionnaire (FFMQ), and Attention to Positive and Negative Information Scale (APNIS). Additionally, in Priddy 115, Obsessive-Compulsive Drug Use Scale – Revised (OCDS-R) was also used, to measure craving. In Priddy 141 and Priddy 44, Visual Analogue Scales (VAS) was used to measure craving.

### *Quality Assessment*

Quality of the studies was scored using the Downs and Black checklist tool. The 27-question tool utilizes “yes” or “no” answers in five sections, scoring for study quality on a scale of 28 possible points. The scale (1-28) is used to indicate low to high quality. A score of 28 being the highest quality. The sections include study quality, external validity, study bias, confounding and selection bias, and power of the study.

The lowest scoring study with a score of 21 was the feasibility study, due to weaknesses in reporting, external validity and internal validity. The three cross-sectional studies scored between 24-25. The highest scoring study was the RCT with a score of 26.

### *Results*

Mindfulness-Orientation Recovery Enhancement (MORE) participants reported significantly greater reduction in pain severity, increased non-reactivity and reinterpretation of pain sensations, compared to the controlled Support Group (SG) participants, at both time intervals (immediately after treatment and at the 3-month follow up). MORE participants also reported significantly less stress arousal and less desire for opioids than the SG participants immediately after treatment. These last two results were not sustained at the 3-month follow up assessment. Additionally, those in the MORE treatment group were significantly more likely to no longer meet criteria for OUD immediately after treatment (Garland, et al., 2014).

Mindfulness-based relapse prevention showed a statistically significant change in depression, craving and trauma symptoms. Feasibility and acceptability of MBRP was also indicated through the Bowen trial.

Within the three Priddy studies, a significant association was found between dispositional mindfulness measured using the total score of FFMQ and attention to positive information from API on the APNIS (Priddy 141 & Priddy 44); and opioid craving and misuse (Priddy 115). While a significant association for dispositional mindfulness and opioid craving was found in Priddy 115, Priddy 44 did not show a similarly statistically significance difference.

Priddy 115 found a statistically significant indirect effect of dispositional mindfulness on opioid misuse as mediated by opioid craving. Priddy 141 showed statistically significant indirect effect of dispositional mindfulness on opioid misuse and mediated by attention to positive information. In two samples with heterogeneous participants, a significant negative association between attention to positive information and opioid misuse (Priddy 44 & Priddy 141) was shown.

## **Discussion**

In the mixed methods study (Bowen et al., 2017) the sample size was small (n=15). In addition, the study included clinic staff (n=5) within the sample, leaving a smaller sample of actual clients (n=10). While the staff is helpful in facilitating recruitment of clients and recommending clearance for participants, it is unclear if the staff included in the sample were previous clients themselves. The rationale for including staff within the study sample is not clear and may have biased the results. In addition, poor retention (57% session attendance) of participants further limits what conclusions can be drawn from this study. 10 participants attended the first session, and 7 of the 15 participants completed the post-course assessment. This study noted a change in depression and craving, which is an important finding as craving is a key factor which promotes the development of addiction and opioid use (Priddy et al., 2018). Yet, the findings are weak due to the limited retention of participants in the study and the small sample size.

In the three studies which analyzed data of three separate samples (Priddy et al., 2018), it is difficult to assess the validity of the analysis as the types of treatments were not discussed and measurement of treatment was not reported. Specific information of how many sessions of mediation occurred and the duration of each session is needed for further analysis. The data also is completely self-reported.

As mentioned in the Priddy 44 study, the influence of possible negative consequences for reporting may have skewed reporting among the military sample. The other possible influence upon this sample may have been variable of sex. This sample is the only one of the five studied, which has a majority male. This variable may also affect the self-reported data. Yet, as the highest affected population within the United States for Opioid prescription misuse is reported as Caucasian males age 18-34 (CDC, 2018), the Priddy 44 sample may contain the most indicative findings among the five studies within this review. This study is also the single source which reported a lack of association between dispositional mindfulness and opioid craving. While a sensitivity analyses did not show sex as a moderator, craving is key in addiction and should be further studied in the context of OUD to resolve the conflicting findings.

All studies in this review concluded mindfulness may be an effective treatment - or a protective factor - to prevent opioid misuse among chronic pain patients. All study authors also suggested that additional research is needed as information in the area is limited. The first, and only

completed trial, listed in the ClinicalTrials.gov database on mindfulness as a treatment for opioid use disorders was in 2011 - less than 10 trials have been conducted since then. Further studies on mindfulness and opioid use disorders may deepen our understanding of can benefit from MBIs and how much is needed to deliver reduction in chronic pain and OUDs.

#### *Limitations of this Review*

Two of the three publications reviewed included Eric L. Garland as an author. While only one of those two publications listed EG as first author, this may bias the weight the review places on some conclusions.

The characteristics of populations of the data in this review were not necessarily reflective of the characteristics of the majority of the opioid using population in the United States of America. The data included studies which were mostly majority female, while the OUD population in the USA is majority male. This difference may have an effect on the findings of this review.

#### *Conclusions*

The studies in this review find mindfulness based interventions, delivered in a variety of forms and to a variety of populations, may be beneficial for many of the clinical issues in OUD. With craving and insensitivity to natural rewards being important factors with developing OUD and addiction, these two areas should be focused more deeply with additional, larger samples for further understanding. Additionally, measurement tools should be further developed to better assess changes in study participants. Preferably, studies conducted which remove self-reporting bias.

It is recommended that research is conducted on the most affected population of males age 18-34 to make the greatest impact in fighting the opioid crisis. Finding the most effective dosage of mindfulness based interventions, most accepted forms of MBI, and how to maintain the changes with treatment need to be explored. As the number of lives the opioid crisis continues to claim rises each year in the United States, developing non-drug treatments for OUDs needs to be an immediate priority for research.

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