Journal of Contextual Behavioral Science 32 (2024) 100773

Contents lists available at ScienceDirect

Journal of Contextual Behavioral Science

journal homepage: www.elsevier.com/locate/jcbs

Effectiveness of acceptance and commitment therapy for addictive behaviors: A systematic review and meta-analysis

Andrea Krotter [a], Gema Aonso-Diego [b,*], Ana González-Menéndez [a], Alba González-Roz [a], Roberto Secades-Villa [a], Ángel García-Pérez [c]

[a] Department of Psychology, University of Oviedo, Oviedo, Spain
[b] Department of Psychology, University of Deusto, Bilbao, Spain
[c] Department of Psychology, Sociology and Philosophy, University of Leon, Leon, Spain

ARTICLE INFO

Keywords:
Acceptance and commitment therapy
Addictive behaviors
Substance use
Effectiveness
Meta-analysis
Moderators

ABSTRACT

The use of acceptance and commitment therapy (ACT) has expanded in the field of addictive disorders in recent years. This systematic review and meta-analysis examined the effectiveness of ACT compared to other active interventions in terms of treatment completion, addiction-related outcomes, and changes in psychological flexibility. Searches were conducted in PsycINFO, PubMed, Scopus, and Web of Science. Four random-effects meta-analyses were conducted to assess the effectiveness of ACT in terms of completion rates and abstinence at the end of treatment (EOT), in the short term (≤6 months follow-up), and in the long term (>6-month follow-up). Participants' sex and age, the number of ACT sessions, the characteristics of the experimental condition (i.e., ACT combined with pharmacological intervention or non-combined) and the comparison condition (i.e., ACT compared to cognitive-behavioral therapy [CBT] or non-CBT interventions), treatment modality (face-to-face or technology-based approaches), and the targeted addictive behavior were examined as moderators. A total of 28 studies were included in the systematic review and 22 in the meta-analysis. There were no differences in EOT completion rates (Log RR = 0.0038; 95% CI: −0.026, 0.034). ACT increased the odds of abstinence at EOT (Log RR = 0.264; 95% CI: 0.046, 0.482) and at short-term follow-up (Log RR = 0.295; 95% CI: 0.108, 0.483), but not in the long term (Log RR = 0.164; 95% CI: −0.101, 0.430). ACT demonstrated higher abstinence rates than CBT conditions at EOT ($p = 0.002$). A lower age increased abstinence rates in the short ($p = 0.004$) and long term ($p < 0.001$), whereas a greater number of ACT sessions increased long-term abstinence rates ($p < 0.001$). ACT is an effective approach for promoting short-term abstinence. In the long term, it is at least as effective as other empirically validated therapies, such as CBT. Further studies are needed to clarify the effects of increasing psychological flexibility on addictive behaviors.

1. Introduction

Addictive disorders are a major public health concern worldwide that are responsible for a high global disease burden, increasing the risk of injuries, suicide, and cancer, among other things (Degenhardt et al., 2018; Rehm & Shield, 2019; Tran et al., 2022). The core characteristic of addictive disorders is compulsive engagement in the addictive behavior despite negative consequences. Several psychological processes resulting from the desire for and attraction to pleasure are involved in the onset and progress of addictive disorders, and form part of the palliative avoidance logic of pain and suffering that characterizes us as verbal beings (González-Menéndez, García-Fernández, Krotter, & González-Roz, 2022). The current cultural climate, more and more focused on anesthetizing distress, stimulating humor and making such states of awareness voluntary, creates the paradox that succumbing to immediate gratification causes the loss of other interests, meanings, or values that give meaning to fundamental areas of life (Hayes, Strosahl, & Wilson, 2012; Schalow, 2017).

Several behavioral approaches have been shown to be effective in addressing addictive behaviors and related problems, such as cognitive-behavioral therapy (CBT), contingency management, and motivational interview (see e.g., Pfund, Ginley, Rash, & Zajac, 2022; Ray et al., 2020; Sayegh, Huey, Zara, & Jhaveri, 2017). However, the outcomes of these interventions in terms of treatment completion and long-term

* Corresponding author.
E-mail address: gema.aonso@deusto.es (G. Aonso-Diego).

https://doi.org/10.1016/j.jcbs.2024.100773
Received 28 February 2024; Received in revised form 7 May 2024; Accepted 7 May 2024
Available online 8 May 2024

abstinence rates suggest that there is significant room for improvement (Boness et al., 2023; Davis et al., 2015; Lappan, Brown, & Hendricks, 2020; Pfund et al., 2021, 2022, 2023). For example, contingency management, one of the most effective interventions for addictive behaviors (Ainscough, Brose, Strang, & McNeill, 2021; Getty, Morande, Lynskey, Weaver, & Metrebian, 2019; Notley et al., 2019), shows decreased effectiveness over time, in part because the reinforcer is withdrawn at the end of treatment, and because extrinsic reinforcers (e.g., vouchers, money) of abstinence do not necessarily translate into intrinsic motivation (Benishek et al., 2014).

Third-wave behavior therapies (Hayes, 1987) are process-based therapies that provide alternatives for treating the cognitive, emotional, and behavioral processes involved in addictive behaviors, examining how differing contexts affect behaviors and the functions of psychological phenomena (Harris, 2019; Hofmann & Hayes, 2019). Due to its philosophical and experimental foundation (Barnes-Holmes, Barnes-Holmes, Hussey, & Luciano, 2016; Törneke, Luciano, Barnes-Holmes, & Bond, 2015), Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) is the most representative and widely-researched third-wave therapy.

ACT is a transdiagnostic intervention targeting psychological flexibility (PF) that focuses on the self as context rather than modifying cognitive, emotional, or physiological contents (e.g., thoughts, cravings, urgency, anxiety) (Hayes & Levin, 2012). It helps individuals to reduce the dominance of cognitive, emotional, or physiological content in their behavior and develop a flexible response. ACT defines PF as the ability to maintain or change behavior in the service of chosen values that, in a genuine sense, matter to the person (Hayes, Strosahl, & Wilson, 2012).

The strategies used during the therapy (i.e., metaphors, paradoxes, experiential exercises) aim to address the six core processes of PF: acceptance, cognitive defusion, being present, self as context, values, and committed action (Hayes, Pistorello, & Levin, 2012). In other words, PF means acceptance and openness to distress as well as involvement and commitment to value-oriented behaviors, with acceptance and change the two fundamental processes constituting the therapy (Hayes, Strosahl, & Wilson, 2012). PF enables the individual to adapt to incoherent situations, reframe resources, change perspectives and essentially to balance desires and needs. Behaving according to one's values is a way of dignifying the suffering associated with withdrawal symptoms, which often serves as an escape from distress, craving and consequences of the addiction itself (Wilson & DuFrene, 2012).

Three previous systematic reviews have concluded that ACT has a positive effect on treatment outcomes for substance use disorders. Specifically, Byrne et al. (2019) concluded that ACT is effective for the treatment of alcohol use disorder when compared to both active interventions and inactive groups (e.g., no treatment, waiting lists, health education without targeting at substance use). Maia, dos Santos, de Castro, Vieira, and Da Silveira (2021) indicated that the ACT condition achieved better outcomes in terms of symptomatology of substance use (e.g., severity of substance use) and comorbid disorders (e.g., post-traumatic stress disorder), psychological flexibility, and treatment adherence compared to active and inactive conditions. Finally, Díez-Bejarano and Chaves (2022) showed that ACT produced similar outcomes—in terms of substance abstinence—to active and inactive groups, although ACT was more effective in increasing acceptance and flexibility. These studies had some methodological limitations, such as comparing ACT to a combination of active conditions and inactive conditions (Byrne et al., 2019; Díez-Bejarano & Chaves, 2022; Maia et al., 2021) and analyzing results regardless of the time period they were collected at (Byrne et al., 2019; Maia et al., 2021).

Looking at meta-analytical studies, A-Tjak et al. (2015) examined the effectiveness of ACT in treating mental and physical health problems, and concluded that ACT for addiction provides better results than control conditions. To the best of our knowledge, only one meta-analysis has analyzed the effectiveness of ACT in comparison with active interventions specifically for substance use disorders (Lee, An, Levin, & Twohig, 2015). It found a small effect in favor of ACT at the end of treatment (EOT) and small to medium effects in favor of ACT at follow-ups. However, the results from the long-term analysis combined outcomes from the last available follow-up, which included abstinence rates from EOT and 12-month follow-up, among other time points. This is a limitation, as makes it difficult to interpret the findings. Another meta-analysis (Ii et al., 2019) examined treatments targeting PF (i.e., combining ACT with other approaches such as dialectical behavioral therapy) in individuals with substance use disorders. It found significantly higher abstinence rates in PF-based therapies than other psychosocial interventions (e.g., brief motivational intervention, relapse prevention). When comparing ACT studies to psychosocial interventions targeting psychological flexibility, no significant differences were found. However, because only three studies were included in the analysis, caution should be exercised in interpreting the results. Finally, a recent meta-analysis has examined the effect of ACT for smoking cessation (Kwan, Lau, Ang, & Lau, 2024), showing higher rates of abstinence at EOT and at six months follow-up for ACT.

Additionally, the studies examining moderators of ACT's effectiveness have certain limitations. While Kwan et al. (2024) did not analyze moderators, Lee et al. (2015) only performed subgroup analyses on studies that used CBT as a comparison and by target substance. A-Tjak et al. (2015) analyzed the moderators of ACT combining substance use with other physical and mental health problems. Finally, Ii et al. (2019) examined moderators of therapies aimed at increasing psychological flexibility, such as ACT and dialectical behavior therapy, including trial duration among other variables. Neither study examined moderators of efficacy considering the outcomes at different time points (e.g., EOT, short-term, long-term). Examining significant moderators can provide insight into potential intervention targets that improve clinical outcomes, so it is important to address this gap in the literature.

Against this background, the primary aim of this systematic review and meta-analysis was to assess the effectiveness of ACT for addictive behaviors compared with other active interventions. The specific objectives were as follows: 1) to analyze the impact of ACT on treatment completion rates; 2) to evaluate abstinence rates and changes in the frequency of use and severity of the addictive behavior; 3) to examine the changes in the six core processes of PF (i.e., acceptance, cognitive defusion, being present, self as context, values, and committed action); and 4) to explore the impacts of sample variables and treatment characteristics as moderators on the effectiveness of ACT.

2. Methods

This systematic review and meta-analysis was conducted according to the PRISMA-S statement (Rethlefsen et al., 2021). The study protocol was registered in the International Prospective Register of Systematic Reviews (ID: CRD42023440332).

2.1. Search strategy

Studies were identified by searching the databases PsycINFO, Pubmed, Scopus, and Web of Science by using the following terms: ("acceptance and commitment therapy") AND ("substance use" OR "substance abuse" OR "addict*" OR "drug abuse" OR "drug dependence" OR "alcohol" OR "smok*" OR "tobacco" OR "cannabis" OR "marihuana" OR "marijuana" OR "cocaine" OR "heroin" OR "opioid" OR "amphetamine" OR "MDMA" OR "ecstasy" OR "methamphetamine" OR "narcotics" OR "polydrug" OR "gamb*" OR "gaming" OR "internet use"). Literature searches were conducted up to April 21st, 2024, and no restriction was set by year of publication. In addition, a hand-search of the reference section of previous systematic reviews and meta-analyses on the topic of the study (A-Tjak et al., 2015; Byrne et al., 2019; Díez-Bejarano & Chaves, 2022; Ii et al., 2019; Kwan et al., 2024; Lee et al., 2015; Maia et al., 2021) was performed to find relevant studies not identified in the automated search.

2.2. Eligibility criteria

The primary eligibility criteria were peer-reviewed published studies examining the effectiveness of ACT for addictive behaviors (both substance use disorders and behavioral addictions) that met the following conditions: 1) uses a randomized controlled or quasi-experimental research design; 2) includes ACT for addictive behaviors clearly identified and described in detail by the authors in the manuscript or in other related-sources (e.g., clinical trial registration); 3) compares ACT to another active condition, which includes non-experimental interventions recognized as effective (Capili, 2023) in the treatment of addictive behaviors, such as CBT, and excludes wait-list groups, no-intervention controls, or non-specific controls including content unrelated to addictive disorders (e.g., health education on oral, digestive, or eating health, among others); 4) provides a measure of either addictive behavior (e.g., abstinence rate) or ACT-related psychological processes (i.e., the six core processes of PF: acceptance, defusion, being present, self as context, values, and committed action) at the EOT and/or follow-ups; 5) published in English or Spanish.

2.3. Study selection and data collection

Studies were screened independently by two reviewers using the title and abstract in the first stage and the full text in the second stage. Disagreements were resolved by a third reviewer. Data from eligible studies were extracted independently and compared to ensure their accuracy. The following variables were collected: sample characteristics (i.e., size, sex, age, country of the study), intervention characteristics (i.e., main addictive behavior targeted, description of the experimental and comparison conditions, number of sessions), outcomes related to addictive behaviors (i.e., abstinence rates biochemically verified if available or self-reported if not, changes in frequency of use, and changes in the severity of the addictive behavior), and outcomes about the six PF processes (i.e., acceptance, defusion, being present, self as context, values, and committed action) (Hayes, Strosahl, & Wilson, 2012). Data was categorized as follows: outcomes at EOT, at short term (i.e., $\leq$6 months follow-up) and at long term (i.e., >6 months follow-up). Corresponding authors were asked to provide missing data from 24 studies, which produced data from 10 (41.67%) of them.

2.4. Meta-analytic approach

A total of four separate meta-analyses were performed on completion rates at EOT ($n = 16$) and on abstinence rates at EOT ($n = 12$), at short-term ($n = 17$), and at long-term ($n = 9$). Given that meta-analysis cannot be performed when fewer than three studies are available, we narratively synthesized the outcomes including effectiveness of ACT on frequency of use, the severity of the addictive behavior, and PF.

Completion rates and the effectiveness of interventions on abstinence rates were examined through the Log risk ratio (RR) with a 95% confidence interval (CI). A random effects approach was used due to the expected heterogeneity across the studies. Cochran's *Q,* and its *p*-value, and I^2 were calculated to examine the degree of heterogeneity across studies, which was classified as low ($I^2 < 25\%$), moderate ($I^2 \sim 50\%$), or high ($I^2 \geq 75\%$) (Higgins, Thompson, Deeks, & Altman, 2003).

Potential moderators were examined, considering sample variables (i.e., participants' sex and mean age), and treatment variables, specifically: 1) number of ACT sessions, 2) characteristics of the experimental condition (i.e., ACT combined with pharmacological intervention vs. ACT non-combined), 3) characteristics of the comparison condition (i.e., ACT compared to CBT vs. ACT compared to non-CBT interventions), 4) addictive behavior targeted in the study (i.e., tobacco, alcohol, opiates, methamphetamine, polysubstance, and injected drugs), and 5) treatment modality (i.e., face-to-face or via technology-based approaches, including websites, phone-calls, or Apps, either exclusively or combined with face-to-face intervention). Continuous moderators were tested using meta-regression, and categorical moderators were analyzed using subgroup analysis. All analysis were performed using JAMOVI software 2.3.21 (The JAMOVI Project 2022 – Computer Software, Sydney, Australia).

2.5. Systematic review

A narrative synthesis was conducted to examine the changes in addictive behavior outcomes that could not be examined by meta-analysis, including the severity of addictive behaviors and the frequency of use, and the changes in the six core processes of the PF (i.e., acceptance, cognitive defusion, being present, self as context, values, committed action). Outcome evaluations were conducted in the same time frame as the meta-analysis, including EOT, short-term, and long-term assessments.

2.6. Methodological quality assessment

The methodological quality of the included studies was assessed by two independent reviewers using the revised Cochrane risk-of-bias tool (RoB 2) (Sterne et al., 2019) which covers five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. Each domain was evaluated as having low risk of bias, some concerns, or high risk of bias. The overall risk of bias was rated as 'low risk' when no bias exists for all of the domains; as 'some concerns' when concerns are raised on at least one domain, but there is no high risk of bias for any domain; and as 'high risk' when high risk of bias are raised for at least one domain, or if the study is judged to have some concerns for multiple domains. Discrepancies were resolved by discussion with a third author.

2.7. Publication bias

Impact of publication bias was reported based on three tests. Egger's regression intercept evaluates the asymmetry of the funnel plots and indicates absence of publication bias when the linear regression intercept value is close to zero (Egger, Smith, Schneider, & Minder, 1997). The Begg and Mazumdar rank correlation test calculates the correlation between the effect size and its variance, and deviations from zero indicate the presence publication bias (Begg & Mazumdar, 1994). Rosenthal's fail-safe N test is used to determine the number of missing studies required for the *p*-value to approach non-statistical significance (i.e., $p > 0.05$) (Orwin, 1983; Rosenthal, 1979).

3. Results

The PRISMA flow-chart for the review process is shown in Fig. 1. A total of 1,167 studies were identified by the database searches, and five additional records were identified by manual searches. After removing duplicate records, 591 studies were screened and 46 were identified meeting the inclusion criteria. However, 18 studies (Bricker, Mull, et al., 2022; Bricker, Miao, Mull, Santiago-Torres, & Vock, 2023, Bricker et al., 2024; Heffner et al., 2020; Jones et al., 2015; Kwon et al., 2022; Lanza, García, Lamelas, & González-Menéndez, 2014; Santiago-Torres, Kwon, et al., 2022; Santiago-Torres, Mull, Sullivan, & Bricker, 2024; Santiago-Torres, Mull, Sullivan, Ferketich, & Bricker, 2022; Santiago-Torres, Mull, Sullivan, Kendzor, & Bricker, 2022; Santiago-Torres, Mull, Sullivan, Kwon, Nez Henderson, et al., 2022; Santiago-Torres, Mull, Sullivan, Kwon, Nollen, et al., 2022; Santiago-Torres, Mull, Sullivan, Matthews et al., 2024; Santiago-Torres, Mull, Sullivan, Rigotti, & Bricker, 2023; Santiago-Torres, Mull, Sullivan, Zvolensky, & Bricker, 2022; Santiago--Torres, Mull, Sullivan, Zvolensky, Kahler, et al., 2022; Villagrá Lanza & Menéndez, 2013) were excluded because they presented overlapping samples; that is, they involved the same dataset as four other studies (Bricker, Mul, McClure, Watson &, & Heffner, 2018; Bricker, Watson, Mull, Sullivan, & Heffner, 2020; Bricker, Wyszynski, Comstock, &

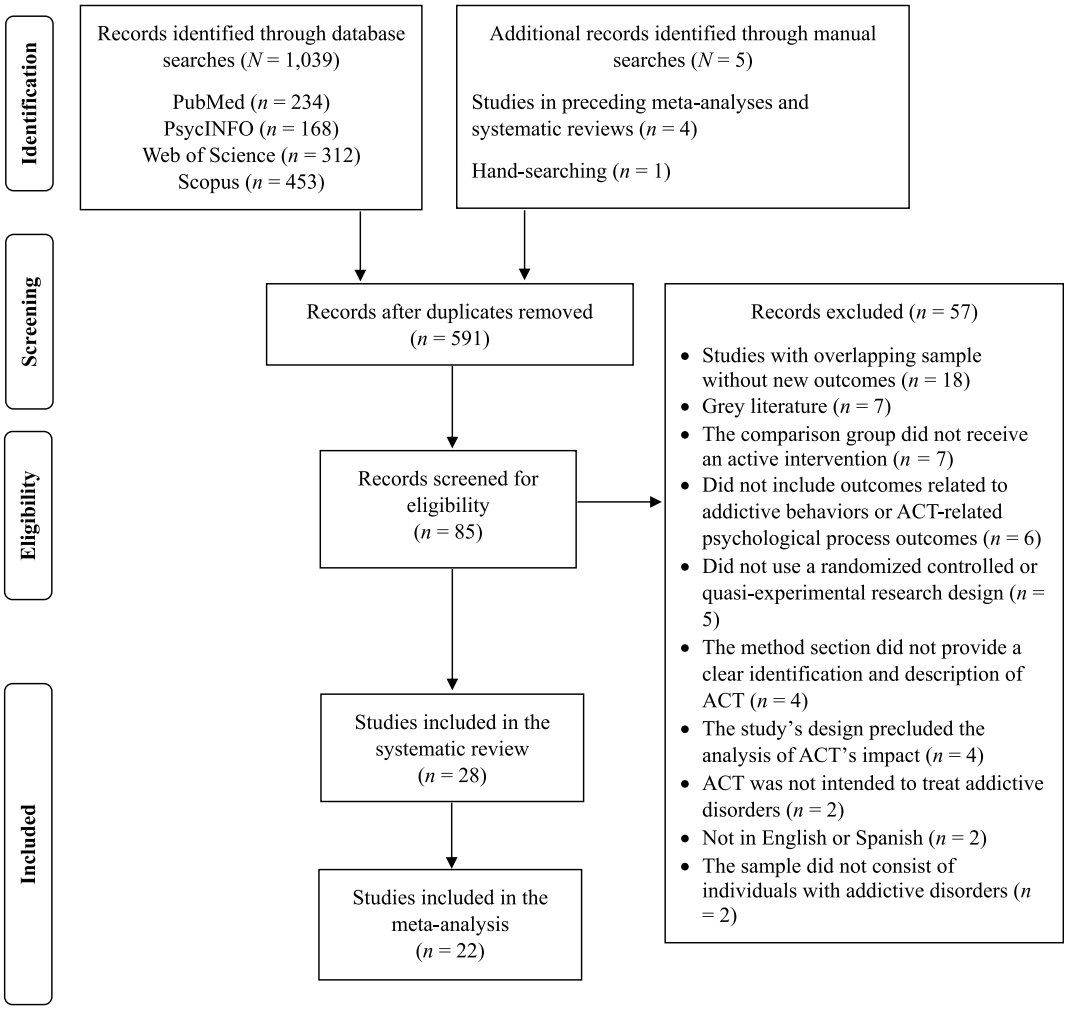

Fig. 1. Flow diagram of the literature search procedure. *Note.* ACT = Acceptance and Commitment Therapy; RCT = randomized controlled trial.

Heffner, 2013; González-Menéndez, Fernández, Rodríguez, & Villagrá, 2014). We included these four studies because they had larger samples and reported more outcomes. Ultimately, 28 studies published between 2004 and 2024 were included in the systematic review and 22 in the meta-analysis.

3.1. Participants and study characteristics

The characteristics of the reviewed studies ($N = 28$) are displayed in Table 1. The sample comprised a total of 9,925 participants, with a mean age of 43.31 ($SD = 12.63$), who were predominantly female (64.86%). The sample size in each study ranged from 24 to 2,637 participants ($M = 322.32$; $SD = 659.25$). The primary addictive behavior examined was tobacco use (17/28; 60.71%), followed by polysubstance use (3/27; 10.71%), alcohol use (3/28; 10.71%), opioid use (2/28; 7.14%), cocaine use (1/28; 3.57%), methamphetamine use (1/28; 3.57%), and injected drug use (1/28; 3.57%). No study included non-substance addictive behaviors. Most of the studies were conducted in the United States (19/28; 67.86%), followed by Hong Kong (2/28; 7.14%), Spain (2/28; 7.14%), Australia (1/28; 3.57%), Iran (1/28; 3.57%), Ireland (1/28; 3.57%), Pakistan (1/28; 3.57%), and Russia (1/28; 3.57%). Most of the interventions were conducted face-to-face (19/28; 67.86%). One study involved a combination of face-to-face and phone-calls (1/28; 3.57%), whereas the remaining interventions were technology-based, specifically delivered through an app (3/28; 10.71%), a website (3/28; 10.71%), or phone calls (2/28; 7.14%). Abstinence rates were mainly confirmed by biochemical analysis of carbon monoxide, saliva, urine, or hair (16/28; 57.14%). The remaining studies self-reported abstinence (9/28; 32.14%) or did not specify the measure of abstinence (3/28; 10.71%).

Almost all studies used a randomized controlled design (27/28; 96.43%; of which 13/28 [46.43%] were pilot studies or preliminary randomized controlled trials), the exception being the study by Hernández-López, Luciano, Bricker, Roales-Nieto, and Montesinos (2009), which followed a quasi-experimental design. Nearly half of the treatment conditions exclusively used ACT (12/28; 42.86%) or focused on experiential acceptance (1/28; 3.57%). Nine studies implemented a combination of ACT with pharmacological interventions, namely nicotine replacement therapy (NRT; 6/28; 21.43%), methadone maintenance therapy (MMT; 2/28; 7.14%), or medication for alcohol detoxification (i.e., diazepam and needed adjunctive sleep, anti-hypertensive, or antihistamine medications; 1/28; 3.57%). Additionally, some studies integrated ACT with 12-step facilitation (2/28; 7.14%), self-help materials (2/28; 7.14%), harm-reduction (1/28; 3.57%), or contingency management (1/28; 3.57%). The total number of sessions in experimental groups ranged from two to 48 ($M = 10.65$; $SD = 10.32$).

The comparison conditions included CBT alone (9/27; 3.14%), a combination of CBT plus NRT via patches, gum, or lozenges (4/27; 14.29%), behavioral intervention with NRT (2/27; 7.14%), exclusively behavioral intervention (1/28; 3.57%), and cognitive restructuring (1/28; 3.57%). The remaining studies included counseling and MMT (2/27; 7.14%), counseling and NRT (1/28; 3.57%), counseling and contingency management (1/28; 3.57%), 12-step interventions alone (1/28; 3.57%)

Table 1
Characteristics of the studies included in the systematic review.

Study	Main addictive behavior targeted	Sample size (% female)	Age [*M* (*SD*)]	Modality (country)	Conditions (experimental vs. comparison)	Sessions (*n*)	Measurement of abstinence	Other addiction measure	Psychological flexibility measure
Bricker et al. (2013)	Tobacco	222 (62%)	45.05 (13.35)	Web (USA)	WeQuit.org (ACT) vs. SmokeFree.gov (CBT)	N/R	Self-reported	–	AIS
Bricker, Bush, et al. (2014)	Tobacco	121 (69%)	39.08 (9.8)	Telephone (USA)	ACT + NRT vs. CBT + NRT	5 vs. 5	Self-reported	–	AIS
Bricker, Mull, et al. (2014)	Tobacco	196 (52.04%)	41.55 (12.95)	App (USA)	SmartQuit (ACT) vs. QuitGuide App (CBT)	N/R	Self-reported	–	AIS
Bricker et al. (2018)	Tobacco	2,637 (78.99%)	46.2 (13.4)	Web (USA)	WeQuit.org (ACT) vs. Smokefree.gov (CBT)	N/R	Self-reported	–	AIS
Bricker, Watson, Mull, Sullivan, and Heffner (2020)	Tobacco	2,415 (70.39%)	38.2 (10.9)	App (USA)	iCanQuit (ACT) vs. QuitGuide (CBT)	N/R	Self-reported	–	–
Bricker, Sullivan, et al. (2022)	Tobacco	1,170 (61.20%)	47.4 (12.7)	Phone calls (USA)	ACT + NRT vs. CBT + NRT	5 vs. 5	Self-reported	–	AIS
Brown et al. (2013)	Tobacco	49 (48.98%)	47.68 (10.31)	Face-to-face (USA)	ACT-based distress tolerance + NRT vs. behavioral intervention + NRT	15 vs. 7	Biochemically verified	–	–
Brown et al. (2018)	Tobacco	116 (41%)	46.06 (11.23)	Face-to-face (USA)	ACT-based distress tolerance + NRT vs. behavioral intervention + NRT	10 vs. 10	Biochemically verified	–	AIS, AAQ
Davoudi, Omidi, Sehat, and Sepehrmanesh (2017)	Tobacco	68 (0)	30 (5.5)	Face-to-face (Iran)	ACT vs. CBT	8 vs. 8	Biochemically verified	–	–
Gifford et al. (2004)	Tobacco	76 (59%)	43 (11.68)	Face-to-face (USA)	ACT vs. basic advice on quitting smoking + education on patch use + NRT	14 vs. 1	Biochemically verified	–	–
González-Menéndez et al. (2014)	Polysubstance	50 (100%)	31.15 (7.12)	Face-to-face (Spain)	ACT vs. CBT	16 vs. 16	Biochemically verified	ASI-6	AAQ
Gul and Aqeel (2021)	Polysubstance	65 (0)	N/R	Face-to-face (Pakistan)	ACT vs. standard (coordination with healthcare services + therapy + psychoeducational groups)	N/R	N/R	–	AAQ
Hayes et al. (2004)	Opioids	124 (50.81%)	42.2	Face-to-face (USA)	ACT + MMT vs. 12-step therapy + MMT	48 vs. 48	Biochemically verified	–	–
Heffner et al. (2023)	Tobacco	49 (22.45%)	51.3 (15)	Web (USA)	Vet Flexiquit (ACT) vs. Vet Smokefree (CBT)	6 vs. N/R	Biochemically verified	–	AIS, VQ
Hernández-López et al. (2009)	Tobacco	81 (64%)	42.43 (9.44)	Face-to-face (Spain)	ACT vs. CBT	7 vs. 7	Biochemically verified	–	–
Luoma et al. (2012)	Polysubstance	133 (45.86%)	33.6	Face-to-face (USA)	ACT + 12-steps therapy vs. 12-steps therapy	3 vs. N/R	Self-reported	Number of weeks of use [a]	–
Luoma et al. (2023)	Injected drugs	100 (49%)	38.1 (5.3)	Face-to-face (Russia)	SCRIPT (ACT) + harm reduction vs. harm reduction	3 vs. N/R	Self-reported	Substance use frequency [a]	–
Mak et al. (2020)	Tobacco	144 (28.47%)	46.34 (13.64)	Face-to-face and phone calls (Hong Kong)	ACT + written self-help materials vs. brief talk on smoking cessation + written self-help materials	3 vs. 1	Biochemically verified	–	AIS
Mak et al. (2021)	Tobacco	130 (13.85%)	49.85 (11.65)	Face-to-face (Hong Kong)	ACT + brief educational talk on smoking cessation + written self-help materials vs. social support + brief educational talk on smoking cessation + written self-help materials	11 vs. 11	Biochemically verified	–	AIS, AAQ
McClure, Bricker, Mull, and Heffner (2020)	Tobacco	450 (52.70%)	51.3 (12.1)	Face-to-face (USA)	ACT + NRT vs. CBT + NRT	5 vs. 5	Biochemically verified	–	–
O'Connor et al. (2020)	Tobacco	150 (52.66%)	35.99 (9.92)	Face-to-face (Ireland)	ACT vs. behavioral support	6 vs. 6	Biochemically verified	Cigarettes per day [a]	AIS

(*continued on next page*)

Table 1 (*continued*)

Study	Main addictive behavior targeted	Sample size (% female)	Age [*M* (*SD*)]	Modality (country)	Conditions (experimental vs. comparison)	Sessions (*n*)	Measurement of abstinence	Other addiction measure	Psychological flexibility measure
Petersen and Zettle (2009)	Alcohol	24 (50%)	37.8 (9.65)	Face-to-face (USA)	ACT + 12-step therapy vs. counseling +12-step therapy	N/R vs. N/R	N/R	–	AAQ
Schmitz et al. (2024)	Cocaine	110 (20%)	49.5 (8)	Face-to-face (USA)	ACT + contingency management vs. counseling + contingency management	8 vs. 8	Biochemically verified	–	–
Smout et al. (2010)	Methamphetamine	104 (40%)	30.9 (6.5)	Face-to-face (Australia)	ACT vs. CBT	12 vs. 12	Biochemically verified	LDQ, proportion of negative drug samples [a]	–
Stappenbeck et al. (2015)	Alcohol	78 (48.70%)	44.3 (11.5)	Face-to-face (USA)	Experiential acceptance vs. cognitive restructuring	5 vs. 5	Self-reported	Drinks per day [a]	–
Stotts et al. (2012)	Opioids	56 (37.50%)	39.88 (9.77)	Face-to-face (USA)	ACT + MMT vs. counseling + MMT	24 vs. 24	Biochemically verified	–	AIS
Vilardaga et al. (2020)	Tobacco	62 (59.68%)	45.87 (11.11)	App (USA)	Learn to Quit (ACT) + NRT vs. QuitGuide (CBT) + NRT	N/R vs. N/R	Biochemically verified	Cigarettes per day [a]	AIS
Weststrate et al. (2023)	Alcohol	45 (46.67%)	42.42 (10.32)	Face-to-face (USA)	Brief ACT + detoxification vs. detoxification	2 vs. N/R	N/R	–	AAQ, MPFI, VLS (ELS)

Note. *M* = Mean; *SD* = Standard Deviation; USA = the United States of America; ACT = Acceptance and Commitment Therapy; CBT = Cognitive-behavioral therapy; N/R = not reported; AIS = Avoidance and Inflexibility Scale; NRT = nicotine replacement therapy; SCRIPT = Stigma Coping to Reduce HIV risks and Improve substance use Prevention and Treatment; AAQ = Acceptance and Action Questionnaire; ASI-6 = Addiction Severity Index; MMT = methadone maintenance therapy; VQ = Valuing Questionnaire; LDQ = Leeds Dependence Questionnaire; MPFI = Multidimensional Psychology Flexibility Inventory – short form; VLS (ELS) = Valued Living Subscale (Engaged Living Scale). [a] Frequency of use.

or 12-step interventions combined with counseling (1/28; 3.57%), alcohol detoxification (1/28; 3.57%), self-help materials with brief talk (1/28; 3.57%), self-help materials with brief talk combined with social support (1/28; 3.57%), harm reduction (1/28; 3.57%), and standard treatment, which involved coordination with healthcare services, therapy, and psychoeducational groups (1/28; 3.57%). Control conditions were implemented in between one and 48 sessions, with a mean of 10.52 (*SD* = 11.12) sessions.

3.2. Meta-analysis

3.2.1. Completion rates

The log RR was estimated at 0.004 and ranged from −0.254 and 0.262 (95% CI: −0.026, 0.034; $p = 0.803$), indicating similar completion rates in experimental and comparison conditions (80.58% and 81%, respectively). The analysis revealed no significant heterogeneity (I^2 = 0%; Q = 11.063; p = 0.748). Fig. 2 displays the forest plot for the

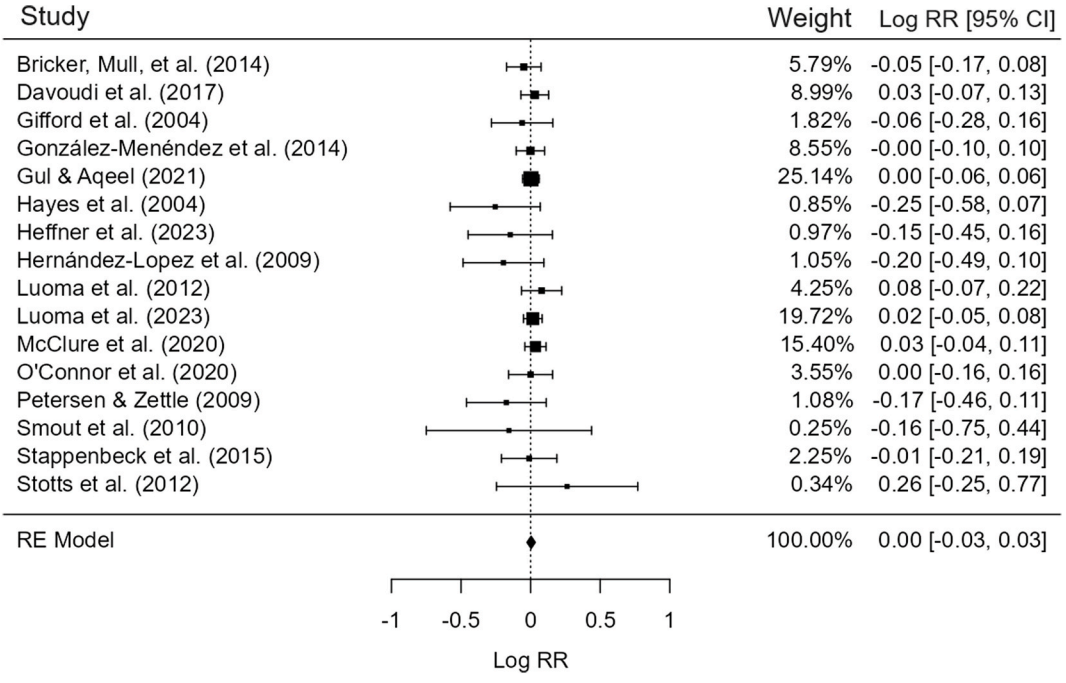

Fig. 2. Forest plot of completion rates. *Note*. RR = risk ratio; CI = confidence interval; RE = random effects.

completion rates at EOT.

3.2.2. Abstinence rates at the end of treatment

At EOT, the Log RR was 0.264 (range: −0.182 to 0.645; 95% CI: 0.046, 0.482; $p = 0.017$). This suggests that ACT increases the likelihood of abstinence at EOT relative to comparison conditions. The mean abstinence rate for the ACT condition was 31.70% compared to 24% in the comparison conditions. Low heterogeneity was observed (I^2 = 21.25%; $Q = 11.126$; $p = 0.433$). A forest plot of treatment efficacy for abstinence rates at EOT is shown in Fig. 3.

Moderator analyses showed that neither the percentage of female participants ($k = 12$; Log RR = −0.249; $p = 0.647$) nor age ($k = 12$; Log RR = −0.012; $p = 0.501$) had a statistically significant impact on EOT abstinence rates. The comparison condition characteristic (i.e., CBT vs. non-CBT) was the only significant moderator regarding intervention characteristics ($k = 12$; Log RR = 0.431; $p = 0.044$). ACT showed higher abstinence rates at EOT than CBT conditions (26.93% vs. 16.05%; $k = 5$; Log RR = 0.519; 95% CI: 0.185, 0.852; $p = 0.002$), demonstrating no heterogeneity ($I^2 = 0\%$; $Q = 1.275$; $p = 0.866$). The comparison between ACT and non-CBT interventions did not show any differences (35.69% vs. 30.69%; $k = 7$; Log RR = 0.128; 95% CI: −0.121, 0.377; $p = 0.313$), and low heterogeneity was found ($I^2 = 14.45\%$; $Q = 5.780$; $p = 0.448$).

The remaining moderators were not significant, including the total number of ACT sessions ($k = 11$; Log RR = 0.001; $p = 0.948$), the use of pharmacological intervention (i.e., combined interventions vs. non-combined; $k = 12$; Log RR = −0.246; $p = 0.238$), treatment modality (i.e., face-to-face vs. technology-based approaches; $k = 12$; Log RR = −0.38; $p = 0.447$), and the target substance use, both comparing each substance (i.e., tobacco [$k = 7$] vs. opiates [$k = 2$] vs. cocaine [$k = 1$]; polysubstance [$k = 1$] vs. methamphetamine [$k = 1$]; [Log RR = 0.097; $p = 0.788$]) or considering tobacco vs. the remaining targeted substances [Log RR = −0.061; $p = 0.810$]).

3.2.3. Abstinence rates at short-term (≤6 months follow-up)

At short-term, the estimated Log RR was 0.295 (95% CI: 0.108, 0.483; $p = 0.002$), with a range of −0.329 to 1.257. The findings show that ACT significantly increased the odds of abstinence in the short-term, with a rate of 21.46% in contrast to 17.90% in the comparison conditions. The analysis showed a moderate level of heterogeneity (I^2 = 47.51%; $Q = 30.125$; $p = 0.017$). Fig. 4 shows a forest plot of treatment efficacy for abstinence rates at short-term.

There was no significant impact on short-term abstinence rates based on the percentage of female participants ($k = 17$; Log RR = −0.367; p = 0.449). However, participants being younger was meaningfully related to higher abstinence rates ($k = 17$; Log RR = −0.037; $p = 0.004$), with substantially decreased heterogeneity (I^2 = 14.64%). There were no significant moderating effects for the total number of ACT sessions (k = 13; Log RR = 0.007; $p = 0.462$), the use of pharmacological intervention (i.e., combined vs. non-combined; $k = 17$; Log RR = −0.123; $p = 0.512$), the characteristics of the comparison condition (i.e., CBT vs. non-CBT; k = 17; Log RR = 0.046; $p = 0.849$), the treatment modality (i.e., delivered face-to-face vs. technology-based approaches; $k = 17$; Log RR = 0.17; p = 0.398), or the target substance use, either considering each substance (i.e., tobacco [$k = 14$] vs. opiates [$k = 1$] vs. polysubstance [$k = 1$] vs. methamphetamine [$k = 1$]; [Log RR = 0.068; $p = 0.891$]; or comparing tobacco vs. the remaining substances [Log RR = −0.166; $p = 0.622$]).

3.2.4. Abstinence rates at long-term (>6 months follow-up)

Finally, the Log RR of abstinence rates at long-term was estimated at 0.164 and ranged from −0.271 to 0.958 (95% CI: −0.101, 0.430; p = 0.225), meaning that similar abstinence rates were found over the long term, specifically, 22.56% in the ACT conditions and 21.72% in the comparison conditions. The analysis showed high heterogeneity (I^2 = 80.76%; $Q = 28.757$; $p < 0.001$). A forest plot of treatment efficacy for abstinence rates at long term is shown in Fig. 5.

The percentage of female participants in the study had no effect on long-term abstinence rates ($k = 9$; Log RR = 0.419; $p = 0.570$), while a lower mean age was associated with higher abstinence rates ($k = 9$; Log RR = −0.045; $p < 0.001$). The inclusion of mean age as a moderator eliminated heterogeneity ($I^2 = 0\%$). In terms of intervention characteristics, the only variable that significantly influenced long-term abstinence rates was the total number of ACT sessions, with a higher number of sessions resulting in higher abstinence rates ($k = 7$; Log RR = 0.100; $p < 0.001$), and reduced levels of heterogeneity ($I^2 = 0\%$). All the

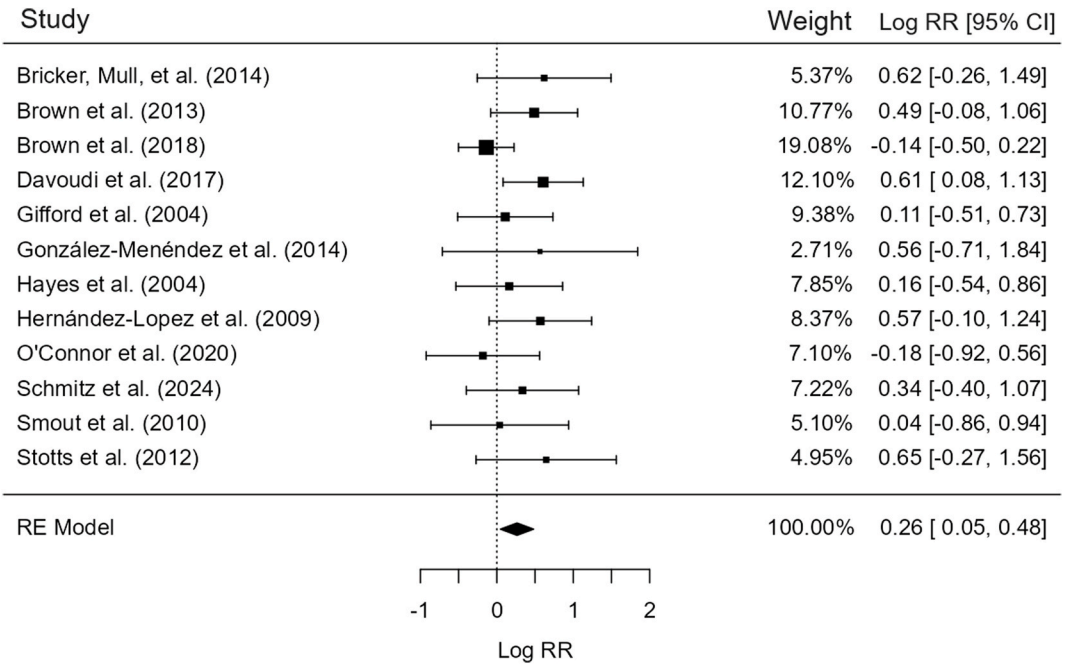

Fig. 3. Forest plot of the efficacy of ACT interventions on abstinence rates at end of treatment. *Note.* RR = risk ratio; CI = confidence interval; RE = random effects.

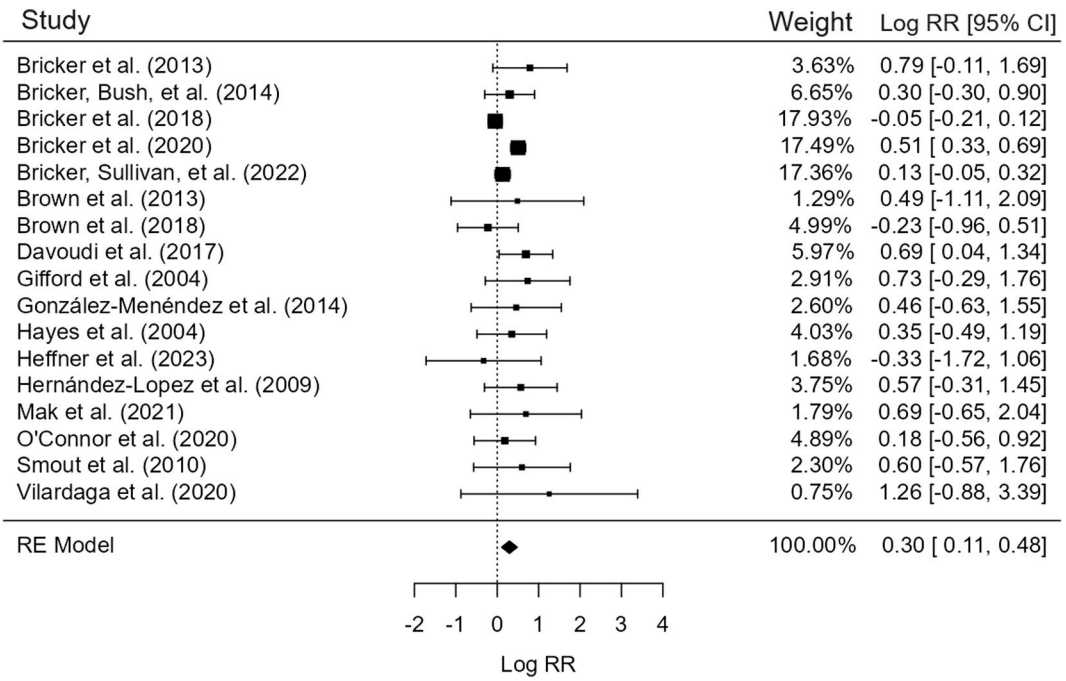

Fig. 4. Forest plot of the efficacy of ACT interventions on abstinence rates at short-term (i.e., ≤6 months follow-up). *Note.* RR = risk ratio; CI = confidence interval; RE = random effects.

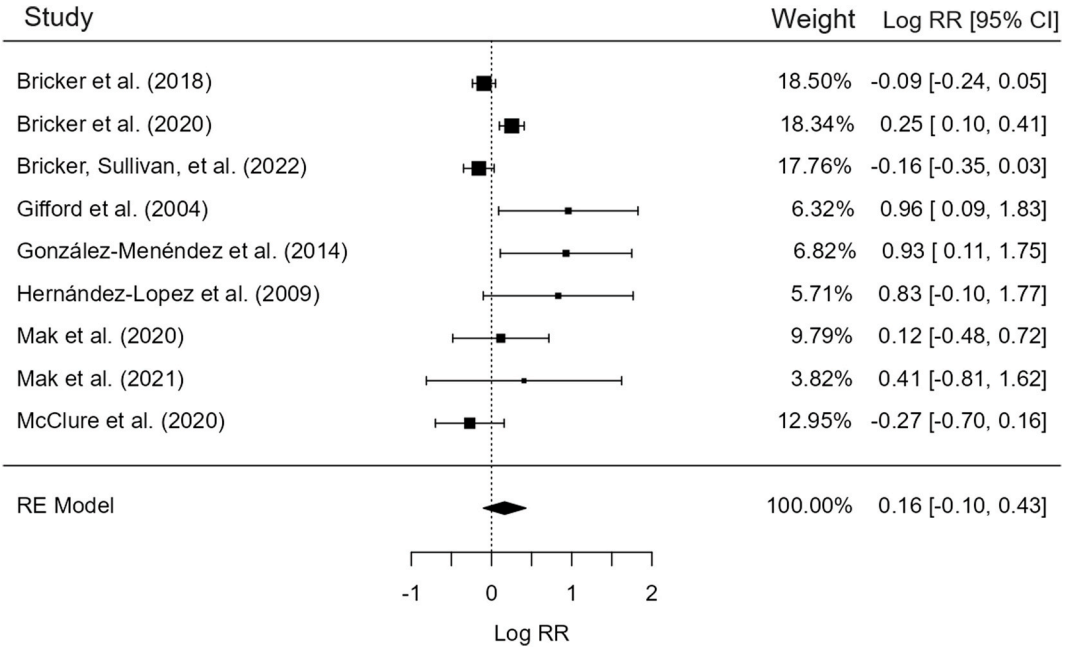

Fig. 5. Forest plot of the efficacy of ACT interventions on abstinence rates at long-term (i.e., >6 months follow-up). *Note.* RR = risk ratio; CI = confidence interval; RE = random effects.

other moderators tested had no significant effect, namely, the use of pharmacological intervention (i.e., combined interventions vs. non-combined; $k = 9$; Log RR = −0.272; $p = 0.336$), the characteristics of the comparison condition (i.e., CBT vs. non-CBT; $k = 9$; Log RR = −0.346; $p = 0.292$), treatment modality (i.e., face-to-face vs. technology-based; $k = 9$; Log RR = 0.413; $p = 0.154$), or target substance use, both considering each substance (i.e., tobacco [$k = 8$] vs. poly-substance [$k = 1$]; Log RR = 0.851; $p = 0.084$) or comparing tobacco vs. the remaining targeted substances [Log RR = −0.850; $p = 0.084$]).

3.3. Systematic review

3.3.1. Addictive behaviors outcomes

The study by González-Menéndez et al. (2014) reported changes in the severity of addictive behavior by group. More specifically, it found a significant treatment effect in favor of ACT compared to CBT in three domains of the Addiction Severity Index (ASI-6), specifically in the 'drug domain' ($p < 0.001$) at EOT, at short- and long-term, and in the 'psychological domain' ($p = 0.043$) and the 'family domain' ($p = 0.005$) in the long-term. In addition, one study examined the differences between

groups in the change of the scores over time in the Leeds Dependence Questionnaire (Smout et al., 2010). There were no significant differences between ACT and CBT at the EOT and in the short-term ($p = 0.98$).

Six studies reported outcomes of frequency of substance use. Luoma, Kohlenberg, Hayes, and Fletcher (2012) compared ACT combined with 12-step therapy vs. 12-step therapy, and the ACT condition demonstrated a greater likelihood of participants not using substances during any week ($OR = 2.32$; 95% CI: 1.14, 4.74) in the short-term. Similarly, Vilardaga et al. (2020) noted that the reduction in cigarettes smoked per day was greater in the Learn to Quit (ACT) plus NRT group than in the QuitGuide (CBT) + NRT group ($p = 0.01$). The remaining studies did not indicate significantly better outcomes in the experimental conditions. In particular, two studies identified improved outcomes in the comparison conditions, whilst two observed no differences. The study by Smout et al. (2010) compared the reduction in hair testing positive for methamphetamine in ACT and CBT groups. While both groups increased the proportion of methamphetamine-free hair samples at EOT and in the short term, only the CBT group showed a significant increase in *post hoc* analyses ($p < 0.01$). Similarly, Stappenbeck et al. (2015) examined the efficacy of experiential acceptance vs. cognitive restructuring. Participants in the comparison group reported consuming significantly fewer drinks per day compared to those in the experimental condition at EOT ($p < 0.001$). Finally, O'Connor, Whelan, Bricker, and McHugh (2020) concluded that non-abstinent members of the ACT group and the behavioral support group showed similar reductions in the number of cigarettes smoked per day at the EOT ($p = 0.921$) and at long-term ($p = 0.689$). On similar lines, the study by Luoma et al. (2023), which examined the changes in injection drug use comparing SCRIPT (Stigma Coping to Reduce HIV risk and Improve Substance Use Prevention and Treatment, an ACT-based intervention) plus harm reduction vs. exclusively harm reduction found no significant differences in substance use frequency over the previous 30 days at the short-term follow up ($p = 0.210$).

3.3.2. Psychological flexibility core processes

Twelve studies analyzed changes in scores on the Avoidance and Inflexibility Scale (AIS), which measure the willingness to experience and not act on substance use cravings. Six studies (50%) that included smoking cessation interventions demonstrated greater improvements in the acceptance of substance use cravings in the experimental condition. In the Bricker, Mull, et al. (2014) study, participants from the SmartQuit (ACT) group showed a significant increase in their acceptance of cravings at EOT ($p = 0.04$), whereas those in the SmartQuit (CBT) group did not ($p = 0.15$). Bricker et al. (2013) showed higher levels of acceptance of smoking-related physical urges, thoughts, and emotions among WeQuit group (ACT) compared to SmokeFree group (CBT) (all p-values ≤ 0.022) in the short term. Similarly, Bricker, Bush, Zbikowski, Mercer, and Heffner (2014) found greater levels of craving acceptance in participants in ACT plus NRT compared to those in CBT plus NRT at short-term ($p = 0.046$), and in the Bricker, Mul, McClure, Watson, and Heffner (2018) study, the WeQuit (ACT) condition had a greater increase in acceptance of craving than the SmokeFree condition ($p = 0.034$). Finally, Mak, Leung, and Loke (2020) observed significant improvement in acceptance rates in ACT compared to the brief talk group over the long-term ($p = 0.022$), while Mak, Loke, and Leung (2021) showed significant differences comparing those conditions at both short- ($p = 0.02$) and long-term ($p = 0.04$) follow-ups in favor of the ACT group. The remaining studies ($n = 6$) did not report any differences when comparing the following conditions: ACT-based distress tolerance vs. behavioral intervention ($p = 0.73$) (Brown et al., 2018) and ACT plus MMT vs. counseling plus MMT ($p = 0.083$) (Stotts et al., 2012) at EOT; ACT vs. CBT ($p > 0.05$) (Bricker, Sullivan, Mull, Torres, & Carpenter, 2022), Vet Flexiquit (ACT) vs. SmokeFree (CBT) ($p > 0.05$) (Heffner et al., 2023) and Learn to Quit (ACT) vs. QuitGuide (CBT) in the short term (Vilardaga et al., 2020); and ACT vs. behavioral support at EOT ($p = 0.181$) and at short-term follow-up ($p = 0.283$) (O'Connor et al., 2020).

Six studies reported changes in psychological inflexibility using the Acceptance and Action Questionnaire (AAQ). Four studies (66.67%) reported ACT having a positive impact on this variable. Specifically, Petersen and Zettle (2009) found a significant reduction in the ACT group at EOT ($p < 0.001$), but not among those receiving exclusively 12-step therapy. Weststrate, Briggs, Miller, Shuster, and Gaynor (2023) indicated that the ACT plus detoxification group achieved a greater reduction in AAQ scores than the detoxification group ($p < 0.01$) at EOT. Along these lines, Gul and Aqeel (2021) found that the ACT group demonstrated greater reduction in AAQ total scores than a standard treatment group in the short-term, which included coordination with healthcare services, therapy, and psychoeducational groups ($p = 0.014$). Similarly, Mak et al. (2021) reported significantly better long-term AAQ improvement from ACT than social support at long-term ($p = 0.003$) follow-up. Conversely, Brown et al. (2018) found no significant differences between ACT-based distress tolerance and behavioral intervention, both including NRT, at short-term ($p = 0.25$), as did González-Menéndez et al. (2014), who compared changes in AAQ scores in ACT and CBT groups at EOT, and at short- and long-term ($p = 00.478$) follow-ups.

In addition, one study (Weststrate et al., 2023) compared differences in the changes in the Multidimensional Psychology Flexibility Inventory-short form at EOT between ACT plus detoxification and detoxification. It found no between-group differences in either the inflexibility scale ($p = 0.77$) or the flexibility scale ($p = 0.82$).

Finally, three studies reported changes in meaningful personal-oriented values, one using the Valued Living subscale from the Engaged Living Scale (ELS) and two using the Valuing Questionnaire (VQ). Weststrate et al. (2023) found no differences in scores on the ELS subscale between the ACT plus detoxification group and the detoxification group at EOT ($p = 0.05$). Heffner et al. (2023) specifically compared scores in Vet Flexiquit (ACT) and the Vet SmokeFree (CBT) in the short term. The subscales of values progress and values obstruction from the VQ exhibited no significant differences between groups (all p-values >0.05). Similarly, O'Connor et al. (2020) did not find any significant differences between those receiving ACT and those receiving behavioral support in terms of progress or obstruction subscales at EOT (all p-values ≥ 0.719) and in the short term (all p-values ≥ 0.339).

3.4. Methodological quality and publication bias

According to the RoB 2.0, 10.71% (3/28) of the studies had a low risk of bias, 75% (21/28) presented some concerns about the risk of bias, and 14.29% (4/28) showed a high risk of bias (see Table 2). The methodological quality was reduced mainly due to domains one and five, respectively related to the randomization process (e.g., studies did not specify how participants were randomized) and the selection of the reported result (e.g., lack of prior analysis plan).

Table 3 displays publication bias. The Egger's and Kendall τ-tests did not show any significant results for abstinence rates at EOT and short-term, suggesting symmetry in the funnel plots. However, the Kendall τ-test detected significant asymmetry in completion rates ($p = 0.041$), whilst Egger's test did not indicate any asymmetry ($p = 0.091$). Conversely, the abstinence rates at long-term did not demonstrate funnel plot asymmetry according to the Kendall τ-test ($p = 0.477$), however, it was identified by Egger's test ($p = 0.022$).

4. Discussion

This systematic review and meta-analysis provides evidence on the effectiveness of ACT targeting addictive disorders in relation to active treatment conditions. The study highlights the following findings: 1) ACT increased the odds of abstinence at EOT and short-term, but not at long-term; 2) ACT demonstrated higher abstinence rates than CBT interventions at EOT; a lower age significantly increased ACT effectiveness

Table 2
Methodological quality summary (Cochrane risk-of-bias tool RoB 2).

Study	Randomization process	Deviation from the intended interventions	Missing outcome data	Measurement of the reported result	Selection of the reported result	Overall risk of bias
Bricker et al. (2013)	Low	Some concerns	Low	Low	Some concerns	Some concerns
Bricker, Bush, et al. (2014)	Low	Low	Low	Low	Some concerns	Some concerns
Bricker, Mull, et al. (2014)	Low	Some concerns	Low	Low	Some concerns	Some concerns
Bricker et al. (2018)	Low	Low	Low	Low	Some concerns	Some concerns
Bricker et al. (2020)	Low	Low	Low	Low	Low	Low
Bricker, Sullivan, et al. (2022)	Low	Low	Low	Low	Some concerns	Some concerns
Brown et al. (2013)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Brown et al. (2018)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Davoudi et al. (2017)	Some concerns	Some concerns	Low	Low	Some concerns	Some concerns
Gifford et al. (2004)	Some concerns	Low	Low	Low	Some concerns	Some concerns
González-Menéndez et al. (2014)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Gul and Aqeel (2021)	Low	Low	Low	Low	Some concerns	Some concerns
Hayes et al. (2004)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Heffner et al. (2023)	Low	Low	Low	Low	Low	Low
Hernández-López et al. (2009)	High	Low	Low	Low	Some concerns	High
Luoma et al. (2012)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Luoma et al. (2023)	Some concerns	Low	Low	Low	Low	Some concerns
Mak et al. (2020)	Low	Low	Low	Low	High	High
Mak et al. (2021)	Low	Low	Low	Low	Some concerns	Some concerns
McClure et al. (2020)	Some concerns	Low	Low	Low	Some concerns	Some concerns
O'Connor et al. (2020)	Low	Low	Low	Low	Some concerns	Some concerns
Petersen and Zettle (2009)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Schmitz et al. (2024)	Low	Low	Low	Low	Low	Low
Smout et al. (2010)	Low	Low	Low	Low	Some concerns	Some concerns
Stappenbeck et al. (2015)	High	Low	Low	Low	Some concerns	High
Stotts et al. (2012)	High	Low	Low	Low	Some concerns	High
Vilardaga et al. (2020)	Some concerns	Low	Low	Low	Some concerns	Some concerns
Weststrate et al. (2023)	Low	Low	Low	Low	Some concerns	Some concerns

Table 3
Publication bias.

	Egger's regression analysis		Begg-Mazumdar test		Fail-safe *N*
	Intercept	*p*-value	Kendall's τ	*p*-value	
Completion rates	−1.691	0.091	−0.383	0.041	0
Abstinence rates at EOT	1.271	0.204	−0.030	0.947	24
Abstinence rates at short-term (≤6 months follow-up)	1.319	0.187	0.162	0.393	112
Abstinence rates at long-term (>6 months follow-up)	2.289	0.022	0.222	0.477	6

Note. EOT = end of treatment.

at short- and long-term follow-ups, whereas a greater number of sessions was related to better ACT effectiveness in the long term; 3) The effectiveness of ACT in reducing the severity and frequency of substance use compared to active conditions was inconclusive, while there was some evidence that ACT showed greater improvements in PF.

In line with prior meta-analyses (Kwan et al., 2024; Lee et al., 2015), ACT demonstrated significantly higher abstinence rates than active comparison conditions at EOT (31.70% vs. 24%) and at short-term (21.46% vs. 17.90%), even though treatment completion rates were similar (80.58% vs. 81%). However, these results disagree with the meta-analysis conducted by Ii et al. (2019), which did not find differences comparing ACT for substance use to first-line psychosocial interventions (e.g., brief motivational intervention, relapse prevention). It is worth noting that this analysis only included three studies (Hayes et al., 2004; Luoma et al., 2012; Stotts et al., 2012) conducted more than ten years ago, which may explain this difference.

In line with the meta-analysis by Kwan et al. (2024) but unlike the study by Lee et al. (2015), the significant impact of ACT on abstinence rates disappeared in the long term. More specifically, the long-term abstinence rate was 22.56% in the ACT conditions vs. 21.72% in the comparison conditions. However, our study separated abstinence outcomes into three time points (EOT, short-term, and long-term), while

Lee et al. (2015) combined outcomes from different time points to analyze the effectiveness of ACT in the last available follow-up (e.g., EOT, 2 months, and 12 months, among others). Six out of nine studies (66.67%) used CBT as a comparison in the long-term analysis. Considering that the moderator related to the comparison group characteristic (ACT vs. CBT or ACT vs. non-CBT) was not significant in the long term, and based on prior meta-analysis (Lee et al., 2015), we can conclude that ACT is at least as effective as CBT in achieving long-term abstinence. This is worth emphasizing, given that CBT has accumulated a significant amount of scientific evidence in relation to substance use (Kiluk et al., 2019; Magill et al., 2019; Ray et al., 2020). As only nine to 28 studies reported long-term abstinence rates, future research on ACT for addiction should undertake follow-ups beyond six months to clarify its added value over other treatments in the long term (A-Tjak et al., 2015).

The only significant moderator found at EOT was the comparison group. The results showed that ACT achieved higher abstinence rates than CBT conditions at EOT (respectively 26.93% vs. 16.05%), suggesting that ACT may be a better treatment option than CBT for addressing addictive behaviors at EOT. However, caution is warranted as the analysis was based on a small number of trials ($n = 5$) and the moderator did not remain significant in the short and long term. On the other hand, ACT demonstrated higher—albeit not significantly so—abstinence rates than non-CBT conditions at EOT. One potential reason for this result may be that there were several comparison approaches (12-step, behavioral intervention, counseling …), and four out of seven studies included supplementary interventions for substance use in both the experimental and the comparison groups (e.g., NRT), which could have made it less likely to find differences due to the added effects of different interventions. Finally, two out of seven studies included a distress tolerance intervention, which focused solely on increasing distress tolerance and valued living (i.e., did not cover the six processes of PF). Considering the heterogeneity of the comparison group in this analysis, further studies are needed to clarify this issue.

A lower mean age was found to be associated with significantly higher abstinence rates in both the short and long term in the ACT groups. This finding is significant because previous studies have indicated that being younger is associated with worse treatment outcomes (e.g., higher likelihood of dropout) in other therapies, including CBT (Aonso-Diego, González-Roz, Weidberg, García-Fernández, & Secades-Villa, 2022; Braitman & Kelley, 2016; Conroy et al., 2020). The fact that ACT focuses on identity, autonomy, and values that give meaning to life could facilitate behavior change in younger people (Keulen, Matthijssen, Schraven, Deković, & Bodden, 2023). Including additional visits during the intervention or booster sessions during follow-ups could improve abstinence outcomes among older individuals (Fishbein, Tynan, Truong, Wetherell, & Herbert, 2023). Additionally, since the mean age of participants in the studies in the analysis ranged from 30 to 51.3 years old, the efficacy of this therapy needs to be examined in a broader age range (<30 years old and >50 years old).

Furthermore, a greater number of ACT sessions was related to greater abstinence rates in the long term. This result has been previously found in meta-analyses examining the efficacy of ACT in populations with health problems such as cancer or chronic pain (Ma, Yuen, & Yang, 2023; Vowles, Pielech, Edwards, McEntee, & Bailey, 2020; Zhao et al., 2021). Specifically, the two studies with higher abstinence rates in the long term included 14 and 16 sessions (Gifford et al., 2004; González-Menéndez et al., 2014). Firstly, more sessions allows therapists to reinforce participants' continued abstinence, which predicts long-term abstinence (Brandt et al., 2023). Secondly, it offers individuals more opportunities to develop and practice different PF processes. These processes need time to practice and become internalized, and individuals may begin to appreciate the value of abstinence as they observe its effects on important areas of their lives that have been neglected for so long. Previous studies on ACT have referred to this phenomenon as an "incubation pattern" or "sleeper effect" (González-Menéndez et al., 2014; Lee et al., 2015; Trindade et al., 2021; Wharton, Edwards, Juhasz, & Walser, 2019). No further significant moderators were found, the benefits of ACT remained when it was conducted face-to-face or via technological means, and both with and without pharmacological interventions. Finally, the effectiveness of ACT was similar across the different substances targeted, in accordance with the transdiagnostic nature of the therapy.

The remaining addiction-related outcomes were systematically reviewed. Only two studies reported outcomes on changes in addiction severity and dependence severity, while regarding changes in frequency, two studies found a significantly greater effect from ACT, two found greater effects from CBT and cognitive restructuring, and two found no differences. The results are inconclusive and there is a need to longitudinally analyze changes in these variables in future studies. Furthermore, there is a pattern of greater improvement in PF in ACT conditions, as 10 studies reported better outcomes from ACT, 12 found no differences, and none found evidence of better outcomes in comparison conditions. It is worth noting that previous systematic reviews have concluded greater improvements in PF in ACT conditions (Díez-Bejarano & Chaves, 2022; Maia et al., 2021), although these studies compared outcomes to both active and inactive conditions, whereas we only compared active conditions. Improving PF during the intervention is expected to reinforce stopping substance use (Albal & Buzlu, 2021). This can be achieved by promoting committed actions based on individuals' values, regardless of their internal events (e.g., substance use craving). Research has shown that PF is related to greater psychological well-being (Kashdan & Rottenberg, 2010; Marshall & Brockman, 2016; Meyer et al., 2018). Therefore, future studies should analyze changes in PF longitudinally. This will enable meta-analytical studies on the changes in PF to clarify its relationship with abstinence.

When drawing conclusions from the study, it is important to consider certain limitations. Firstly, 46.43% of the included studies were pilot trials reporting preliminary results, some had small sample sizes (8 out of 13 had a sample <100 participants), and one study had a quasi-experimental design. These studies may have introduced bias because they were underpowered. Secondly, most of the studies (67.86%) were conducted in the United States. The lack of diversity in the countries in which studies were conducted could potentially limit the generalizability of the results. In addition, the majority of the included studies (60.71%) were focused on smoking cessation, and none targeted non-substance addictive behaviors (e.g., gambling, gaming), so it may not be possible to extrapolate the results to a wide range of addictive behaviors. Furthermore, abstinence status was biochemically verified in only 57.14% of the included studies, so the results should be interpreted with caution, as self-reported abstinence has been shown to have poorer validity (Benowitz et al., 2020; Scheuermann et al., 2017). Another limitation was that the type of substance was not a significant moderator, however, this result should be interpreted with caution due to low statistical power. Finally, only completion and abstinence rates were eligible for meta-analysis. The other outcomes related to addictive behaviors (i.e., frequency of use, addiction severity) and changes in PF required a systematic review, making it less accurate for estimating the effect of the interventions on these variables. The inability to meta-analyze data on changes in addiction severity and frequency of use is a key limitation in the context of harm reduction interventions, where these variables are relevant outcomes beyond abstinence.

The present study provides evidence of the effectiveness of ACT for substance use at EOT and in the short term compared to other active interventions. ACT demonstrated higher abstinence rates than CBT conditions at EOT, and in the long term it achieved results that were at least similar to effective interventions for substance use, including CBT. The effectiveness of ACT was moderated by age and the number of sessions. Specifically, ACT demonstrated higher abstinence rates in younger individuals, and offering more ACT sessions facilitated long-term abstinence. Further studies are required to examine the long-term effects of ACT and to identify other moderators that improve abstinence rates, as well as to analyze changes in the frequency of

substance use and addiction severity over time, which are crucial outcomes of harm reduction programs. Finally, considering the transdiagnostic nature of ACT, future research should focus on longitudinally examining the effect of changes in the six core PF processes in people receiving treatment for substance use, looking beyond abstinence rates, and examining the relationship between PF and other relevant issues in the field of addiction, such as individuals' quality of life. Finally, it should be noted that despite the study's findings about the effectiveness of ACT, the rates of abstinence remain exceedingly low. This indicates a significant gap to bridge before more effective therapies for substance use disorders can be offered.

Data sharing statement

Data is available upon reasonable request to the corresponding author.

Role of funding source

This work was supported by a predoctoral grant for Andrea Krotter from the Government of the Principality of Asturias [ref.: PA-21-PF-BP20-015] and by a postdoctoral grant for Gema Aonso-Diego funded by the Ministry of Science, Innovation and Universities (MCIN/AEI/10.13039/501100011033) and by the European Union NextGenerationEU/PRTR [ref.: JDC2022-048311-I].

CRediT authorship contribution statement

Andrea Krotter: Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Gema Aonso-Diego:** Writing – review & editing, Data curation, Conceptualization. **Ana González-Menéndez:** Writing – review & editing, Supervision. **Alba González-Roz:** Writing – review & editing, Supervision. **Roberto Secades-Villa:** Writing – review & editing, Supervision. **Ángel García-Pérez:** Writing – review & editing, Supervision, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

A-Tjak, J. G. L., Davis, M. L., Morina, N., Powers, M. B., Smits, J. A. J., & Emmelkamp, P. M. G. (2015). A meta-analysis of the efficacy of acceptance and commitment therapy for clinically relevant mental and physical health problems. *Psychotherapy and Psychosomatics, 84*(1), 30–36. https://doi.org/10.1159/000365764

Ainscough, T. S., Brose, L. S., Strang, J., & McNeill, A. (2021). Contingency management for tobacco smoking during opioid addiction treatment: Implementation challenges. *Drug and Alcohol Review, 40*(4), 658–661. https://doi.org/10.1111/dar.13216

Albal, E., & Buzlu, S. (2021). The effect of maladaptive schemas and psychological flexibility approaches on the addiction severity of drug addicts. *Archives of Psychiatric Nursing, 35*(6), 617–624. https://doi.org/10.1016/j.apnu.2021.09.001

Aonso-Diego, G., González-Roz, A., Weidberg, S., García-Fernández, G., & Secades-Villa, R. (2022). Smoking cessation treatment attendance among smokers with substance use disorders. *Adicciones, 34*(4), 327–330. https://doi.org/10.20882/adicciones.1718

Barnes-Holmes, D., Barnes-Holmes, Y., Hussey, I., & Luciano, C. (2016). Relational frame theory: Finding its historical and philosophical roots and reflecting upon its future development: An introduction to part II. In R. D. Zettle, S. C. Hayes, D. Barnes-Holmes, & A. Biglan (Eds.), *The Wiley Handbook of contextual behavioral science* (pp. 115–128). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118489857.CH8.

Begg, C. B., & Mazumdar, M. (1994). Operating characteristics of a rank correlation test for publication bias. *Biometrics, 50*(4), 1088–1101. https://doi.org/10.2307/2533446

Benishek, L. A., Dugosh, K. L., Kirby, K. C., Matejkowski, J., Clements, N. T., Seymour, B. L., et al. (2014). Prize-based contingency management for the treatment of substance abusers: A meta-analysis. *Addiction, 109*(9), 1426–1436. https://doi.org/10.1111/add.12589

Benowitz, N. L., Bernert, J. T., Foulds, J., Hecht, S. S., Iii, P. J., Jarvis, M. J., et al. (2020). Biochemical verification of tobacco use and abstinence: 2019 update. *Nicotine & Tobacco Research, 22*(7), 1086–1097. https://doi.org/10.1093/ntr/ntz132

Boness, C. L., Votaw, V. R., Schwebel, F. J., Moniz-Lewis, D. I. K., McHugh, R. K., & Witkiewitz, K. (2023). An evaluation of cognitive behavioral therapy for substance use disorder: A systematic review and application of the society of clinical psychology criteria for empirically supported treatments. *Clinical Psychologist, 30*(2), 129–142. https://doi.org/10.1037/cps0000131

Braitman, A. L., & Kelley, M. L. (2016). Initiation and retention in couples outpatient treatment for parents with drug and alcohol use disorders. *Experimental and Clinical Psychopharmacology, 24*(3), 174–184. https://doi.org/10.1037/pha0000072

Brandt, L., Hu, M. C., Nunes, E. V., & Campbell, A. N. C. (2023). Exploring the performance of during-treatment substance use outcome measures in predicting longer-term psychosocial functioning and post-treatment abstinence. *Drug and Alcohol Dependence, 248*. https://doi.org/10.1016/j.drugalcdep.2023.109918. Article 109918.

Bricker, J. B., Bush, T., Zbikowski, S. M., Mercer, L. D., & Heffner, J. L. (2014a). Randomized trial of telephone-delivered acceptance and commitment therapy versus cognitive behavioral therapy for smoking cessation: A pilot study. *Nicotine & Tobacco Research, 16*(11), 1446–1454. https://doi.org/10.1093/ntr/ntu102

Bricker, J. B., Miao, Z., Mull, K., Santiago-Torres, M., & Vock, D. M. (2023). Can a single variable predict early dropout from digital health interventions? comparison of predictive models from two large randomized trials. *Journal of Medical Internet Research, 25*. https://doi.org/10.2196/43629

Bricker, J. B., Mul, K. E., McClure, J. B., Watson, N. L., & Heffner, J. L. (2018). Improving quit rates of web-delivered interventions for smoking cessation: Full-scale randomized trial of WebQuit.org versus Smokefree.gov. *Addiction, 113*(5), 914–923. https://doi.org/10.1111/add.14127

Bricker, J. B., Mull, K. E., Kientz, J. A., Vilardaga, R., Mercer, L. D., Akioka, K. J., et al. (2014b). Randomized, controlled pilot trial of a smartphone app for smoking cessation using acceptance and commitment therapy. *Drug and Alcohol Dependence, 143*, 87–94. https://doi.org/10.1016/j.drugalcdep.2014.07.006

Bricker, J. B., Mull, K. E., Santiago-Torres, M., Miao, Z., Perski, O., & Di, C. (2022a). Smoking cessation smartphone app use over time: Predicting 12-month cessation outcomes in a 2-arm randomized trial. *Journal of Medical Internet Research, 24*(8). https://doi.org/10.2196/39208

Bricker, J. B., Santiago-Torres, M., Mull, K. E., Sullivan, B. M., David, S. P., Schmitz, J., … Rigotti, N. A. (2024). Do medications increase the efficacy of digital interventions for smoking cessation? Secondary results from the iCanQuit randomized trial. *Addiction (Abingdon, England), 119*(4), 664–676. https://doi.org/10.1111/ADD.16396.

Bricker, J. B., Sullivan, B. M., Mull, K. E., Torres, A. J., & Carpenter, K. M. (2022b). Full-scale randomized trial comparing acceptance and commitment therapy telephone-delivered coaching with standard telephone-delivered coaching among medicare/uninsured quitline callers. *Nicotine & Tobacco Research, 24*(10), 1556–1566. https://doi.org/10.1093/ntr/ntac052

Bricker, J. B., Watson, N. L., Mull, K. E., Sullivan, B. M., & Heffner, J. L. (2020). Efficacy of smartphone applications for smoking cessation: A randomized clinical trial. *JAMA Internal Medicine, 180*(11), 1472–1480. https://doi.org/10.1001/jamainternmed.2020.4055

Bricker, J. B., Wyszynski, C., Comstock, B., & Heffner, J. L. (2013). Pilot randomized controlled trial of web-based acceptance and commitment therapy for smoking cessation. *Nicotine & Tobacco Research, 15*(10), 1756–1764. https://doi.org/10.1093/ntr/ntt056

Brown, R. A., Palm Reed, K. M., Bloom, E. L., Minami, H., Strong, D. R., Lejuez, C. W., et al. (2018). A randomized controlled trial of distress tolerance treatment for smoking cessation. *Psychology of Addictive Behaviors, 32*(4), 389–400. https://doi.org/10.1037/adb0000372

Brown, R. A., Reed, K. M. P., Bloom, E. L., Minami, H., Strong, D. R., Lejuez, C. W., et al. (2013). Development and preliminary randomized controlled trial of a distress tolerance treatment for smokers with a history of early lapse. *Nicotine & Tobacco Research, 15*(12), 2005–2015. https://doi.org/10.1093/ntr/ntt093

Byrne, S. P., Haber, P., Baillie, A., Costa, D. S. J., Fogliati, V., & Morley, K. (2019). Systematic reviews of mindfulness and acceptance and commitment therapy for alcohol use disorder: Should we be using third wave therapies? *Alcohol and Alcoholism, 54*(2), 159–166. https://doi.org/10.1093/alcalc/agy089

Capili, B. (2023). A primer to the randomized controlled trial. *American Journal of Nursing, 123*(3), 47–51. https://doi.org/10.1097/01.naj.0000921808.23646.01

Conroy, H. E., Jacquart, J., Baird, S. O., Rosenfield, D., Davis, M. L., Powers, M. B., et al. (2020). Age and pre quit-day attrition during smoking cessation treatment. *Cognitive Behaviour Therapy, 49*(5), 361–373. https://doi.org/10.1080/16506073.2020.1751262

Davis, M. L., Powers, M. B., Handelsman, P., Medina, J. L., Zvolensky, M., & Smits, J. A. J. (2015). Behavioral therapies for treatment-seeking cannabis users: A meta-analysis of randomized controlled trials. *Evaluation & the Health Professions, 38*(1), 94–114. https://doi.org/10.1177/0163278714529970

Davoudi, M., Omidi, A., Sehat, M., & Sepehrmanesh, Z. (2017). The effects of acceptance and commitment therapy on man smokers' comorbid depression and anxiety symptoms and smoking cessation: A randomized controlled trial. *Addiction & Health, 9*(3), 129–138.

Degenhardt, L., Charlson, F., Ferrari, A., Santomauro, D., Erskine, H., Mantilla-Herrara, A., et al. (2018). The global burden of disease attributable to alcohol and drug use in 195 countries and territories, 1990-2016: A systematic analysis for the global burden of disease study 2016. *The Lancet Psychiatry, 5*(12), 987–1012. https://doi.org/10.1016/S2215-0366(18)30337-7

Díez-Bejarano, L., & Chaves, C. (2022). Is acceptance and commitment therapy effective in treating addiction? A systematic review. *Psychiatric Annals, 52*(6), 248–260. https://doi.org/10.3928/00485713-20220504-01

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ, 315*(7109), 629–634. https://doi.org/10.1136/bmj.315.7109.629

Fishbein, J. N., Tynan, M., Truong, L., Wetherell, J. L., & Herbert, M. S. (2023). Age differences in acceptance and commitment therapy for chronic pain. *Journal of Contextual Behavioral Science, 30*, 106–111. https://doi.org/10.1016/j.jcbs.2023.09.006

Getty, C. A., Morande, A., Lynskey, M., Weaver, T., & Metrebian, N. (2019). Mobile telephone-delivered contingency management interventions promoting behaviour change in individuals with substance use disorders: A meta-analysis. *Addiction, 114*(11), 1915–1925. https://doi.org/10.1111/add.14725

Gifford, E. V., Kohlenberg, B. S., Hayes, S. C., Antonuccio, D. O., Piasecki, M. M., Rasmussen-Hall, M. L., et al. (2004). Acceptance-based treatment for smoking cessation. *Behavior Therapy, 35*(4), 689–705. https://doi.org/10.1016/S0005-7894(04)80015-7

González-Menéndez, A., Fernández, P., Rodríguez, F., & Villagrá, P. (2014). Long-term outcomes of acceptance and commitment therapy in drug-dependent female inmates: A randomized controlled trial. *International Journal of Clinical and Health Psychology, 14*(1), 18–27. https://doi.org/10.1016/S1697-2600(14)70033-X

González-Menéndez, A., García-Fernández, G., Krotter, A., & González-Roz, A. (2022). Terapias contextuales [contextual therapies]. In R. Secades-Villa, G. García-Fernández, & S. Fernández-Artamendi (Eds.), *Manual de Conductas Adictivas: Teoría, evaluación y tratamiento [Handbook of Addictive Behaviors: Theory, Assessment and Treatment]* (pp. 315–338). Pirámide.

Gul, M., & Aqeel, M. (2021). Acceptance and commitment therapy for treatment of stigma and shame in substance use disorders: A double-blind, parallel-group, randomized controlled trial. *Journal of Substance Use, 26*(4), 413–419. https://doi.org/10.1080/14659891.2020.1846803

Harris, R. (2019). *ACT made simple: An easy-to-read primer on acceptance and commitment therapy* (2nd ed.) New Harbinger.

Hayes, S. C. (1987). A contextual approach to therapeutic change. In N. S. Jacobson (Ed.), *Psychotherapists in clinical practice: Cognitive and behavioral perspectives* (pp. 327–387). Guilford Press.

Hayes, S. C., & Levin, M. (2012). *Mindfulness & acceptance for addictive behaviors: Applying contextual CBT to substance abuse & behavioral addictions*. New Harbinger Publications.

Hayes, S. C., Pistorello, J., & Levin, M. E. (2012a). Acceptance and commitment therapy as a unified model of behavior change. *The Counseling Psychologist, 40*(7), 976–1002. https://doi.org/10.1177/0011000012460836

Hayes, S. C., Strosahl, K., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. Guilford Press.

Hayes, S. C., Strosahl, K., & Wilson, K. G. (2012b). *Acceptance and commitment therapy: The process and practice of mindful change* (2nd ed.). Guilford Press.

Hayes, S. C., Wilson, K. G., Gifford, E. V., Bissett, R., Piasecki, M., Batten, S. V., et al. (2004). A preliminary trial of twelve-step facilitation and acceptance and commitment therapy with polysubstance-abusing methadone-maintained opiate addicts. *Behavior Therapy, 35*(4), 667–688. https://doi.org/10.1016/S0005-7894(04)80014-5

Heffner, J. L., Kelly, M. M., Reilly, E. D., Reece, S. G., Claudio, T., Serfozo, E., et al. (2023). An avatar-led web-based and SMS text message smoking cessation program for socioeconomically disadvantaged veterans: Pilot randomized controlled trial. *JMIR Formative Research, 7*. https://doi.org/10.2196/44503

Heffner, J. L., Kelly, M. M., Waxmonsky, J., Mattocks, K., Serfozo, E., Bricker, J. B., et al. (2020). Pilot randomized controlled trial of web-delivered acceptance and commitment therapy versus smokefree.gov for smokers with bipolar disorder. *Nicotine & Tobacco Research, 22*(9), 1543–1552. https://doi.org/10.1093/ntr/ntz242

Hernández-López, M., Luciano, M. C., Bricker, J. B., Roales-Nieto, J. G., & Montesinos, F. (2009). Acceptance and commitment therapy for smoking cessation: A preliminary study of its effectiveness in comparison with cognitive behavioral therapy. *Psychology of Addictive Behaviors, 23*(4), 723–730. https://doi.org/10.1037/a0017632

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ, 327*(7414), 557–560. https://doi.org/10.1136/bmj.327.7414.557

Hofmann, S. G., & Hayes, S. C. (2019). The future of intervention science: Process-based therapy. *Clinical Psychological Science, 7*(1), 37–50. https://doi.org/10.1177/2167702618772296

Ii, T., Sato, H., Watanabe, N., Kondo, M., Masuda, A., Hayes, S. C., et al. (2019). Psychological flexibility-based interventions versus first-line psychosocial interventions for substance use disorders: Systematic review and meta-analyses of randomized controlled trials. *Journal of Contextual Behavioral Science, 13*, 109–120. https://doi.org/10.1016/j.jcbs.2019.07.003

Jones, H. A., Heffner, J. L., Mercer, L. D., Wyszynski, C., Vilardaga, R., & Bricker, J. B. (2015). Web-based acceptance and commitment therapy smoking cessation treatment for smokers with depressive symptoms. *Journal of Dual Diagnosis, 11*(1), 56–62. https://doi.org/10.1080/15504263.2014.992588

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review, 30*(7), 865–878. https://doi.org/10.1016/j.cpr.2010.03.001

Keulen, J., Matthijssen, D., Schraven, J., Deković, M., & Bodden, D. (2023). The effectiveness and cost-effectiveness of Acceptance and Commitment Therapy as a transdiagnostic intervention for transitional-age youth: Study protocol of a randomized controlled trial. *BMC Psychiatry, 23*(1). https://doi.org/10.1186/S12888-023-04535-Z. Article 51.

Kiluk, B. D., Ray, L. A., Walthers, J., Bernstein, M., Tonigan, J. S., & Magill, M. (2019). Technology-delivered cognitive-behavioral interventions for alcohol use: A meta-analysis. *Alcoholism: Clinical and Experimental Research, 43*(11), 2285–2295. https://doi.org/10.1111/acer.14189

Kwan, Y. K., Lau, Y., Ang, W. W., & Lau, S. T. (2024). Immediate, short-term, medium-term, and long-term effects of acceptance and commitment therapy for smoking cessation: A systematic review and meta-analysis. *Nicotine & Tobacco Research, 26*(1), 12–22. https://doi.org/10.1093/ntr/ntad145

Kwon, D. M., Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Zvolensky, M. J., & Bricker, J. B. (2022). Web-delivered acceptance and commitment therapy (ACT) for smoking cessation: Is it engaging and efficacious for US Hispanic/Latinx adult smokers? *Preventive Medicine Reports, 29*, Article 101952. https://doi.org/10.1016/j.pmedr.2022.101952

Lanza, P. V., García, P. F., Lamelas, F. R., & González-Menéndez, A. (2014). Acceptance and commitment therapy versus cognitive behavioral therapy in the treatment of substance use disorder with incarcerated women. *Journal of Clinical Psychology, 70*(7), 644–657. https://doi.org/10.1002/jclp.22060

Lappan, S. N., Brown, A. W., & Hendricks, P. S. (2020). Dropout rates of in-person psychosocial substance use disorder treatments: A systematic review and meta-analysis. *Addiction, 115*(2), 201–217. https://doi.org/10.1111/add.14793

Lee, E. B., An, W., Levin, M. E., & Twohig, M. P. (2015). An initial meta-analysis of Acceptance and Commitment Therapy for treating substance use disorders. *Drug and Alcohol Dependence, 155*, 1–7. https://doi.org/10.1016/j.drugalcdep.2015.08.004

Luoma, J. B., Kohlenberg, B. S., Hayes, S. C., & Fletcher, L. (2012). Slow and steady wins the race: A randomized clinical trial of acceptance and commitment therapy targeting shame in substance use disorders. *Journal of Consulting and Clinical Psychology, 80*(1), 43–53. https://doi.org/10.1037/a0026070

Luoma, J. B., Rossi, S. L., Sereda, Y., Pavlov, N., Toussova, O., Vetrova, M., et al. (2023). An acceptance-based, intersectional stigma coping intervention for people with HIV who inject drugs—a randomized clinical trial. *The Lancet Regional Health - Europe, 28*. https://doi.org/10.1016/j.lanepe.2023.100611. Article 100611.

Ma, T. W., Yuen, A. S. K., & Yang, Z. (2023). The efficacy of acceptance and commitment therapy for chronic pain: A systematic review and meta-analysis. *The Clinical Journal of Pain, 39*(3), 147–157. https://doi.org/10.1097/ajp.0000000000001096

Magill, M., Ray, L., Kiluk, B., Hoadley, A., Bernstein, M., Scott Tonigan, J., et al. (2019). A meta-analysis of cognitive-behavioral therapy for alcohol or other drug use disorders: Treatment efficacy by contrast condition. *Journal of Consulting and Clinical Psychology, 87*(12), 1093–1105. https://doi.org/10.1037/ccp0000447

Maia, M. F. C., dos Santos, B. F., de Castro, L. C., Vieira, N. S. T., & Da Silveira, P. S. (2021). Acceptance and commitment therapy and drug use: A systematic review. *Paideia, 31*, 1–10. https://doi.org/10.1590/1982-4327e3136

Mak, Y. W., Leung, D. Y. P., & Loke, A. Y. (2020). Effectiveness of an individual acceptance and commitment therapy for smoking cessation, delivered face-to-face and by telephone to adults recruited in primary health care settings: A randomized controlled trial. *BMC Public Health, 20*(1). https://doi.org/10.1186/s12889-020-09820-0. Article 1719.

Mak, Y. W., Loke, A. Y., & Leung, D. Y. P. (2021). Acceptance and commitment therapy versus social support for smoking cessation for people with schizophrenia: A randomised controlled trial. *Journal of Clinical Medicine, 10*(19). https://doi.org/10.3390/jcm10194304. Article 4304.

Marshall, E. J., & Brockman, R. N. (2016). The relationships between psychological flexibility, self-compassion, and emotional well-being. *Journal of Cognitive Psychotherapy, 30*(1), 60–72. https://doi.org/10.1891/0889-8391.30.1.60

McClure, J. B., Bricker, J., Mull, K., & Heffner, J. L. (2020). Comparative effectiveness of group-delivered acceptance and commitment therapy versus cognitive behavioral therapy for smoking cessation: A randomized controlled trial. *Nicotine & Tobacco Research, 22*(3), 354–362. https://doi.org/10.1093/ntr/nty268

Meyer, E. C., Frankfurt, S. B., Kimbrel, N. A., DeBeer, B. B., Gulliver, S. B., & Morrisette, S. B. (2018). The influence of mindfulness, self-compassion, psychological flexibility, and posttraumatic stress disorder on disability and quality of life over time in war veterans. *Journal of Clinical Psychology, 74*(7), 1272–1280. https://doi.org/10.1002/JCLP.22596

Notley, C., Gentry, S., Livingstone-Banks, J., Bauld, L., Perera, R., & Hartmann-Boyce, J. (2019). Incentives for smoking cessation. *Cochrane Database of Systematic Reviews, 7*(7). https://doi.org/10.1002/14651858.cd004307.pub6. Article CD004307.

O'Connor, M., Whelan, R., Bricker, J., & McHugh, L. (2020). Randomized controlled trial of a smartphone application as an adjunct to acceptance and commitment therapy for smoking cessation. *Behavior Therapy, 51*(1), 162–177. https://doi.org/10.1016/j.beth.2019.06.003

Orwin, R. G. (1983). A Fail-Safe N for effect size in meta-analysis. *Journal of Educational Statistics, 8*(2), 157–159. https://doi.org/10.2307/1164923

Petersen, C. L., & Zettle, R. D. (2009). Treating inpatients with comorbid depression and alcohol use disorders: A comparison of acceptance and commitment therapy versus treatment as usual. *Psychological Record, 59*(4), 521–536. https://doi.org/10.1007/BF03395679

Pfund, R. A., Forman, D. P., Whalen, S. K., Zech, J. M., Ginley, M. K., Peter, S. C., et al. (2023). Effect of cognitive-behavioral techniques for problem gambling and gambling disorder: A systematic review and meta-analysis. *Addiction, 118*(9), 1661–1674. https://doi.org/10.1111/add.16221

Pfund, R. A., Ginley, M. K., Rash, C. J., & Zajac, K. (2022). Contingency management for treatment attendance: A meta-analysis. *Journal of Substance Abuse Treatment, 133*. https://doi.org/10.1016/j.jsat.2021.108556. Article 108556.

Pfund, R. A., Peter, S. C., McAfee, N. W., Ginley, M. K., Whelan, J. P., & Meyers, A. W. (2021). Dropout from face-to-face, multi-session psychological treatments for

problem and disordered gambling: A systematic review and meta-analysis. *Psychology of Addictive Behaviors, 35*(8), 901–913. https://doi.org/10.1037/adb0000710

Ray, L. A., Meredith, L. R., Kiluk, B. D., Walthers, J., Carroll, K. M., & Magill, M. (2020). Combined pharmacotherapy and cognitive behavioral therapy for adults with alcohol or substance use disorders: A systematic review and meta-analysis. *JAMA Network Open, 3*(6). https://doi.org/10.1001/jamanetworkopen.2020.8279. Article e208279.

Rehm, J., & Shield, K. D. (2019). Global burden of disease and the impact of mental and addictive disorders. *Current Psychiatry Reports, 21*(2). https://doi.org/10.1007/s11920-019-0997-0. Article 10.

Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J., et al. (2021). PRISMA-S: An extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic Reviews, 10*. https://doi.org/10.1186/s13643-020-01542-z. Article 39.

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin, 86*(3), 638–641. https://doi.org/10.1037/0033-2909.86.3.638

Santiago-Torres, M., Kwon, D. M., Mull, K. E., Sullivan, B. M., Ahluwalia, J. S., Alexander, A. C., et al. (2022). Efficacy of web-delivered acceptance and commitment therapy (ACT) for helping black adults quit smoking. *Journal of Racial and Ethnic Health Disparities, 10*(6), 2816–2825. https://doi.org/10.1007/s40615-022-01458-5

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., & Bricker, J. B. (2024). Relative Efficacy of an Acceptance and Commitment Therapy-Based Smartphone App with a Standard US Clinical Practice Guidelines-Based App for Smoking Cessation in Dual Users of Combustible and Electronic Cigarettes: Secondary Findings from a Randomized Trial. *Substance Use & Misuse, 59*(4), 591–600. https://doi.org/10.1080/10826084.2023.2293732.

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Ferketich, A. K., & Bricker, J. B. (2022). Efficacy of an acceptance and commitment therapy-based smartphone application for helping rural populations quit smoking: Results from the iCanQuit randomized trial. *Preventive Medicine, 157*. https://doi.org/10.1016/j.ypmed.2022.107008. Article 107008.

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Kendzor, D. E., & Bricker, J. B. (2022). Efficacy and utilization of smartphone applications for smoking cessation among low-income adults: Secondary analysis of the iCanQuit randomized trial. *Drug and Alcohol Dependence, 231*. https://doi.org/10.1016/j.drugalcdep.2021.109258. Article 109258.

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Kwon, D. M., Nez Henderson, P., Nelson, L. A., et al. (2022). Efficacy and utilization of smartphone applications for smoking cessation among American Indians and Alaska natives: Results from the iCanQuit trial. *Nicotine & Tobacco Research, 24*(4), 544–554. https://doi.org/10.1093/ntr/ntab213

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Kwon, D., Nollen, N. L., Zvolensky, M. J., et al. (2022). Efficacy and utilization of an acceptance and commitment therapy-based smartphone application for smoking cessation among black adults: Secondary analysis of the iCanQuit randomized trial. *Addiction, 117*(3), 760–771. https://doi.org/10.1111/add.15721

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Matthews, A. K., Skinta, M. D., Thrul, J., … Bricker, J. B. (2024). Do Smartphone Apps Impact Long-Term Smoking Cessation for Sexual and Gender Minority Adults? Exploratory Results from a 2-Arm Randomized Trial Comparing Acceptance and Commitment Therapy with Standard US Clinical Practice Guidelines. *Journal of Homosexuality*. https://doi.org/10.1080/00918369.2024.2309491.

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Rigotti, N. A., & Bricker, J. B. (2023). Acceptance and commitment therapy-based smartphone applications for cessation of tobacco use among adults with high nicotine dependence: Results from the iCanQuit randomized trial. *Substance Use & Misuse, 58*(3), 354–364. https://doi.org/10.1080/10826084.2022.2161317

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Zvolensky, M. J., & Bricker, J. B. (2022). Can a smartphone application help Hispanic/Latinx adults quit smoking? A randomized trial secondary analysis. *Journal of Contextual Behavioral Science, 26*, 261–270. https://doi.org/10.1016/j.jcbs.2022.11.001

Santiago-Torres, M., Mull, K. E., Sullivan, B. M., Zvolensky, M. J., Kahler, C. W., & Bricker, J. B. (2022). Efficacy of smartphone applications for smoking cessation in heavy-drinking adults: Secondary analysis of the iCanQuit randomized trial. *Addictive Behaviors, 132*. https://doi.org/10.1016/j.addbeh.2022.107377. Article 107377.

Sayegh, C. S., Huey, S. J., Zara, E. J., & Jhaveri, K. (2017). Follow-up treatment effects of contingency management and motivational interviewing on substance use: A meta-analysis. *Psychology of Addictive Behaviors, 31*(4), 403–414. https://doi.org/10.1037/adb0000277

Schalow, F. (2017). *Toward a phenomenology of addiction: Embodiment, technology, transcendence*. Springer.

Scheuermann, T. S., Richter, K. P., Rigotti, N. A., Cummins, S. E., Harrington, K. F., Sherman, S. E., et al. (2017). Accuracy of self-reported smoking abstinence in clinical trials of hospital-initiated smoking interventions. *Addiction, 112*(12), 2227–2236. https://doi.org/10.1111/add.13913

Schmitz, J. M., Stotts, A. L., Vujanovic, A. A., Yoon, J. H., Webber, H. E., Lane, S. D., et al. (2024). Contingency management plus acceptance and commitment therapy for initial cocaine abstinence: Results of a sequential multiple assignment randomized trial (SMART). *Drug and Alcohol Dependence, 256*. https://doi.org/10.1016/j.drugalcdep.2023.111078. Article 111078.

Smout, M. F., Longo, M., Harrison, S., Minniti, R., Wickes, W., & White, J. M. (2010). Psychosocial treatment for methamphetamine use disorders: A preliminary randomized controlled trial of cognitive behavior therapy and acceptance and commitment therapy. *Substance Abuse, 31*(2), 98–107. https://doi.org/10.1080/08897071003641578

Stappenbeck, C. A., Luterek, J. A., Kaysen, D., Rosenthal, C. F., Gurrad, B., & Simpson, T. L. (2015). A controlled examination of two coping skills for daily alcohol use and PTSD symptom severity among dually diagnosed individuals. *Behaviour Research and Therapy, 66*, 8–17. https://doi.org/10.1016/j.brat.2014.12.013

Sterne, J. A. C., Savović, J., Page, M. J., Elbers, R. G., Blencowe, N. S., Boutron, I., et al. (2019). RoB 2: A revised tool for assessing risk of bias in randomised trials. *BMJ*, 366. https://doi.org/10.1136/bmj.l4898. Article L4898.

Stotts, A. L., Green, C., Masuda, A., Grabowski, J., Wilson, K., Northrup, T. F., et al. (2012). A Stage I pilot study of acceptance and commitment therapy for methadone detoxification. *Drug and Alcohol Dependence, 125*(3), 215–222. https://doi.org/10.1016/j.drugalcdep.2012.02.015

Törneke, N., Luciano, C., Barnes-Holmes, Y., & Bond, F. W. (2015). RFT for clinical practice. In R. D. Zettle, S. C. Hayes, D. Barnes-Holmes, & A. Biglan (Eds.), *The Wiley handbook of contextual behavioral science* (pp. 254–272). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118489857.ch12.

Tran, K. B., Lang, J. J., Compton, K., Xu, R., Acheson, A. R., Henrikson, H. J., et al. (2022). The global burden of cancer attributable to risk factors, 2010-19: A systematic analysis for the global burden of disease study 2019. *Lancet (London, England), 400*(10352), 563–591. https://doi.org/10.1016/S0140-6736(22)01438-6

Trindade, I. A., Guiomar, R., Carvalho, S. A., Duarte, J., Lapa, T., Menezes, P., et al. (2021). Efficacy of online-based acceptance and commitment therapy for chronic pain: A systematic review and meta-analysis. *The Journal of Pain, 22*(11), 1328–1342. https://doi.org/10.1016/j.jpain.2021.04.003

Vilardaga, R., Rizo, J., Palenski, P. E., Mannelli, P., Oliver, J. A., & McClernon, F. J. (2020). Pilot randomized controlled trial of a novel smoking cessation app designed for individuals with co-occurring tobacco use disorder and serious mental illness. *Nicotine & Tobacco Research, 22*(9), 1533–1542. https://doi.org/10.1093/ntr/ntz202

Villagrá Lanza, P., & Menéndez, A. G. (2013). Terapia de aceptación y compromiso para el abuso de sustancias en mujeres encarceladas. *Psicothema, 25*(3), 307–312. https://doi.org/10.7334/psicothema2012.292

Vowles, K. E., Pielech, M., Edwards, K. A., McEntee, M. L., & Bailey, R. W. (2020). A comparative meta-analysis of unidisciplinary psychology and interdisciplinary treatment outcomes following acceptance and commitment therapy for adults with chronic pain. *The Journal of Pain, 21*(5–6), 529–545. https://doi.org/10.1016/j.jpain.2019.10.004

Weststrate, T. R., Briggs, C. A., Miller, A., Shuster, A. E., & Gaynor, S. T. (2023). Brief acceptance and commitment therapy added to medication management during acute alcohol detoxification: A pilot randomized controlled effectiveness trial. *Journal of Contextual Behavioral Science, 29*, 76–85. https://doi.org/10.1016/j.jcbs.2023.06.002

Wharton, E., Edwards, K. S., Juhasz, K., & Walser, R. D. (2019). Acceptance-based interventions in the treatment of PTSD: Group and individual pilot data using Acceptance and Commitment Therapy. *Journal of Contextual Behavioral Science, 14*, 55–64. https://doi.org/10.1016/J.JCBS.2019.09.006

Wilson, K. G., & DuFrene, T. (2012). *The wisdom to know the difference: An acceptance & commitment therapy workbook for overcoming substance abuse*. New Harbinger Publications, Inc.

Zhao, C., Lai, L., Zhang, L., Cai, Z., Ren, Z., Shi, C., et al. (2021). The effects of acceptance and commitment therapy on the psychological and physical outcomes among cancer patients: A meta-analysis with trial sequential analysis. *Journal of Psychosomatic Research, 140*. https://doi.org/10.1016/j.jpsychores.2020.110304. Article 110304.