The Effectiveness of EMDR With Individuals Experiencing Substance Use Disorder: A Meta-Analysis

Elizabeth Logsdon
Jeffrey H. D. Cornelius-White
Missouri State University, Springfield, MO, USA

Yasuko Kanamori
University of Memphis, Memphis, TN, USA
Missouri State University, Springfield, MO, USA

The current meta-analysis aims to synthesize existing studies on the effectiveness of both trauma-focused and addiction-focused eye movement desensitization and reprocessing (EMDR) for people with substance use disorder (SUD). Search and selection procedures involved screening 1,733 references, yielding 10 studies published between 2008 and 2021 from 8 countries with 561 participants. After the removal of one outlier study, the results showed EMDR to be effective on a variety of outcomes for people with SUD ($n = 9$, $d = .654$, 95% CI [.332, .985], $p < .001$). Regarding the effects on SUD outcomes, meta-analysis also showed EMDR to be effective ($n = 7$, $d = .580$, 95% CI [.209, .951], $p = .002$). Specifically, EMDR was effective with SUD treatment engagement and severity, but not necessarily the reduction of cravings, and also effective for reducing comorbid posttraumatic and depressive symptoms. This meta-analysis is limited by the number of studies and participants, heterogeneity in methods of included studies, the quality of studies, and other factors.

Keywords: eye movement desensitization reprocessing (EMDR); posttraumatic stress disorder (PTSD); substance use disorder (SUD); depression; meta-analysis

Substance use disorder (SUD) affects an estimated 20.3 million adults in the United States and has severe consequences, such as death, family dysfunction, and chronic medical conditions (Palumbo et al., 2020). According to the Substance Abuse and Mental Health Services Administration (2022), SUD occurs when an individual continues to use substances or alcohol despite harmful consequences and significant impairment to their health, ability, and work-, home-, or school-related responsibilities. The diagnosis of SUD is based on pathological patterns of behavior related to use and is often accompanied by underlying changes in brain circuits and neural networks, often demonstrated through relapse patterns or strong cravings when presented with drug stimuli (DSM-5; American Psychiatric Association [APA], 2013). The research has indicated some gender differences related to SUD, such as men more frequently having the diagnosis at various ages, though both genders are equally likely to develop SUD. Some studies have also indicated that women are more at risk to experience stronger craving and more frequent relapse to physical substance use (National Institute on Drug Abuse [NIDA], 2020b).

It is common for individuals who have SUD to also have other mental health diagnoses. Factors contributing to the development of disorders comorbid to SUD include common risk factors (environment, genetics, and early exposure to trauma and stress) and self-medication (NIDA, 2020a). Previous research has shown that SUD has high comorbidity rates with posttraumatic stress disorder (PTSD; McCauley et al., 2012; NIDA, 2020a) with rates ranging from 34.4% (Mills et al., 2006) to 46.4% (Piertrzak et al.,

 http://dx.doi.org/10.1891/EMDR-2022-0046

2011). Previous research has also shown that the co-occurrence of PTSD and SUD is associated with worsening of psychopathological severity and depressive symptoms, which raises the value of research, evaluation, and integration of treatment options for this particular population (Tapia, 2019).

EMDR therapy, developed by Francine Shapiro in 1989, is well known for its use in treating trauma and PTSD. In short, EMDR takes a bottom-up approach to calm the limbic system in a three-pronged, adaptive information processing method, which addresses the past, present, and future experiences. Substantial empirical evidence has been garnered over the years supporting the effectiveness of EMDR for the treatment of a variety of mental and physical health disorders/symptoms, including pain, anxiety, mood, somatoform, and personality and sexual disorders (Scelles & Bulnes, 2021), but especially for PTSD and depressive symptoms (Carletto et al., 2021; Chen et al., 2014; Davidson & Parker, 2001; Sepehry et al., 2021).

Specifically, Davidson and Parker's (2001) seminal work with 34 studies found that EMDR, when compared with no treatment or pretreatment status, demonstrated positive client processes and outcomes with regard to posttraumatic stress and depressive symptoms with an effect size of $r = .40$ ($d = .87$) when compared to nonspecific therapies. However, they did not find specific effects of EMDR compared with other exposure therapies, suggesting that exposure may be the operative element. Similarly, Chen et al. (2014) conducted a meta-analysis of 26 randomized controlled trials of EMDR for patients with PTSD and found an effect size of $g = 0.66$ for PTSD symptoms, $g = 0.64$ for depression symptoms, and $g = .95$ for subjective distress. Most potential moderators (age, treatment duration, publication year, and sample size) in this study did not explain the heterogeneity found in the studies, further supporting the effectiveness of EMDR in reducing examined symptoms and outcomes. More recently, Sepehry et al. (2021) meta-analyzed existing studies on the use of EMDR for the treatment of depressive symptoms. Removing two outliers from their sample of 39 studies (1,738 total participants), they reported an effect size of $g = 0.70$. Carletto et al. (2021) also meta-analyzed EMDR related to depressive symptoms with nine studies (373 total participants) and found an effect size of $g = 1.07$. Valiente-Gómez et al. (2017) conducted a review of EMDR use for conditions comorbid with PTSD, which indicated a partial symptomatic improvement of the primary disorder.

Strong evidence for the effectiveness of EMDR in the treatment of PTSD and depressive symptoms as reviewed above has raised curiosity among providers and researchers in the field of addiction, resulting in emerging research in the field (Markus et al., 2015; Markus & Hornsveld, 2017). For example, Abel and O'Brien (2010) and Qurishi et al. (2017) conducted single-subject case studies with those struggling with SUD. More recently, Van Minnen et al. (2020) conducted a multiple-baseline design study with eight participants diagnosed with gambling disorder, whereas Markus et al. (2019) conducted a four-participant feasibility study with alcohol use disorder. Additionally, due to the high comorbidity rate of PTSD and SUD, the practice of using EMDR with SUD has been evaluated in conjunction with its use in the treatment of PTSD (Palumbo et al., 2020; Tapia, 2019; Wise & Marich, 2016). Overall, these studies likely showed tolerability of EMDR as a treatment and its potential effectiveness in reducing symptoms associated with the examined addiction-related disorders. While the exact mechanism through which EMDR works to reduce addictive behaviors and related outcomes are unclear, one recent work found that EMDR can alter a client's dysfunctional belief/attitudes and help develop a sense of self-worth while improving self-regulation (Virrey & Dominiques, 2021). This finding coupled with earlier findings seems to provide preliminary support to Shapiro et al.'s (1994) assertion that EMDR could successfully facilitate addiction recovery and improve the lives of those struggling with addiction. This emerging evidence holds significance for those involved in the field of addiction treatment, given the known negative consequences associated with substance use as described previously.

As seen earlier, overall the existing research seems to suggest that using EMDR with individuals with SUD can have therapeutic potential (Markus & Hornsveld, 2019; Pilz et al., 2017; Scelles & Bulnes, 2021). Nevertheless, to the authors' knowledge, there are no meta-analyses specifically related to EMDR and SUD. The purpose of this meta-analysis, therefore, was to examine the research literature to assess the effectiveness of EMDR for individuals diagnosed with SUD. Specifically, the following research questions were addressed:

1. What is the overall effectiveness of EMDR for people with SUD (considering all therapeutic outcomes)?
2. What is the effectiveness of EMDR for SUD-specific outcomes, such as severity/relapse, substance use cravings, substance use treatment engagement (attendance, motivation, and completion), and lasting effects (as seen in follow-up studies)?
3. What is the effectiveness of EMDR for people with SUD concerning their PTSD and depressive symptoms?

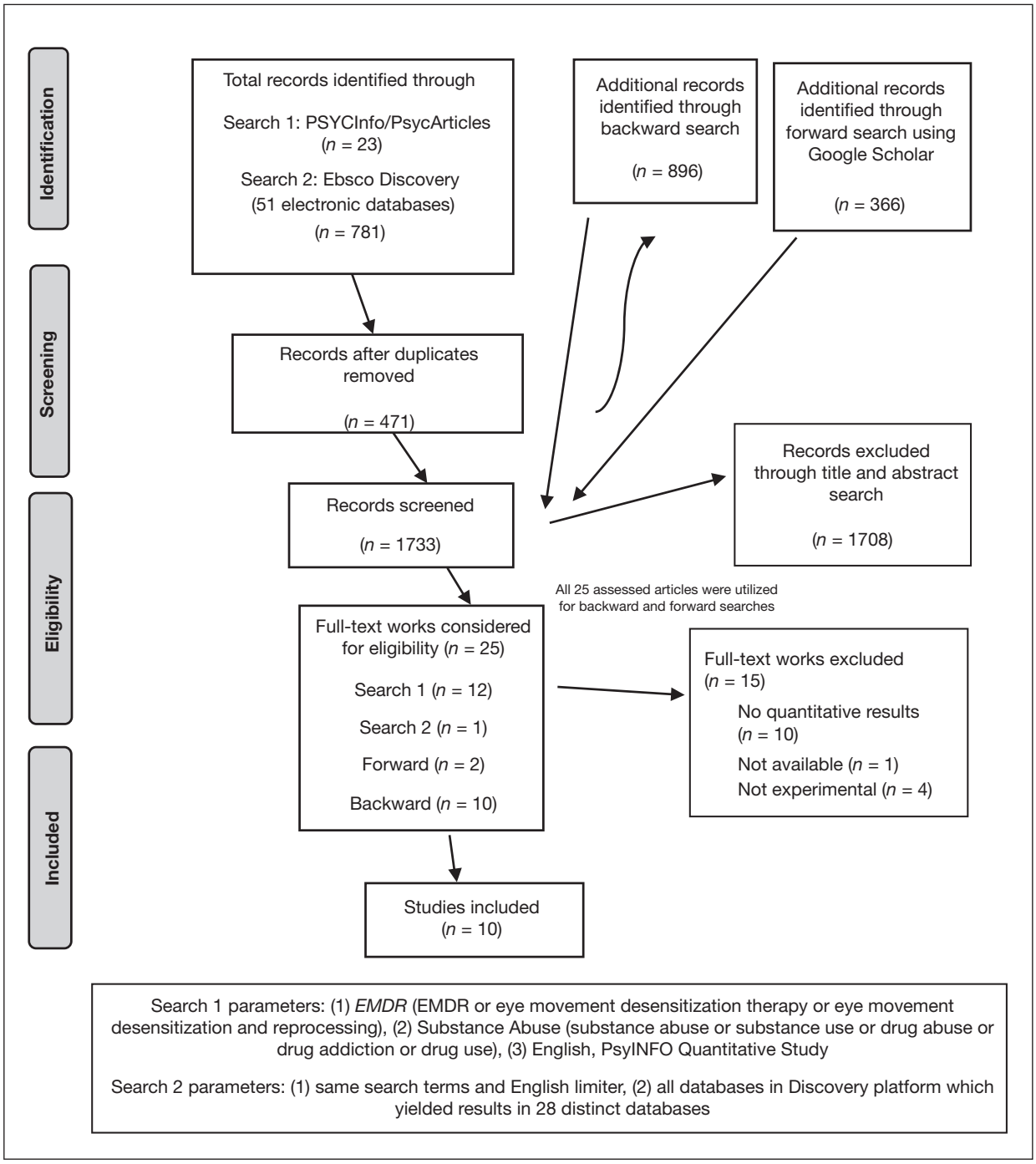

Figure 1. PRISMA flow diagram of search procedure.

Methods

Search and Selection

Figure 1 presents the PRISMA Flow Diagram. Researchers conducted two initial searches with PsycINFO/PsycArticles and the EBSCO Discovery platform, which involved 51 databases. Search 1 utilized PsycINFO/PsycArticles with the following parameters: EMDR (EMDR OR eye movement desensitization therapy OR eye movement desensitization and reprocessing); Substance Abuse (substance abuse OR substance use OR drug abuse OR drug addiction OR drug use); and English and Quantitative Study as delimiters. Search 2 was conducted using the EBSCO Discovery platform with the same search terms as search 1 with English as a delimiter. The Discovery databases generating the greatest number of results were Academic Search Complete,

Complementary Index BASE, and Medline, but results came from 51 separate databases.

Search 1 yielded 23 articles, and search 2 yielded 781 articles. After duplicates were removed, these two searches yielded 471 articles. The researchers then employed a forward and backward search. The backward search involved screening references of the included studies, which yielded 896 additional records. The forward search used Google Scholar to screen citations to the included studies, which yielded 366 additional references, producing a total of 1,733 screened records. A total of 1,708 records were excluded through title and abstract search, resulting in 25 works for full-text consideration. A vast majority of the 1,708 records were not studies and thereby could be excluded quickly. When a work might be a study based on its title or abstract (if available), the researchers skimmed available materials to determine whether it was a study, and if so, it might meet the inclusion criteria. Of the highly promising 25 full-text works considered for eligibility, 15 were excluded as seen in the PRISMA flow diagram, leaving a total of 10 studies to include in the meta-analysis.

Inclusion and Exclusion Criteria

The included studies consisted of those that experimentally evaluated EMDR with individuals with SUD. More specifically, the researchers included studies of people with SUD receiving EMDR in the meta-analysis if they (a) had an experimental or quasiexperimental design with control groups, (b) were published in English, (c) had a measure of outcome that involved SUD, PTSD, depressive symptoms, or other mental health outcomes that were not just feasibility or protocol-only studies, and (d) were available through online and interlibrary loan searches as well as through contacting study authors directly. Studies on behavioral addictions, such as gambling, internet disorder, or compulsive eating, were excluded as the focus was only on people with SUD.

Data Extraction

After skimming the studies and an initial pilot data extraction from two studies to develop coding procedures, two researchers independently coded the studies for the variables of interest: first author, year, publication venue, design classification, total sample size, sample size for each group and measure, sample age, proportion of male participants, other sample characteristics, study location by country, treatment description, number of EMDR sessions, dependent variables, and effect size information. For effect sizes, coders merely noted the location of the information in the papers when multiple potential sources of information for effect size calculations were available in a study. For example, sometimes results were given as percentages without a chi-square calculation; means and standard deviations were given at multiple time points; multiple *t*-test or ANOVA results were given over time, between groups, or at follow-ups; or other information was provided in an inconsistent manner. Therefore, only one researcher performed effect-size calculations. This process was conducted in consultation with the other two researchers who gave input on decisions where the provided information in the studies was ambiguous. Ultimately, to answer the main research question, one study-level effect size was extracted from each study by averaging effects where more than one was given (Berkeljon & Baldwin, 2009). Likewise, one effect size was extracted for each outcome specific to the dependent variable category explored in research questions 2 and 3.

Data Analysis

The researchers used the Cochran Risk of Bias-2 (Sterne et al., 2019) as a measure of study quality. The RoB-2 assesses the level of risk in five specific categories of the sources of bias arising from 1) the randomization process, 2) deviations from the intended intervention, 3) missing outcome data, 4) measurement of outcome, and 5) selection of the reported results. Each category is evaluated using three judgement options of the risk of bias (high, some concerns, low) based on signaling questions in each category. The overall risk of bias is then evaluated considering the results in separate categories and a holistic view of the study. Typically, if any category has a high risk of bias or there are several categories with some concerns, the study overall has a high risk of bias. If all areas are assessed to have a low risk of bias, then the study has a low risk. If a study only has few categories with some concerns, the overall study is deemed as having some concerns.

In terms of statistical analyses, descriptive statistics were first calculated to provide the basic frequency information on the coded variables to aid in the description and critique of the reviewed literature and resultant meta-analysis. Meta-analytic procedures were used to answer the research questions concerning the effectiveness of EMDR for individuals with SUD. Specifically, the Campbell Collaboration effect size calculator (Wilson, n.d.) was used to convert all

effect sizes into a common metric of Hedges' *d* and calculate variances prior to running the analyses. The researchers then used the random effects model to compute the weighted mean effect size (Lipsey & Wilson, 2001), correcting for sample size variation by weighting the studies proportional to their inverse variances (Hedges & Olkin, 1985). Hedges' *d* was the chosen effect size indicator, and the following benchmarks were used as a guide to interpret the effect size estimates: values near 0.2 for a small effect size, between 0.5 and 0.8 for medium effect size, and greater than 0.8 for large effect sizes (Cohen, 1988).

Several tests and plots were used to assess the variability and potential for publication bias in the sample of studies. Homogeneity tests, 95% confidence intervals, and forest plots were used to assess the effect size variability. Specifically, these methods assessed the likelihood that the studies were part of the same distribution and whether potential moderators might explain the differences in effect sizes. Funnel plots and trim-and-fill analysis were utilized to assess the publication bias, which typically requires near 10 studies. Funnel plots show the effect sizes on the x-axis, the weight of each study through the inverse of the variance on the y-axis, and a 95% confidence interval (the funnel) for the expected distribution of studies. When studies fall outside of the funnel, this indicates that the study may not be part of the same distribution as the other studies or may represent publication bias. Trim-and-fill analysis provides an imputation of missing studies that would realign the distribution to be symmetrical as a hypothetical distribution with imputed (i.e., "missing") studies that would correct the overall effect size and confidence interval had they been "found" (Shi & Lin, 2019). All analyses were conducted in SPSS 28.0.

Results

Descriptive Results

Table 1 presents basic information on the sample of studies, including first author, year of publication, assessment of study quality using the RoB-2 (Sterne et al., 2019), total sample size, diagnoses of participants in each sample, inpatient or outpatient status of participants, country from which the study originated, outcomes measured, and average effect sizes extracted from the studies.

The researchers reviewed 10 studies conducted from 2008 to 2021 with mean publication year of 2015. Sample sizes varied across studies, ranging from 12 to 112, with an average of 57.33 and a total of 561 participants. All studies had a sample of people with SUD and some included or excluded certain people with comorbid conditions. The study settings were evenly divided between inpatient or outpatient status: three studies included inpatients, four studies included outpatients (including two in a university lab setting), and three studies included both inpatient and outpatient settings. Studies were conducted in eight countries in Europe, Asia, and Australia, including three from the Netherlands and two from the United States.

The researchers utilized the Cochran Risk of Bias-2 (RoB-2; Sterne et al., 2019) to assess the study quality. Seven of the ten experiments had high risk of bias. The most common risk of bias arose from the randomization process as three studies did not randomize participants (Brown et al., 2015; Carletto et al., 2018; Habibović et al., 2021), and others provided evidence that the randomization process resulted in differences between the experimental and the control group, which is more likely to occur with small sample sizes (common in this sample of studies). Markus et al. (2016) and Littell et al. (2016) were at high risk of showing biased results for the purpose of this meta-analysis as they deviated significantly from regular EMDR. Specifically, they were laboratory studies providing only one session of EMDR to participants and focused on addiction rather than trauma memories. One study, Bonab et al. (2012), was at high risk of bias in multiple ways. First, the study used an outcome measure distinct from any other studies in the sample, namely, only emotion regulation and recognition. It is plausible that the effects of EMDR on these narrow outcomes might be more pronounced, but these outcomes were not appreciably similar to the other studies to be deemed an appropriate measure of SUD outcomes or comorbid symptoms of PTSD, depression, or overall mental health, which were the foci of the meta-analysis. Bonab et al. (2012) were measuring the effects of EMDR on an appreciably different outcome. Second, there was a problem in the randomization as there was evidence that the experimental group showed higher pathology, making it more likely to show a positive effect of treatment. Bonab (2012) also has an older publication date and a sample size smaller than the mean, suggesting more likelihood of positive result bias (Egger et al., 1997).

A review of the outcome measures in the studies suggested the following six categories: (a) SUD severity (most often addiction severity index or relapse), (b) SUD cravings, (c) PTSD symptoms (most often a version of the PTSD checklist), (d) treatment engagement (motivation, attendance, completion), (e) depressive symptoms (most often the Beck Depression Inventory-II), and

TABLE 1. Sample of Studies

First author	Year	Sample size	Sample diagnostic descriptors	Inpatient/ outpatient	Country	Risk of bias-2	Outcomes measured[a]	Follow-up	Hedge's *d*
Bonab	2012	30	Addicted individuals with traumatic experiences	Inpatient	Iran	High	Emotion regulation and recognition	None	6.51
Brown	2015	112	Self-reported trauma and drug-court-referred SUD	Inpatient and outpatient	USA	High	Treatment engagement, SUD relapse	5 years	1.05
Carleto	2018	40	SUD without psychosis, bipolar, dementia	Inpatient and outpatient	Italy	High	Symptoms of PTSD, depression, anxiety, general mental health	None	0.75
Habibović	2021	70	Opiate addicts	Inpatient	Bosnia	High	Attendance and motivation, self-esteem	None	0.78
Hase	2008	34	Chronic alcohol dependency without multiple drug use or organic disorders	Inpatient	Germany	High	SUD cravings, SUD relapse, depressive symptoms	1 month and 6 months	1.05
Kutsukos	2021	24	Addiction and comorbid trauma	Inpatient and outpatient	USA	Some	Symptoms of PTSD, depression, anxiety, self esteem	None	0.57
Littel (Study 2)	2016	50	Smokers	Outpatient (not at clinic, but a university experiment)	Netherlands	High	SUD cravings	None	0.42
Markus	2016	47	Daily smokers	Outpatient (not at clinic, but a university experiment)	Netherlands	High	SUD cravings	1 week	0.41
Markus	2020	109	Nonsevere alcohol dependence without PTSD or severe psychiatric symptoms	Outpatient	Netherlands	Low	SUD severity, SUD cravings, positive and negative affect and effect	1 month and 6 months	0.06
Perez-Dandieu	2014	12	Met both DSM-IV SUD and PTSD with self-reported trauma	Outpatient	France	Some	SUD severity, symptoms of PTSD depression, anxiety, self esteem	None	1.99

[a]As Markus et al. (2016, 2020) presented over 30 measurements each and included supplemental files, only measures that were considered primary or secondary, subject to hypothesis testing, or that were appreciably similar to those found in other studies were included. For example, the data using the implicit association test and Stroop test or numerous subscales that were not subject to hypothesis testing were correspondingly not synthesized; though, like the primary and secondary results, the results were generally nonsignificant.

(f) other outcomes that were not appreciably similar to each other but were similar across the studies as conventional psychotherapy outcomes, such as general measures of mental health (e.g., Symptom Checklist-90), anxiety, or self-esteem. Finally, four studies also had follow-up assessments, taking place between 1 week and 5 years following treatment completion.

While not fitting within the space limitations of Table 1, additional variables from the studies were coded and analyzed. Overall, the sample was 57.55% male. The average age of the participants was 34.01 years but represented all ages of adults. The treatments varied from 1 session in a lab to up to 30 sessions in the field with an average of 9.10 sessions, a mode of 8, and a median of 6.50 sessions. All studies included an active control, not a wait-list type of control, with all but Littel et al. (2016) and Markus et al. (2016) including treatment as usual (TAU) as the active control group. The studies were evenly divided regarding the focus of the EMDR in terms of target memories, with three studies targeting traumatic memories, four studies targeting addiction memories, and three studies targeting both.

Inferential Results

Overall Effectiveness of EMDR for People With SUD. The initial meta-analysis concerned the overall effectiveness of EMDR for people with SUD (RQ1), giving an overview of how helpful EMDR is for individuals with SUD for their mental health symptoms, including but not limited to SUD symptoms. This effectiveness is typically EMDR compared to treatment-as-usual (TAU). Results showed a statistically significant, large, yet highly heterogeneous effect of EMDR for people with SUD ($n = 10$, $d = 1.21$, 95% CI [.235, 2.185], $p = .015$, $I^2 = 0.95$). An examination of the funnel plot indicated that Bonab et al. (2012) was a clear outlier, very far from the funnel on the right side. Given several unique features of Bonab et al. (2012) discussed earlier, most notably that the dependent measure was dissimilar to all other measures in the sample, it was removed from further analyses.

An analysis excluding Bonab et al. (2012) showed a significant, medium effect size with a medium degree of heterogeneity ($n = 9$, $d = .654$, 95% CI [.332, .985], $p < .001$, $I^2 = 0.53$). This was a much smaller effect size with much less heterogeneity. Figure 2 presents the funnel plot for the accepted distribution of nine studies. In this funnel plot, Markus et al. (2020) resides outside of the left side of the funnel, and Perez-Dandieu and Tapia (2014) resides just at the right side of the funnel, reflective of the remaining heterogeneity in the sample of studies and suggesting that these studies may not be part of the same distribution. It is important to note, however, that these two studies were among the higher quality studies in terms of risk of

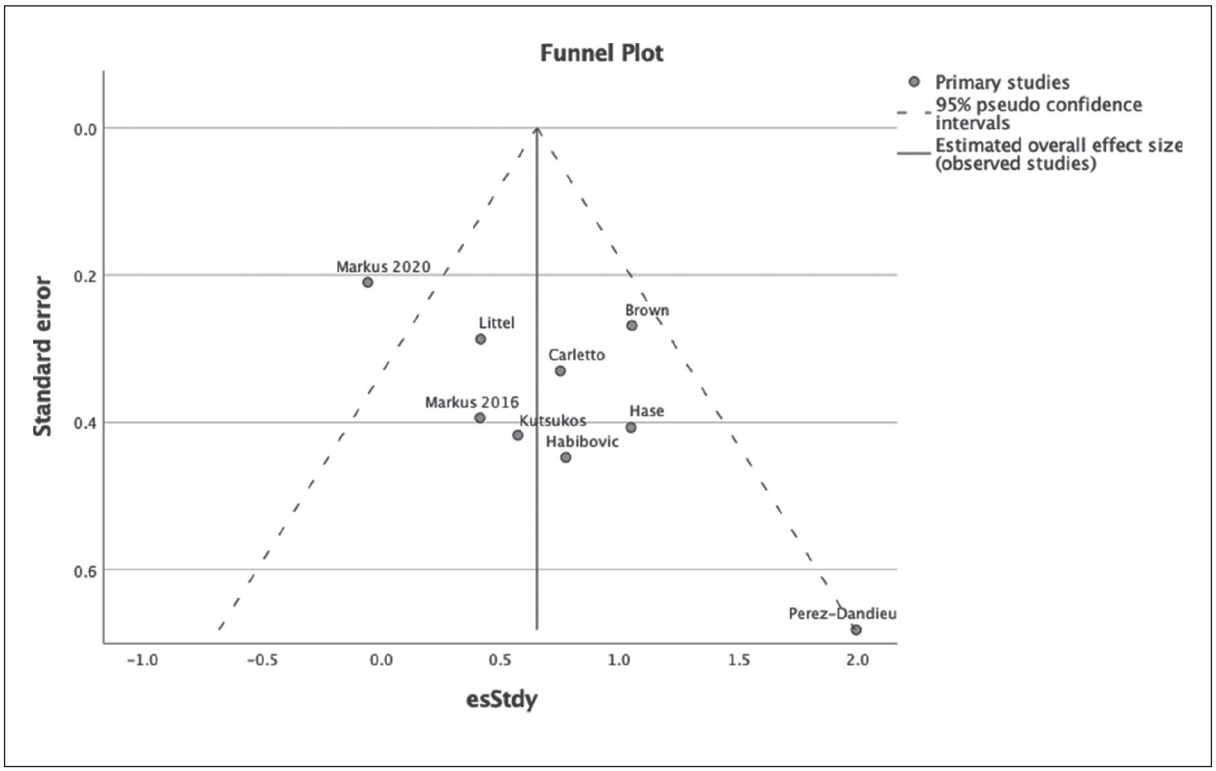

Figure 2. Funnel plot for the accepted distribution of studies on EMDR for people with SUD (n = 9).

bias on the RoB-2. Likewise, Markus et al. (2020) had the lowest standard error, indicating its larger impact on the overall effect size. In contrast, Perez-Dandieu and Tapia (2014) had only 12 people as reflected in its high standard error and its small impact on the mean effect size. Finally, the overall sample of studies is modest, limiting the utility of funnel plot analysis. In other words, this sample of studies was retained as the final distribution with significant heterogeneity.

Figure 3 shows the funnel plot based on the trim-and-fill analysis with four imputed missing studies from the left side of the hypothetical distribution, indicated by darker dots. This analysis resulted in a small, yet significant imputed effect size (n = 13, d = .370, 95% CI [.016, .725], p < .041). Therefore, even with imputed studies, the effectiveness of EMDR for people with SUD appears to be significant, if smaller in size than what was found with actual observed studies.

Given the evidence of heterogeneity (I^2 = .53), the researchers ran a moderator analysis using Wilson's SPSS Macros MetaReg to identify possible study-level variables that may impact EMDR effects. However, none of variables tested—sample size, gender, age, year of publication, memory target of EMDR, number of EMDR sessions in the treatment intervention—showed evidence for moderating EMDR effects.

Additionally, smaller meta-analyses were conducted to answer research questions 2 and 3. To answer RQ 2, separate meta-analyses were run for the effects of EMDR on the SUD-specific outcomes: severity/relapse, cravings, and treatment engagement. To answer RQ 3, separate meta-analyses were run for two other categories of common comorbid symptoms of SUD that also have EMDR meta-analytic results: PTSD and depressive symptoms.

Effectiveness of EMDR for SUD Outcomes. Overall, the results showed a medium, significant effect of EMDR on SUD-specific outcomes with a high level of heterogeneity (n = 7, d = .580, 95 % CI [.209, .951], p = .002, I^2 = .53), indicating that EMDR is useful for treating SUD outcomes. Given the heterogeneity level, the researchers examined the funnel plot, which showed Markus et al.'s (2020) study to the left near the top of the funnel. The researchers also ran a trim-and-fill analysis, which showed one imputed study but a very similar effect size, suggesting that even with publication bias accounted for in this method, the effects of EMDR on SUD-specific outcomes remain largely the same. This analysis resulted in a medium, significant imputed effect size for EMDR on SUD-specific outcomes (n = 8, d = .510, 95% CI [.159, .860], p < .004).

The results of the subsample analysis on SUD severity/relapse effects showed a small but statistically significant effect with a medium level of heterogeneity (n = 7, d = .414, 95% CI [.071, .757], p = .018, I^2 =

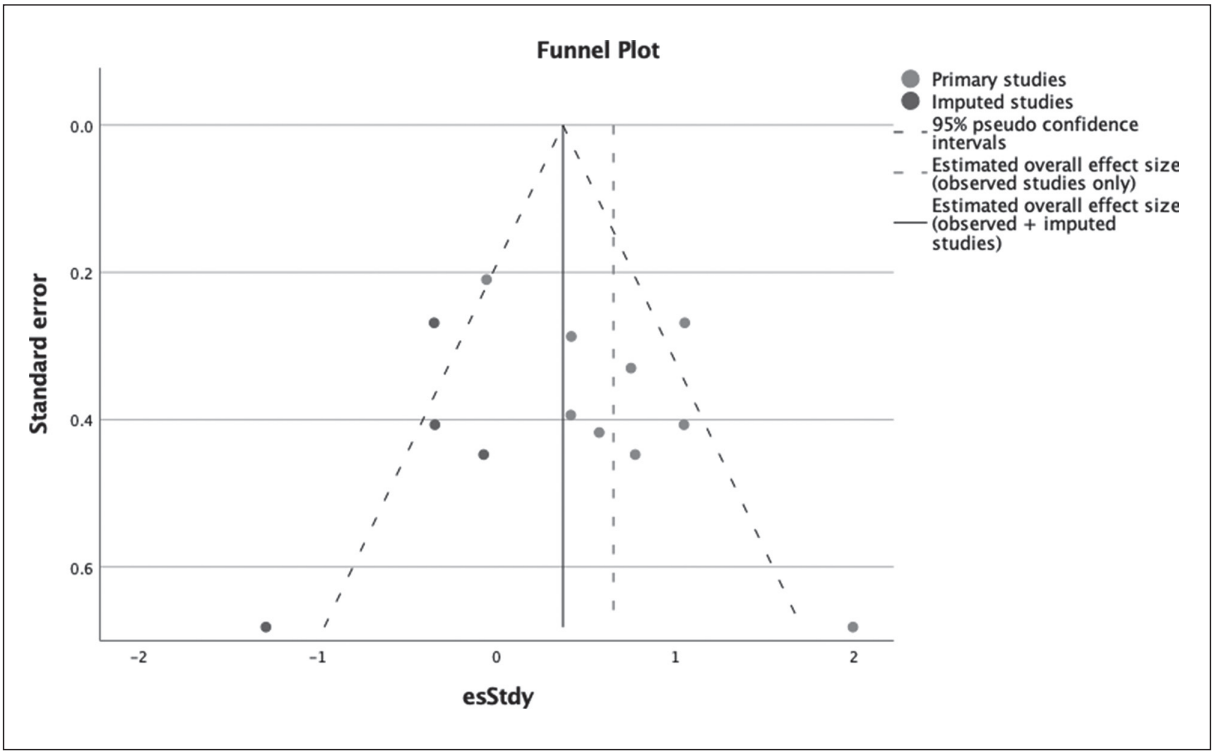

Figure 3. Funnel plot for the imputed distribution of studies on EMDR for people with SUD (n = 13).

.54). Thus, EMDR does appear to help people reduce the severity of their addiction as measured by the addiction severity index, drug testing, or reported prevention of relapse. Given the heterogeneity level, the researchers examined the funnel plot, which showed all studies inside the funnel. The researchers also ran a trim-and-fill analysis, which showed no imputed studies. Both tests suggest that the actual effect size may be accurate as concerns publication bias.

The results of the subsample analysis on substance cravings effects showed a nonsignificant, small-to-medium effect with a medium degree of heterogeneity ($n = 4$, $d = .435$, 95% CI [.110, .979], $p = .117$, $I^2 = .66$). Given the nonsignificant result coupled with the small number of studies and the level of heterogeneity, the effects of EMDR on SUD cravings cannot be assured.

The results of the subsample analysis on SUD treatment engagement effects (attendance, motivation, and completion) showed a significant, large effect with low heterogeneity ($n = 2$, $d = 1.091$, 95% CI [.595, 1.587], $p < .001$, $I^2 = .00$). While limited to only two studies, the effects of EMDR on the attendance, motivation, and completion of treatment among people with SUD appear large.

The results of the subsample analysis on follow-up effects showed a nonsignificant, medium effect with a high degree of heterogeneity ($n = 4$, $d = .445$, 95% CI [.039, .929], $p = .072$, $I^2 = .71$). Given that the confidence interval included zero and high heterogeneity was present, the lasting effects of EMDR after treatment completion for SUD cravings and severity cannot be assured.

Effectiveness of EMDR for Comorbid PTSD and Depressive Symptoms. The results of the subsample analysis on PTSD symptoms showed a significant, large, yet highly heterogeneous effect ($n = 3$, $d = 1.426$, 95% CI [.196, 2.656], $p = .023$, $I^2 = .80$). While limited to only three studies, the effectiveness of EMDR in treating PTSD symptoms for people with SUD appears large.

When looking at the subset of studies examining the effects of EMDR on depressive symptoms, the researchers found a significant, large effect ($n = 4$, $d = 0.93$, 95% CI [.040, 1.46], $p < .001$, $I^2 = .38$). The level of heterogeneity appears relatively small (< 0.50), suggesting that the studies are likely part of the same distribution. Compared to the effects on PTSD symptoms, the effectiveness of EMDR in treating depressive symptoms for people with SUD appears large.

Discussion

After the removal of a biased outlier, the present study conducted a meta-analysis of nine studies to examine the effectiveness of EMDR compared to TAU for individuals with SUD to address the lack of such an analysis in the existing literature. Overall, the results were comparable to those reported in Davidson and Parker's (2001) ($g = .87$) and Chen et al.'s (2014) ($d = .66$) meta-analyses of EMDR effectiveness, providing evidence for EMDR effectiveness over and above TAU for improving mental health outcomes for people with SUD ($d = .65$).

The analyses of SUD-specific outcomes also generally showed support for EMDR effectiveness. EMDR appeared to have a significant effect overall, and particularly, for improving SUD treatment engagement and in reducing addiction severity but not substance cravings. These findings suggest that clients with SUD generally found EMDR helpful with motivation, attendance, and completion of treatment. While the current meta-analysis excluded pure feasibility studies, the finding related to treatment motivation within the SUD-specific outcome studies parallels those reported in feasibility studies (Brown, 2015; Markus et al., 2020). The finding that EMDR is useful in reducing severity but not substance craving may be partially explained by the heterogeneity of methods across studies. A subsample analysis of the lasting effects of EMDR on SUD-specific outcomes after treatment completion (i.e., follow-up studies) also did not show significant or sizable results. This nonsignificant finding, however, could be a function of the small sample of studies and high heterogeneity related to the varied lengths of the follow-up assessments (ranging from 1 week to 5 years), again, suggesting the need for additional studies.

Similarly, analyses of the effectiveness of EMDR for comorbid PTSD and depressive symptoms among individuals with SUD showed support for its effectiveness. Of the outcomes examined in this study (including SUD-specific outcomes), the largest effects were found for reductions in symptoms of PTSD and depression. This finding is consistent with those found by Chen et al. (2014) ($d = 0.64$), Sephery et al. (2021) ($d = 0.70$), and Carletto et al. (2021) $d = 1.07$, providing additional support for the use of EMDR with those with SUD experiencing depressive and PTSD symptoms. Moreover, evidence for the high comorbidity of SUD seen in people with PTSD, ranging from 34.4% (Mills et al., 2006) to 46.4% (Piertrzak et al., 2011), makes findings from this study particularly relevant.

As with all other studies, the current study is not without limitations. First, the current meta-analysis is limited by sample size—both the number of studies included in the main and sub meta-analyses and the number of participants within those studies.

Furthermore, two studies (i.e., Little et al., 2016; Markus et al., 2019) focused on addiction imagery rather than trauma memories, altering EMDR from its original focus on trauma. Nevertheless, the processes are held constant with some key concepts as EMDR is applied into new settings with new foci. This study is additionally limited by the inclusion of only one unpublished study and the fact that the included studies were limited to those published in English. Furthermore, while the accepted distribution of studies showed much less heterogeneity than the original sample of 10 studies, the heterogeneity of the results remained high (above $I^2 = .50$). Nevertheless, the meta-analysis has been shown to be effective with as little as two studies (Ryan, 2016; Valentine et al., 2010). Likewise, despite the known limitations related to exclusions of unpublished and non-English studies, the exploration of potential publication bias through asymmetry in funnel plots and trim-and-fill analysis lends strength to the findings of EMDR to reduce SUD severity, PTSD, and depressive symptoms as well as to improve treatment engagement for people with SUD. Moreover, while the small number of studies and the heterogeneity in methods between studies limit the identification of the effects of specific types and lengths of EMDR in specific settings for specific symptoms with specific measurements, that EMDR for people with SUD still show significant effects beyond TAU is important.

The findings and limitations of the current study highlight avenues for future research. Importantly, future research is needed with larger sample sizes and with more follow-up studies to improve the quality of the literature and assess the lasting benefits of EMDR for people with SUD. Moreover, researchers should pay particular attention to minimizing the risk of bias through checks on the adequacy of randomization as this was the most common concern on the RoB-2 analysis, including pretest checks of equivalence between the groups and robust sample sizes. Similarly, researchers should be concerned with the possibility of missing data as follow-up assessments are completed. Small samples often become smaller at follow-ups; thus researchers are encouraged to assure adequate sample sizes for attrition and to employ strategies to maintain participation. More studies are also needed in other areas showing high heterogeneity or lower effects, such as the effects of EMDR on SUD cravings. Authors should also dutifully report potential moderator or confounding variables, both demographic (e.g., age, gender, race) and methodological (e.g., pretest assessments of severity, reliabilities of selected measurements, specific memory types targeted, length of treatment, EMDR protocols used, and adaptations therein) so that they can be included in analyses. Journals and other venues are also encouraged to facilitate registration of trials, publication of well-designed studies without significant findings, and other steps to minimize risk of publication bias that might be inflating results as seen in some analyses. Likewise, as the size of the literature grows on EMDR with people with SUD, further meta-analyses can and should be conducted with more homogenous types of studies. Finally, additional research on the effectiveness of EMDR in treating outcomes other than SUD-specific symptoms, PTSD, or depression (e.g., for anxiety or overall quality of life) are needed to further advance the literature.

In conclusion, the use of EMDR to improve the mental health of people with SUD appears to be supported by the existing literature. Likewise, the effectiveness of EMDR for SUD-specific outcomes and comorbid symptoms alike are also supported with most notable effects found for the reduction of SUD severity, improvement of treatment engagement, and the amelioration of PTSD and depressive symptoms. The limited literature does not, as of yet, support EMDR for curbing substance cravings or for producing lasting effects after treatment completion. Future research is needed specifically with larger sample sizes and more follow-up measurements, among other study quality features, to improve the quality of the literature.

References

* Indicates study in the meta-analysis.

Abel, N. J., O'Brien, J. M. (2010). EMDR treatment of comorbid PTSD and alcohol dependence: A case example. *Journal of EMDR Practice and Research, 4*(2), 50–59. https://doi.org/10.1891/1933-3196.4.2.50

American Psychiatric Association. (2013). Substance use disorders. In *Diagnostic and statistical manual of mental disorders* (5th ed.).

*Bonab, S. M., Abolghasemi, A., Sheikhian, M., Barahmand, U., & Rasooliazad, M. (2012). The effectiveness of eye movement desensitization and reprocessing therapy on the emotion regulation and emotion recognition of addicted individuals. *Zahedan Journal of Research in Medical Sciences, 14*, 33–37.

*Brown, S. H., Gilman, S. G., Goodman, E. G., Adler-Tapia, R., & Freng, S. (2015). Integrated trauma treatment in drug court: Combining EMDR therapy and seeking safety. *Journal of EMDR Practice and Research, 9*(3), 123–136. https://doi.org/10.1891/1933-3196.9.3.123

*Carletto, S., Oliva, F., Barnato, M., Antonelli, T., Cardia, A., Mazzaferro, P., Raho, C., Ostacoli, L., Fernandez, I., & Pagani, M. (2018). EMDR as add-on treatment for psychiatric and traumatic symptoms in patients with substance use disorder. *Frontiers in Psychology, 8*(2333), 1–8. https://doi.org/10.3389/fpsyg.2017.02333

Carletto, S., Malandrone, F., Berchialla, P., Oliva, F., Colombi, N., Hase, M., Hofmann, A., & Ostacoli, L. (2021). Eye movement desensitization and reprocessing for depression: A systematic review and meta-analysis. *European Journal of Psychotraumatology, 12*(1), 1–16. https://doi.org/10.1080/20008198.2021.1894736

Chen, Y., Hung, K-. W., Tsai, J-. C., Chu, H., Chung, M-. H., Chen, S-. R, Liao, Y-. M., Ou, K-. L., Chang, Y-. C., & Chou, K-. R. (2014). Efficacy of eye-movement desensitization and reprocessing for patients with posttraumatic-stress disorder: A meta-analysis of randomized controlled trials. *PLoS ONE, 9*(8). http://doi.org/10.1371/journal.pone.0103676

Davidson, P. R. & Parker, K. C. (2001). Eye movement desensitization and reprocessing (EMDR): A meta-analysis. *Journal of Consulting and Clinical Psychology, 69*(2), 305–316. https://doi.org/10.1037//0022-006x.69.2.305

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ, 315*, 629–634. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2127453/pdf/9310563.pdf

*Habibović S. (2021). Preliminary results of doctoral dissertation: Empirical review of EMDR in the process of hospital treatment of opiates addicts. *Psychiatria Danubina*, *33*(Suppl 1), 29–32.

*Hase, M., Schallmayer, S., & Sack, M. (2008). EMDR reprocessing of the addiction memory: Pretreatment, posttreatment, and 1-month follow up. *Journal of EMDR Practice and Research, 2*(3), 170–179. https://doi.org/10.1891/1933-3196.2.3.170

*Kutsukos, J. (2021). Eye movement desensitization reprocessing as a complementary treatment for clients with addiction and comorbid trauma. *Dissertations, 617*. https://digitalcommons.nl.edu/diss/617

*Littel, M., Van Den Hout, M. A., & Engelhard, I. M. (2016). Desensitizing addiction: Using eye movements to reduce the intensity of substance-related mental imagery and craving. *Frontiers in Psychiatry, 7*, 14. https://doi.org/10.3389/fpsyt.2016.00014

Markus, W., De Weert-Van Oene, G. H., Becker, E. S., & DeJong, C. A. (2015). A multi-site randomized study to compare the effects of eye movement desensitization and reprocessing (EMDR) added to TAU versus TAU to reduce craving and drinking behavior in alcohol dependent outpatients: Study protocol. *BMC Psychiatry, 15*, 51. https://doi.org/10.1186/s12888-015-0431-z

*Markus, W., De Weert-Van Oene, G. H., Woud, M. L., Becker, E. S., DeJong, C. A. J. (2016). Are addiction-related memories malleable by working memory competition? Transient effects on memory vividness and nicotene craving in a randomized lab experiment. *Journal of Behavioral Therapy & Experimental Psychiatry, 52*, 83–91. https://doi.org/10.1016/j.jbtep.2016.03.007

Markus, W., & Hornsveld, H. (2017). EMDR interventions in addiction. *Journal of EMDR Practice and Research, 11*(1), 3–24. https://doi.org/10.1891/1933-3196.11.1.3

Markus, W., De Kruijk, C., Hornsveld, H. K., De Weert-Van Oene, G. H., Becker, E. S., & DeJong, C. A. (2019). Treatment of alcohol use disorder with adjunctive addiction-focused EMDR: A feasibility study. *Journal of EMDR Practice and Research, 13*(3), 187–220. https://doi.org/10.1891/1933-3196.13.3.187

*Markus, W., Hornsveld, H. K., Oene, G. H., Becker, E. S., & Dejong, C. (2020). A multi-site randomized study to compare the effects of Eye Movement Desensitization and Reprocessing (EMDR) added to TAU verses TAU to reduce craving and drinking behavior in alcohol dependent outpatients: Results from a randomized clinical trial. *Journal of Alcoholism: Clinical and Experimental Research, 44*(1), 272–283. https://doi.org/10.10002/jts.21970

McCauley, J. L., Killeen, T., Gros, D. F., Brady, K. T., & Back, S. E. (2012). Posttraumatic stress disorder and co-occurring substance use disorders: Advances in assessment and treatment. *Clinical Psychology: Science and Practice, 19*(3), 283–304. https://doi.org/10.1111/cpsp.12006

National Institute on Drug Abuse. (2020a, April). *Common comorbidities with substance use disorders research report. Part 1: The connection between substance use disorders and mental illness*. https://nida.nih.gov/publications/research-reports/common-comorbidities-substance-use-disorders/part-1-connection-between-substance-use-disorders-mental-illness

National Institute on Drug Abuse. (2020b, April). *Sex and gender differences in substance use*. https://nida.nih.gov/publications/research-reports/substance-use-in-women/sex-gender-differences-in-substance-use

Palumbo, R., Protokowicz, J., & Roberto, A. (2020). Eye movement desensitization and reprocessing therapy as a path to recovery for patients with substance use disorder. *Journal of Addictions Nursing, 31*(3), 225–226. https://doi.org/10.1097/JAN.0000000000000354

*Perez-Dandieu, B. & Tapia, G. (2014). Treating trauma in addiction with EMDR: A pilot study. *Journal of Psychoactive Drugs, 46*(4), 303–309. https://doi.org/10.1080/02791072.2014.921744

Pilz, R., Hartleb, R., Konrad, G., Reininghaus, E., & Unterainer, H. F. (2017). The role of eye movement desensitization and reprocessing (EMDR) in substance use disorders: A systematic review. *Fortschritte der Neurologie Psychiatrie, 85*(10), 584–591. https://doi.org/10.1055/s-0043-118338.

Qurishi, R., Markus, W., Habra, M. M. J., Bressers, B., & De Jong, C. A. (2017). EMDR therapy reduces intense treatment-resistant cravings in a case of

gamma-hydroxybutyric acid addiction. *Journal of EMDR Practice and Research, 11*(1), 30–42. https://doi.org/10.1891/1933-3196.11.1.30

Ryan, R. (2016). *Cochrane consumers and communication group reviews: Meta-analysis.* http://cccrg.cochrane.org.

Substance Abuse and Mental Health Services Administration. (2022, November 22). *Mental health and substance use disorders*. https://www.samhsa.gov/find-help/disorders

Scelles, C. & Bulnes, L. C. (2021). EMDR as treatment option for conditions other than PTSD: A systematic review. *Frontiers in Psychology, 12*(644369). https://doi.org/10.3389/fpsyg.2021.644369

Sepehry, A. A., Lam, K., Sheppard, M., Guirguis-Younger, M., & Maglio, A. T. (2021). EMDR for depression: A meta-analysis and systematic review. *Journal of EMDR Practice and Research, 15*(1), 2–17. https://doi.org/10.1891/EMDR-D-20-00038

Shapiro, F., Vogelmann-Sine, S., & Sine, L. F. (1994). Eye movement desensitization and reprocessing: Treating trauma and substance abuse. *Journal of Psychoactive Drugs, 26*(4), 379–391. http://doi.org/10.1080/02791072.1994.10472458

Shi, L., & Lin, L. (2019). The trim-and-fill method for publication bias: Practical guidelines and recommendations based on a large database of meta-analyses. *Medicine*, *98*(23), e15987. http://doi.org/10.1097/MD.0000000000015987

Sterne, J. A. C., Savovic, J., Page, M. J., Eibers, R. G., Blencowe, N. S., Boutron, I., Cates, C. J., Cheng, H. Y., Corbett, M. S., Eldrige, S. M., Emberson, J. R., Hernan, M. A., Hopewell, S., Hrobjartsson, A., Junqueira, D. R., Juni, P., Kirkham, J. J., Lasserson, T., Li, T … Higgins, J. P. T. (2019). RoB 2: A revised tool for assessing risk of bias in randomized trials. *BMJ*, *366*, I4898. https://doi.org/10.1136/bmj.l4898

Tapia, G. (2019). Review of EMDR interventions for individuals with substance use disorders with/without comorbid posttraumatic stress disorder. *Journal of EMDR Practice and Research, 13*(4), 345–353. https://doi.org/10.1891/1933-3196.13.4.345

Valentine, J. C., Pigott, T. D., & Rothstein, H. B. (2010). How many studies do you need? A primer on statistical power for meta-analysis. *Journal of Educational and Behavioral Statistics, 35*(2), 215–247. https://doi.org/10.3102/1076998609346961

Valiente-Gómez, A., Moreno-Alcázar, A., Treen, D., Cedrón, C., Colom, F., Pérez, V., & Amann, B. L. (2017). EMDR beyond PTSD: A systematic literature review. *Frontiers in Psychology, 8*, 1668. https://doi.org/10.3389/fpsyg.2017.01668

Van Minnen, M. V., Markus, W., & Blaauw, E. (2020). Addiction-focused EMDR therapy in gambling disorder: A multiple baseline study. *Journal of EMDR Practice & Research, 14*(1), 46–59. https://doi.org/10.1891/1933-3196.14.1.46

Virrey, A. V., & Dominguez, J. N. (2021). Efficacy of eye movement desensitization reprocessing (EMDR) in improving self-regulation of in-house filipino clients with substance-use-disorder. *Psikodimensia Kajian Ilmiah Psikologi, 20*(1), 87–106. https://doi.org/10.24167/psidim.v20i1.3231

Wise, A. & Marich, J. (2016). The perceived effects of standard and addiction-specific EMDR therapy protocols. *Journal of EMDR Practice and Research, 10*(4), 231–244. https://doi.org/10.1891/1933-3196.10.4.231

Disclosure. The authors have no relevant financial interest or affiliations with any commercial interests related to the subjects discussed within this article.

Funding. The authors received no specific grant or financial support for the research, authorship, or publication of this article.

Correspondence regarding this article should be directed to Jeffrey H. D. Cornelius-White, Missouri State University, Counseling Leadership and Special Ed, 901 S. National Ave., Springfield, MO 65897. Email: jcornelius-white@missouristate.edu