REVIEW | Article in Press

Drumming-based interventions in substance use recovery: an integrative review

David Pogosyan · Zhanette Coffee · Angela Murrell · Andrew Ecker · Stephen Dahmer

Received: 15 April 2026 / Accepted: 3 November 2026
© The Author(s) 2026

Abstract

Substance use disorders (SUDs) remain difficult to treat and are often complicated by return to use risk, psychiatric comorbidity, and disengagement from care, supporting interest in acceptable adjunctive interventions that strengthen recovery processes. We conducted an integrative review of peer-reviewed studies evaluating drumming-based interventions delivered within SUD treatment or recovery settings. MEDLINE (Ovid), Embase, CINAHL Plus with Full Text, PsycINFO, and Scopus were searched from inception through April 3, 2025. Two reviewers screened titles and abstracts and then full texts. Due to heterogeneity in designs and outcomes, findings were synthesized narratively. From 676 records, eight studies met inclusion criteria, including one feasibility randomized controlled trial and seven primarily small pre-post, mixed-methods, or qualitative studies. Sample sizes ranged from seven to 80, with most enrolling fewer than 25 participants. Interventions were group-based and included adjunctive approaches, such as structured group drumming programs (HealthRhythms) and music therapy programs incorporating drumming, as well as the culturally grounded Drum-Assisted Recovery Therapy for Native Americans (DARTNA), a stand-alone treatment model, delivered across inpatient, outpatient, residential, and drug court settings. Quantitative substance use outcomes were rarely reported, limiting conclusions regarding effects on consumption, return to use, abstinence, and durability. More consistent signals were observed in recovery-relevant domains, including reported pre-post improvements to functioning or global clinical severity, reduced stress and psychiatric symptom burden, and engagement indicators such as attendance, readiness to change, and aftercare follow-through. Qualitative findings commonly emphasized relaxation, emotional expression, and social connection, and in Indigenous contexts, cultural identity, continuity, and spiritually meaningful participation. Overall, drumming-based interventions appear feasible and acceptable in SUD treatment and recovery settings, but evidence for direct substance use reduction and recovery outcomes remains limited. Larger controlled trials using standardized substance use and craving measures, longer follow-up, and explicit evaluation of implementation and cultural fidelity are needed.

Registration

Open Science Framework: https://doi.org/10.17605/OSF.IO/AQDE8.

Keywords Drumming therapy · Substance use disorders · Complementary and integrative health

This Article in Press is shared early to give you faster access to new research. It is citable and carries a permanent DOI. The final edited version will replace it automatically.



Published online: 18 November 2026

Introduction

Traditional evidence-based treatments for substance use disorders (SUDs), such as medications for opioid use disorder (MOUD) and behavioral therapies (e.g., cognitive behavioral therapy, motivational interviewing), have shown effectiveness but remain limited in their ability to fully address the complex, multidimensional nature of substance addiction. Return to use rates for SUDs remain high, ranging from 40% to 60%, which is comparable to other chronic health conditions such as diabetes and hypertension [1]. A further complication in treating SUDs is the frequent presence of co-occurring health conditions, including depression, anxiety, chronic pain, and post-traumatic stress disorder (PTSD), which can significantly interfere with recovery efforts [2, 3]. This underscores the urgent need for innovative, integrative (or whole-person care) approaches to enhance existing treatments and improve long-term outcomes.

When conventional therapies alone are insufficient to fully meet the needs of individuals with SUDs, complementary and integrative health (CIH) practices can be considered as adjunctive therapies to enhance whole-person care [4, 5]. One promising yet underutilized integrative approach is drumming therapy, which uses rhythmic group drumming to promote physical, emotional, and social well-being [6–8]. Although there is growing interest among recovery communities in offering integrative therapies like drumming, access to these services within clinical treatment settings remains limited. One significant barrier is the lack of reimbursement mechanisms for these services, creating financial and operational challenges for treatment programs [6]. To advocate for expanded coverage and integration into mainstream care, additional rigorous research is needed to assess the feasibility, acceptability, and therapeutic effectiveness of drumming therapy within clinical contexts. Although drumming-based interventions have been implemented across diverse substance use treatment and recovery settings, the available evidence has not previously been comprehensively synthesized to characterize these interventions and their reported outcomes.

Drumming circles are structured group experiences involving communal rhythmic drumming that have shown potential benefits for addiction recovery, particularly for individuals experiencing repeated return to use or those who have not fully responded to traditional counseling approaches [9]. Emerging evidence suggests that drumming may enhance recovery by inducing relaxation, promoting brain-wave synchronization [9], and contributing to reduced substance use [10]. Furthermore, drumming offers a range of biopsychosocial benefits, including emotional expression, stress relief, trauma processing, and enhanced social connectedness, all of which are critical components of sustained recovery [8, 11, 12].

Drumming therapy also supports positive affect, helping individuals experience pleasurable, embodied moments that enhance self-awareness, release unresolved emotional trauma, and foster reconnection with self and community [7, 9]. These effects are particularly relevant in addiction recovery, where social disconnection, including isolation from cultural, familial, and spiritual networks, has been identified as a significant risk factor for addictive behaviors [13]. As addiction treatment continues to evolve toward whole-person, trauma-informed, and culturally responsive care, exploring and rigorously evaluating drumming therapy as a complementary, culturally adaptable intervention holds great promise for improving both patient engagement and treatment outcomes in SUD recovery. The following questions guided this review:

1. What recovery-related outcomes have been reported for drumming-based interventions among individuals with substance use disorders?
2. What are the reported mechanisms through which drumming therapy may influence physical, emotional, and social well-being in the context of SUD treatment?
3. What are the implementation considerations, including feasibility, acceptability, and cultural relevance, for integrating drumming therapy into SUD treatment settings?

Methods

Research design

We conducted an integrative review to synthesize evidence on drumming therapy for adults with SUDs across inpatient, outpatient, community, and correctional settings. Reporting was informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 guidelines where applicable. The PRISMA checklist can be found in the supplemental material. The protocol was registered with Open Science Framework: https://doi.org/10.17605/OSF.IO/AQDE8 (Accessed March 15, 2026).

An integrative review methodology was selected because the available literature included heterogeneous quantitative, qualitative, mixed-methods, and feasibility studies that could not be meaningfully synthesized using traditional systematic review or meta-analytic approaches. Integrative reviews are designed to permit the synthesis of diverse evidence sources while supporting conceptual integration and identification of future research priorities [14]. PRISMA 2020 guidelines were used to enhance reporting transparency and reproducibility but were not intended to imply that this review followed systematic review methodology in all respects.

Search strategy

The literature search was designed using subject headings and free text terms and performed by a medical librarian (AM) in the following databases: MEDLINE (Ovid), Embase, CINAHL Plus with Full Text, APA PsycInfo, and Scopus from database inception to April 3, 2025, restricting to English-language records. No formal grey-literature or trial-registry searches were undertaken as we focused on peer-reviewed evidence. Search strategies combined terms for drumming/percussion (e.g., drumming, drum circle, rhythmic group drumming) with substance use and recovery terms (e.g., substance use disorder, addiction, recovery, craving). The search returned 676 records. Before screening, 228 duplicates and 57 off-topic records (primarily addressing circadian rhythm) were removed, leaving 391 records for evaluation. The detailed search strategy for this review can be found in the supplemental material.

Inclusion and exclusion criteria

Studies with the following attributes were included: randomized clinical trials, other quantitative designs, or mixed-methods studies; evaluation of drumming therapy as an intervention; adult participants with substance use disorder; and English, full-length articles. Studies with the following attributes were excluded: animal/basic science studies; conference proceedings or abstracts; pediatric samples; and systematic or other review articles.

Data screening

Two reviewers (DP, ZC) independently screened titles and abstracts in DistillerSR (2025.8), followed by independent full-text review. The two reviewers performed a norming exercise prior to screening to ensure inter-rater consistency. Any initial discrepancies were resolved by discussion until consensus about inclusion or exclusion was achieved. The reference lists of study reports included in the review were carefully examined for additional citations.

Data extraction

Two reviewers (DP, ZC) performed dual, independent data extraction in DistillerSR using a standardized form capturing: study design; sample size and population; research team composition; intervention characteristics; outcome measures; key findings; methodological rigor (high/low); and data relevance (high/low).

Quality appraisal

Following Whittemore and Knafl's (2005) integrative review guidelines [14], we coded each included article on a two-point scale (High/Low) for rigor (e.g., design appropriateness, sampling, outcome validity, attrition, analytic transparency) and data relevance (e.g., alignment with review questions, outcomes meaningful to recovery, intervention clarity). Rigor ratings reflected methodological quality relative to the study design employed rather than the overall strength of evidence. For example, a well-conducted qualitative study could receive a high rigor rating despite providing lower levels of evidence than randomized controlled trials. Thus, ratings were intended to evaluate methodological execution rather than evidentiary hierarchy. A binary classification approach was selected to provide a transparent and consistent appraisal across diverse study designs, recognizing that more complex quality appraisal tools are often not directly comparable across qualitative, quantitative, mixed-methods, and feasibility studies included in integrative reviews. Two reviewers (DP, ZC) independently assigned rigor and relevance ratings. Any disagreements were resolved through discussion until consensus was achieved. No study was excluded based on this alone.This quality appraisal approach has been used in a similar review [15].

The rhythmic recovery support model (RRSM)

This integrative review is conceptually grounded in the Recovery Capital Theory [16], which frames recovery as supported by resources across personal, social, and community domains. The Rhythmic Recovery Support Model (RRSM) is presented as a heuristic extension of this framework, organizing potential domains through which facilitated group drumming may be understood within SUD care. The model is informed by the synthesized literature as well as the facilitation experience of co-author Andrew Ecker, a peer recovery specialist with over three decades of experience leading structured group drumming interventions in recovery and community settings.

Drawing from traditional drumming practices, recovery capital theory, emotion regulation research, group cohesion literature, and emerging work on rhythmic entrainment, the RRSM conceptualizes structured group drumming across four interrelated domains: (1) neuro-physiological regulation, (2) affective expression and regulation, (3) social cohesion and peer identity, and (4) cultural meaning and continuity (Fig. 1).

At the level of personal recovery capital, rhythmic entrainment and synchronized percussion have been associated in prior research with changes in autonomic activity and stress-related processes [12]. Given that stress dysregulation and negative affect are linked with vulnerability to return to use [17], these domains are theoretically relevant to recovery. Group drumming may also offer a structured, nonverbal modality for embodied emotional expression, aligning with literature identifying emotion regulation deficits as common in SUDs [18, 19].

At the social level, coordinated rhythm is theorized to facilitate shared engagement and social bonding. Group cohesion has been associated with improved engagement and outcomes in SUD treatment settings [20, 21]. Within a recovery capital framework, facilitated drumming may be conceptualized as a practice that supports belonging, pro-social identity, and collective efficacy [16]. In culturally grounded contexts, rhythmic practice may additionally be experienced as identity-affirming and meaning-oriented, domains that align with recovery-oriented and community-informed care models [6, 11].

The RRSM is not presented as a tested causal model but as a conceptual scaffold to guide interpretation of existing findings and inform future hypothesis-driven research examining mechanisms, outcome alignment, and implementation pathways for drumming-based interventions in substance use recovery.

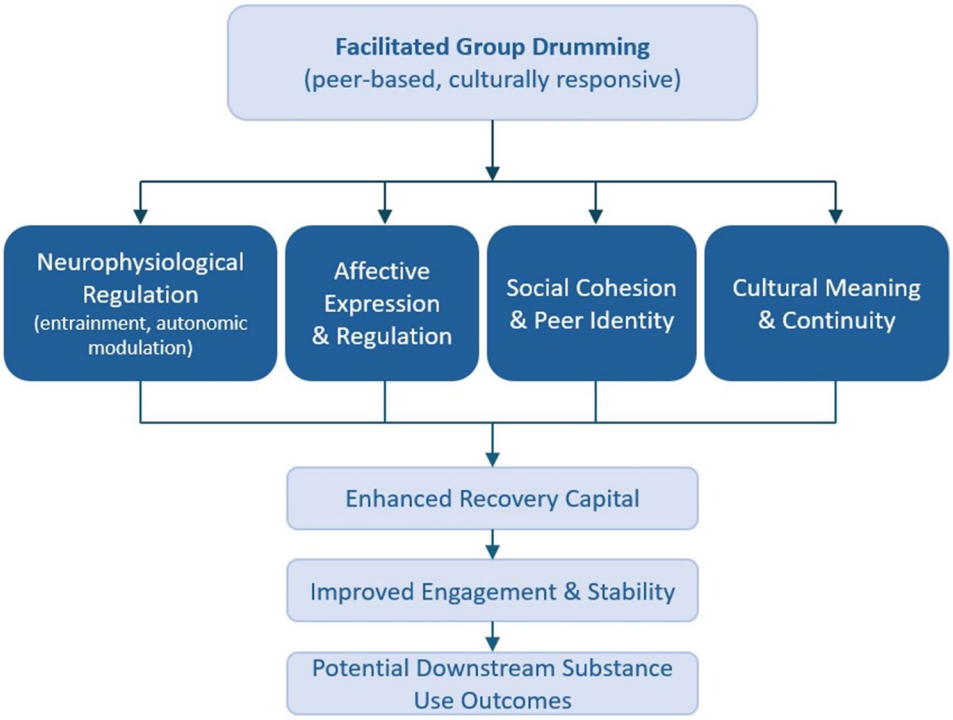

Fig. 1 The rhythmic recovery support model (RRSM)

Results

Search results and study characteristics

The search yielded 676 records. After removal of duplicate records ($n=228$) and records excluded prior to screening for other reasons, including those related to circadian rhythms ($n=57$), 391 records remained for title and abstract screening. Of these, 374 were excluded, and 17 full-text articles were assessed for eligibility. Nine full-text articles were excluded (not a drumming therapy intervention, $n=3$; conference abstract, $n=1$; review article, $n=3$; other reasons, $n=2$). The two studies excluded for other reasons involved drumming as either a minor component of a broader intervention without drumming-specific outcomes or as part of multimodal therapies with outcomes not stratified by drumming. A total of eight studies met inclusion criteria and underwent data extraction (Fig. 2).

Included studies

We screened abstracts and full texts as shown in Table 1, and eight studies met the inclusion criteria. Designs included one feasibility randomized controlled trial of a culturally grounded protocol [6], three mixed-methods or pre-post pilot studies with quantitative and qualitative components [7, 22, 23], three qualitative studies using focus groups or in-depth interviews [11, 24, 25], and one nonrandomized pre-post cohort in an inpatient setting [26]. Sample sizes per study ranged from seven to 80 participants, with most enrolling fewer than 25 individuals.

Several studies specifically involved American Indian and Alaska Native (AI/AN) participants in culturally grounded Drum-Assisted Recovery Therapy for Native Americans (DARTNA) implementations [6, 11, 23]. Other settings included a structured day-services program for individuals with substance misuse [22], an inpatient psychiatric and chemical dependency unit [26], a residential treatment program [25], and a drug court program [7]. Drumming was delivered in groups across all studies that described intervention format, with considerable variability in intervention dose, ranging from single one-hour sessions to 12-week programs delivered twice

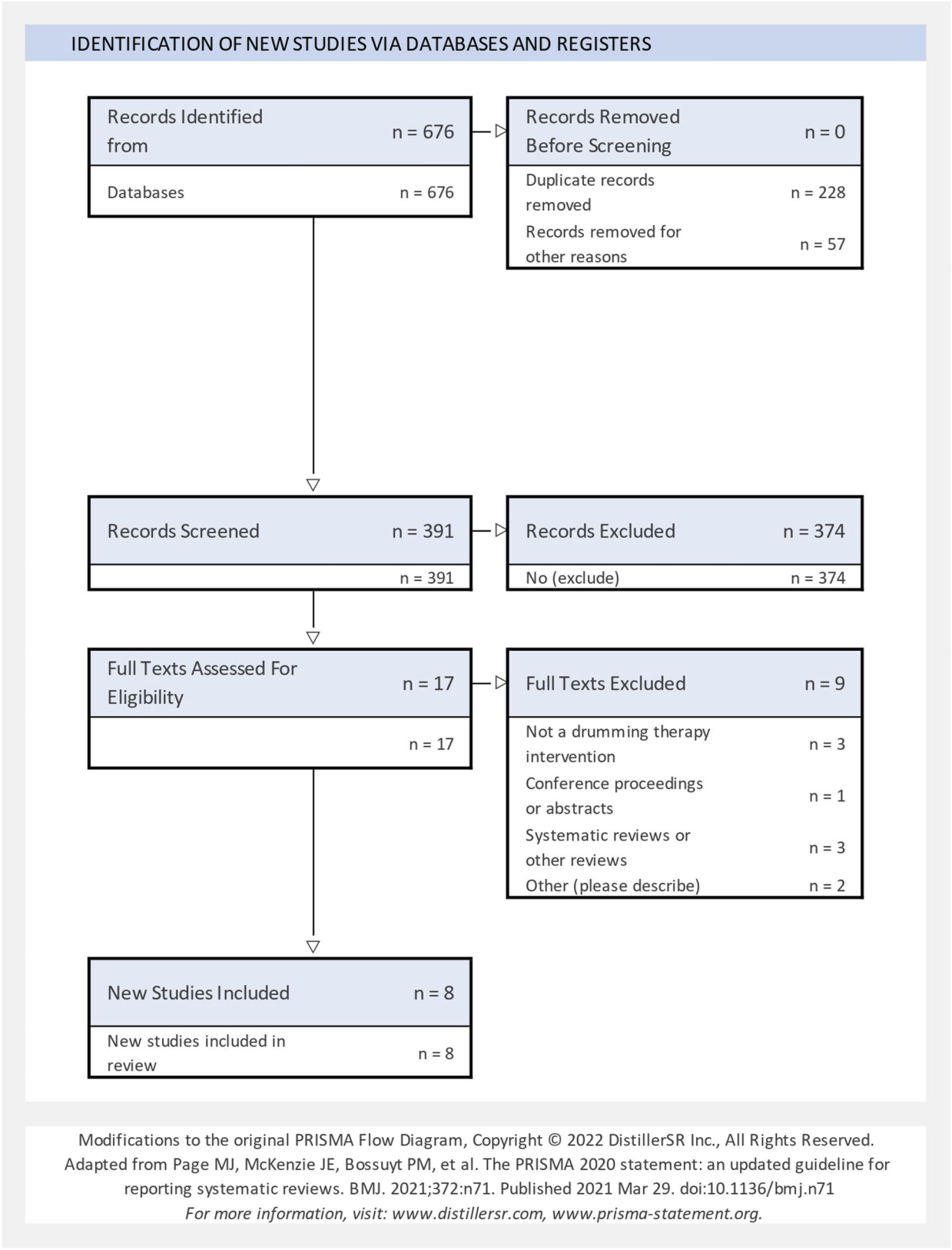

Fig. 2 PRISMA flow diagram

Table 1 Characteristics of included studies

Study	Design; sample	Setting; role	Facilitator(s)	Intervention and dose	Primary outcomes	Key findings	Quality*
Blackett & Payne (2005)	Mixed methods; $N=7$	Structured day treatment; adjunctive	Practitioner-researcher, qualified counselor, trained HealthRhythms practitioner	HealthRhythms group drumming; 7 weekly 1-h sessions	Readiness to change (SOCRATES); attendance; participant experience	SOCRATES scores mostly decreased or were unchanged. Participants described stress reduction, emotional processing, improved communication, and social connection; drumming was viewed as an accessible and meaningful treatment adjunct. Attendance at drumming sessions (71–100%) exceeded overall program attendance (47–93%).	High/High
Dickerson et al. (2012)	Qualitative focus groups; $N=18$	AI/AN community; stand-alone treatment development	Cultural/drumming teacher, SUD counselor, community advisory board	DARTNA protocol development: traditional drumming, Medicine Wheel, 12-step principles, and talking circles	Acceptability, cultural relevance, and implementation feedback	Four themes: perceived benefits of drumming; importance of a culture-based focus; gender roles; and a foundation of shared AI/AN traditions. Participants viewed DARTNA as potentially beneficial and culturally appropriate.	High/High
Dickerson et al. (2014a)	Formative qualitative focus groups; $N=27$	AI/AN community; stand-alone treatment development	Community advisory board, AI/AN cultural leaders, SUD treatment providers	DARTNA protocol refinement	Recruitment, retention, barriers, and culturally appropriate implementation	Cultural relevance, trust, community engagement, respect for tribal diversity, and logistical supports (transportation, childcare, flexible scheduling) were identified as central to recruitment, retention, and implementation.	Low/High
Dickerson et al. (2014b)	Pilot pre-post; $N=10$	SUD treatment; stand-alone treatment model	Certified alcohol and drug counselor, community advisory board, cultural facilitators	DARTNA; 12 weeks, 2 sessions/week, 3 h/session	Psychiatric and medical status; spirituality; physical and cognitive functioning; treatment orientation	Psychiatric status improved at 6 weeks ($p<0.05$) and approached significance at 12 weeks ($p=0.06$); medical status improved ($p<0.05$). Meaning/peace increased ($p<0.01$), as did spiritual well-being and physical functioning (both $p<0.05$). No noticeable improvement occurred in cognition, cultural identity, 12-step adoption, or global symptom scores.	High/High
Dickerson et al. (2021)	Feasibility RCT; $N=63$	Urban AI/AN SUD treatment; stand-alone treatment model compared with usual care	Certified alcohol and drug counselor, AI/AN traditional practitioners, research team	DARTNA; 12 sessions compared with usual care plus	Substance use; physical and cognitive functioning; mental health; engagement, fidelity, and satisfaction	At end of treatment, DARTNA participants had lower cognitive impairment ($p<0.05$; d=-0.48, 95% CI [-1.14, 0.18]) and fewer physical ailments ($p<0.05$; d=-0.25, 95% CI [-0.90, 0.40]). Clinically meaningful signals favored DARTNA for physical health, drinks/day, and marijuana use; 3-month results were mixed. Fidelity and satisfaction were high.	High/High
Hill et al. (2017)	Exploratory qualitative study; $N=7$	Drug court; adjunctive	Ethnomusicologist and drug court staff	Group drumming; 10 weeks, with percussion training and weekly emotional-intelligence lessons	Emotional intelligence, self-esteem, stress management, coping, journals, and reflections	Pre-post surveys showed minimal change, while weekly emotion charts recorded shifts from anger and fear toward joy. Qualitative findings emphasized emotional expression, stress relief, cultural connection, and group cohesion; inferential statistics were not reported.	Low/High

Table 1 (continued)

Study	Design; sample	Setting; role	Facilitator(s)	Intervention and dose	Primary outcomes	Key findings	Quality*
Miller (1999)	Phenomenological study; $N=12$	Residential addiction treatment; adjunctive	Experienced shamanic practitioner	Single-session shamanic drum journey using 15 min of recorded drumming	Psychological screening (MMPI-2), Multimodal Life History Questionnaire, and post-intervention qualitative interviews	Participants described relaxation, reduced distress, increased self-reflection, enhanced emotional awareness, spiritual insight, values clarification, and deeper insight into their recovery and personal lives. Inferential statistics were not reported.	Low/High
Ross et al. (2008)	Prospective naturalistic pilot; $N=80$	Inpatient dual-diagnosis treatment; adjunctive	Board-certified music therapist and clinical staff	Group music therapy incorporating imagery, drumming, and improvisation; 1-h sessions	Functioning, clinical severity, psychiatric symptoms, readiness to change, attendance, and aftercare adherence	GAF increased from M = 24.56 to 50.81 (t = 28.20, $p<0.0001$); CGI decreased from M = 5.98 to 2.29 (t = 32.14, $p<0.0001$); all BSI subscales improved ($p<0.0001$). SOCRATES Taking Steps increased from M = 29.63 to 32.60 (t = 2.92, $p=0.005$). Aftercare adherence was 96%, 82%, and 30% for > 6, 3–6, and 1–2 sessions, respectively (chi-square = 27.44, df = 2, $p=0.0001$).	High/High

*Quality is presented as methodological rigor/data relevance. AI/AN = American Indian/Alaska Native; BSI = Brief Symptom Inventory; CGI = Clinical Global Impression; DARTNA = Drum-Assisted Recovery Therapy for Native Americans; GAF = Global Assessment of Functioning; N = Sample size; RCT = randomized controlled trial; SOCRATES = Stages of Change Readiness and Treatment Eagerness Scale; SUD = substance use disorder

weekly. Most interventions were implemented as adjuncts to usual counseling or recovery supports, whereas DARTNA was developed as a culturally grounded stand-alone treatment model. Facilitators included clinicians, board-certified music therapists, certified alcohol and drug counselors, cultural practitioners, trained HealthRhythms facilitators, ethnomusicologists, peer leaders, and research teams. Several interventions used standardized protocols such as HealthRhythms or DARTNA, whereas others were locally developed and adapted to the treatment setting.

Taxonomy of drumming-based interventions

To enhance interpretability across heterogeneous interventions, drumming-based approaches were grouped into three conceptually distinct categories. Culturally grounded drumming protocols (e.g., DARTNA) are embedded within Indigenous cultural and spiritual traditions and utilize peer-to-peer, community-centered approaches that reinforce identity, foster collective meaning, and strengthen social connection. Structured group drumming wellness programs (e.g., HealthRhythms) are standardized, non-denominational interventions designed to support stress regulation, social connection, and group cohesion. Although all three categories involve rhythmic participation, they differ in theoretical foundations, intended therapeutic mechanisms, and appropriate outcome evaluation. This taxonomy was developed to facilitate interpretation across heterogeneous interventions rather than to imply equivalence among approaches.

Quantitative outcomes

Substance use outcomes and cravings

Across the eight included studies, direct substance use outcomes were rarely reported. Only the DARTNA feasibility randomized trial provided quantitative substance use data, demonstrating end-of-treatment differences favoring DARTNA in fewer drinks per day and lower odds of cannabis use compared with usual care, with mixed

group differences at 3-month follow-up [6]. No study reported opioid-specific consumption outcomes, validated craving scales, or biochemically verified abstinence or return to use.

The remaining studies described SUD profiles but did not present validated pre-and post-substance use or craving outcomes. Samples included individuals using heroin, crack cocaine, and multiple substances in a structured day-services program; [22] dually diagnosed in-patients with alcohol, cocaine, cannabis, opioid, and polysubstance dependence; [26] drug court participants with SUDs; [7] men with SUDs in residential treatment [25]; and AI/AN adults with alcohol or other SUDs in culturally grounded drumming programs [11, 23].

Functioning and clinical severity

Functioning and clinical severity improved in an inpatient cohort with co-occurring SUD and mental health disorders receiving group music therapy that included drumming. Global Assessment of Functioning (GAF) scores increased from 24.56 to 50.81, and Clinical Global Impression (CGI) scores decreased from 5.98 to 2.29, both $p < 0.0001$ [26]. In a pre-post DARTNA cohort, Addiction Severity Index-Native American Version composites indicated improved psychiatric status from baseline to 6 weeks ($p < 0.05$) with a trend toward significance at 12 weeks ($p = 0.06$), alongside improvement in medical status composites ($p < 0.05$) [23]. In the DARTNA feasibility trial, participants in the intervention arm reported fewer physical ailments at the end of treatment than in the usual care plus arm [6].

Mood, anxiety, and stress

Psychiatric symptom burden decreased across multiple Brief Symptom Inventory domains in the co-occurring inpatient cohort receiving music therapy with drumming [26]. In a drug court program, weekly emotion charts during a 10-week drum-based curriculum redorded that emotions shifted from anger and fear towards joy, and participant journals supported drumming as a coping skill for stress [7]. DARTNA studies that included mood measures such as the Patient Health Questionnaire-9 and Generalized Anxiety Disorder-7 reported variable change, with some cohorts showing improvements in depressive or anxiety symptoms and others showing no statistically significant differences [6, 24].

Spirituality, meaning, and identity

Culturally grounded DARTNA studies reported increases in spirituality and meaning-related outcomes. In a pre-post cohort, scores on the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being (FACIT-Sp) meaning/peace subscale and the SP12 total increased significantly over time, and improvements in physical functioning were observed on the FACIT-F Trial Outcome Index [23]. In the DARTNA feasibility trial, participants in the intervention arm showed improvements in spirituality and meaning indices alongside gains in medical and psychiatric status composites from baseline to follow-up [6].

Cognition and attention

In the DARTNA feasibility trial, cognitive impairment decreased on the Functional Assessment of Cancer Therapy-Cognitive Function (FACT-Cog) Total score at endline ($p < 0.05$), with an effect size in the small-to-moderate range, and counts of physical ailments were also lower at follow-up [6]. In a smaller pre-post DARTNA cohort, FACT-Cog scores did not change appreciably despite improvements in spirituality and physical functioning [23].

Engagement, readiness to change, and aftercare

Readiness to change increased modestly in the co-occurring inpatient cohort, with SOCRATES "Taking Steps" scores rising from 29.63 to 32.60 (p = 0.005) following the music therapy with drumming program [26]. A HealthRhythms day-program evaluation reported variable SOCRATES changes across participants, with some individuals showing increased readiness and others showing little change [22]. In the inpatient program, greater session attendance was associated with improvements observed post-discharge adherence to aftercare appointments, with markedly higher adherence among those attending more than six sessions [26]. In the DARTNA trial, treatment satisfaction, therapeutic alliance, and perceived session quality were high in the intervention arm [6].

Qualitative findings

Across qualitative and mixed-methods studies, participants described reductions in stress and tension, experiences of relaxation, opportunities for emotional expression, and a sense of being seen and supported within the drumming circle [7, 22, 25]. Enhanced social connectedness, group cohesion, and peer encouragement were common themes across both standardized and culturally grounded formats. For example, one treatment provider described the drum as "the heartbeat.Mother Earth," highlighting its symbolic role in fostering connection and healing within culturally grounded interventions [11].

In AI/AN contexts, DARTNA focus groups and pretest work emphasized that drumming in a culturally grounded protocol was experienced as sacred, identity-affirming, and respectful of community teachings [11, 24]. One community advisory board member emphasized that "the healing power is there in the drum and the songs if we use it in the right way," illustrating the importance of cultural fidelity [11]. Participants and cultural leaders highlighted the importance of cultural fidelity, appropriate attention to gender roles, and leadership by cultural facilitators. Implementation themes across studies included the need for trust-building and community engagement in recruitment, as well as the practical importance of addressing transportation, childcare, and scheduling barriers to support participation and retention [7, 11, 24].

Discussion

Interpretation of key findings

This integrative review suggests that drumming-based interventions may represent promising recovery supports for adults with SUD, with the most consistent signals observed in psychosocial domains that support recovery rather than in direct substance use outcomes. This pattern aligns with prior evidence of music therapy and other music-based interventions in SUD treatment, which report more consistent effects on psychosocial functioning, affective symptoms, craving-related outcomes, and treatment engagement [8, 27, 28]. Only one included study reported quantitative substance use outcomes, with the DARTNA feasibility randomized controlled trial showing end-of-treatment benefits in fewer drinks per day and lower odds of cannabis use compared with usual care, alongside mixed findings at three-month follow-up [6]. Pre-post improvements in global functioning and clinical severity were also reported in an inpatient music therapy cohort that included drumming components, consistent with earlier music therapy literature demonstrating improvements in psychosocial functioning among individuals with SUDs [26]. Notably, these findings were observed across diverse treatment and recovery settings, including residential treatment, inpatient and outpatient programs, drug courts, and culturally grounded AI/AN community settings. Although intervention formats and populations varied, the consistency of psychosocial benefits across these settings suggests that drumming-based interventions may be adaptable to a range of clinical and community-based recovery contexts.

Across qualitative and mixed-methods studies, participants consistently described decreased stress, improved coping, enhanced emotional expression, and strengthened social connectedness associated with participation in group drumming interventions [7, 11, 22, 24, 25]. These findings mirror prior work highlighting the role of embodied, nonverbal, and group-based interventions in promoting emotional regulation and interpersonal connection among individuals in recovery [20, 29, 30]. The pattern of findings suggests that drumming interventions may function as recovery supports that strengthen affect regulation, social engagement, and meaning-making processes foundational to sustained behavior change. These patterns are consistent with the Rhythmic Recovery Support Model (RRSM), which conceptualizes drumming-based interventions across neurophysiological, affective, social, and cultural domains, with the most consistent findings aligning with stress regulation, emotional expression, engagement, and social connection. Although several synthesized findings are conceptually consistent with the RRSM, many proposed mechanisms including neurophysiological regulation, rhythmic entrainment, and affective processing, remain theoretical and have not yet been directly evaluated within the included studies. The relative contribution of direct neurophysiological regulation versus indirect social and relational processes, such as trust, cohesion, and community building, also remains unknown and warrants empirical investigation. Accordingly, the RRSM should be interpreted as a heuristic framework that integrates the synthesized evidence with broader theory to guide future hypothesis-driven research rather than as a validated mechanistic model.

This interpretation is consistent with recovery capital theory, which conceptualizes recovery as supported by resources across personal, social, and community or cultural domains [16]. In that context, the relative absence of validated craving measures, biologically verified abstinence, and opioid-specific outcomes in the reviewed studies represents a critical evidence gap rather than evidence of null effects. The findings underscore the importance of aligning outcome selection with intervention intent and stage of recovery, particularly for adjunctive approaches designed to enhance engagement and psychosocial stability.

Intervention intent also differed across studies. Most drumming-based interventions were designed as adjunctive therapies delivered alongside existing evidence-based treatment, whereas DARTNA was developed as a culturally grounded, stand-alone substance use treatment model in which drumming serves as the core therapeutic modality. Recognizing these differences is important when interpreting outcomes, as intervention goals and evaluation strategies may differ between adjunctive and stand-alone treatment models.

An important distinction emerging from this review is between drumming as a cultural practice and drumming as a therapeutic technique. Culturally grounded drumming practices are embedded within traditions, community identity, and spiritual meaning, and may be more appropriately evaluated using outcomes related to cultural connectedness, meaning-making, community belonging, and historical continuity [6, 11, 23]. In contrast, drumming implemented as a therapeutic technique, such as structured group drumming or therapist-led music interventions is typically designed to target stress regulation, emotional processing, or behavioral change and may align better with conventional clinical outcomes [22]. These distinctions are also important for selecting appropriate evaluative frameworks and avoiding misalignment between intervention intent and measured outcomes.

Importantly, culturally grounded and therapeutic approaches should not be viewed as mutually exclusive. DARTNA illustrates how culturally grounded drumming can simultaneously function as a therapeutic intervention while preserving Indigenous cultural identity, spirituality, and community healing traditions [6, 11, 23]. In contrast, standardized wellness drumming programs and therapist-led music interventions are generally designed to improve stress regulation, emotional expression, or group cohesion independent of a specific cultural context [12, 22]. Although these approaches share rhythmic participation as a common feature, they may operate through different therapeutic mechanisms and therefore require different outcome measures and evaluative frameworks.

Drumming-based interventions also share common therapeutic elements with broader music therapy, including opportunities for emotional expression, social connection, and engagement [8, 12]. However, group drumming may offer several distinctive features, such as synchronous rhythmic participation, coordinated movement, and collective nonverbal interaction, which have been proposed to promote social cohesion, shared attention, and interpersonal connection [12, 13]. These characteristics may be particularly relevant for individuals with SUDs, for whom social disconnection and emotional dysregulation often present barriers to recovery [16, 20].

Nevertheless, direct comparisons between drumming-based interventions and other music-based therapies are lacking, and it remains unclear whether these unique features confer additional therapeutic benefit. Comparative effectiveness research is needed to better define the therapeutic specificity of drumming-based interventions.

Additionally, although drumming supports positive affect (e.g., joyful, hedonic experience), positive affect was rarely measured as a primary outcome [6, 7, 11, 22–26]. Quantitative SUD studies generally reported pre-to-post changes in clinical, functional, spiritual, or engagement domains rather than using validated positive affect measures [6, 22, 23, 26]. When joy was mentioned, it was mostly qualitative, participants described drumming as "fun" or "enjoyable," sometimes noting laughter, feeling "happy," or shifts from "content" to "excited," but these experiences were not operationalized with structured metrics or reported as proportions [7, 22, 25]. Outside SUD samples, group-drumming studies have shown measurable pre-to-post increases in positive affect and decreases in negative affect on standardized mood scales, and qualitative work has described hedonia (happiness, joy, fun, feeling uplifted) as a central, near-universal theme [12]. Systematic measurement of positive affect and connection in future SUD drumming trials could clarify whether these experiences help drive engagement, retention, and broader recovery outcomes.

Drumming, community connection, and cultural meaning

A key insight from the reviewed literature is the consistent identification of connection as a core therapeutic factor. In community and program-based settings, participants described the drumming circle as providing a sense of being seen, supported, and emotionally relieved, with themes of relaxation and mutual encouragement emerging across studies [7, 22, 25]. These experiences may be especially relevant for individuals with SUDs who face isolation and fractured relationships during and after treatment, and who may benefit from nonverbal, shared activities that promote belonging and positive group identity. These findings align with prior literature on group-based therapies, which highlights cohesion and peer support as mechanisms that reduce isolation and improve engagement. This aligns with evidence showing that structured group interventions can produce clinically meaningful improvements in substance use and related psychosocial outcomes [21, 31].

Culturally grounded drumming interventions in AI/AN communities further demonstrate that drumming can carry meanings beyond a generic wellness activity. Across DARTNA developmental and implementation work, participants and cultural leaders emphasized the sacred and identity-affirming nature of drumming, and highlighted the importance of cultural fidelity, appropriate attention to gender roles, and leadership by cultural facilitators [11, 24]. The DARTNA feasibility trial also reported high satisfaction, strong perceived session quality, and a positive therapeutic alliance in the intervention arm, findings consistent with prior research demonstrating improved engagement and acceptability when interventions reflect participants' cultural values and lived experiences [32, 33]. These findings suggest that cultural meaning represent an important therapeutic pathway through which identity, values, and community connection are restored.

Feasibility and implementation

Across settings, the evidence indicates that drumming interventions are generally acceptable and can be implemented as adjuncts to usual counseling and recovery supports. Group delivery was common, and facilitators ranged from clinicians to board-certified music therapists to cultural practitioners and trained staff. Structured protocols such as DARTNA and HealthRhythms were used in some settings [6, 7, 11, 22, 23, 26]. Practical barriers were also prominent, including transportation, childcare, and scheduling obstacles noted in implementation-focused work [7, 11, 24]. These constraints are clinically important because they shape who can access adjunctive services, especially among patients with socioeconomic instability.

A further implementation challenge raised in the introduction is the lack of reimbursement mechanisms for integrative health services, such as drumming therapy, which limits routine integration into treatment programs and raises sustainability concerns. The reviewed studies collectively suggest that successful implementation may

require attention to facilitator training and role clarity, alignment with program workflow, and, for culturally grounded interventions, strong community engagement and cultural leadership [11, 24]. These considerations support the need for implementation research that evaluates fidelity alongside culturally safe adaptation.

Safety and adverse events

Safety reporting was limited, and adverse events were not systematically defined or monitored in the included studies [6, 22, 23, 26]. A theoretical concern raised in prior work on rhythmic drumming and auditory driving is the possibility of seizure precipitation in individuals with epilepsy [34]. Within the eight included studies, no seizure events or other serious intervention-related harms were reported, and safety-related content focused on screening and safeguards [6, 7, 11, 22–26]. In Health Rhythms, the only explicit "contraindications" noted were apprehension toward music-making and one participant's concern that drumming could increase stress and cause headache [22]. In DARTNA, investigators excluded participants with clinically significant mental or medical illness that could preclude safe participation in active drumming and used breathalyzer screening prior to sessions to maintain sobriety around the drum [6]. Overall, available reports suggest that drumming-based interventions are likely low risk and well tolerated when delivered in structured, supervised settings [6, 22, 26].

Limitations of the evidence base

The current evidence base remains preliminary. Only one feasibility randomized controlled trial has evaluated a drumming-specific intervention with quantitative substance use outcomes [6], and most other studies used pre to post-designs, mixed-methods approaches, or qualitative methods, limiting causal inference [7, 11, 22–26]. Sample sizes were small, often fewer than 25 participants, and intervention formats and facilitator backgrounds varied, complicating cross-study comparison and synthesis. Substance use outcomes were rarely measured using validated instruments, craving scales were not reported, and biochemical verification was absent, leaving uncertainty about the magnitude and durability of effects on substance use behaviors. Since this review synthesized diverse study designs using an integrative review methodology, formal risk-of-bias, certainty-of-evidence, and reporting-bias assessments were not conducted. Although several studies demonstrated high methodological rigor relative to their respective study designs, these ratings should not be interpreted as indicating high-certainty evidence. Rather, the overall evidence base remains limited by the predominance of small samples, qualitative and feasibility designs, and the limited number of randomized controlled trials. Consequently, the findings should be interpreted as an integrative synthesis of the available evidence.

This review was limited to English-language, peer-reviewed publications and did not include grey literature, dissertations, conference proceedings, or trial registries. As a result, community-based programs, Indigenous healing initiatives, and other culturally grounded drumming interventions that are not published in indexed journals may not have been captured, potentially limiting the comprehensiveness of the evidence synthesis. Additionally, publication bias cannot be excluded, as studies reporting positive or culturally meaningful findings may have been more likely to be published than studies reporting null or unfavorable results.

Furthermore, the strongest evidence for cultural and spiritual outcomes comes from DARTNA studies in AI/AN populations [6, 11, 23], which may not generalize to other populations without careful cultural adaptation and attention to meaning. Conversely, general program-based drumming approaches may not capture the depth of cultural and spiritual mechanisms described in DARTNA contexts. These limitations highlight the need to define for whom drumming is most effective, under what conditions, and through which core components.

Implications and future directions

Clinically, drumming therapy may be best conceptualized as an adjunct that supports recovery-relevant processes, including stress regulation, emotional expression, social connectedness, and engagement with ongoing

care, as suggested across qualitative and quantitative findings [6, 7, 11, 22–26]. For culturally grounded models such as DARTNA, cultural continuity and spirituality appear to be central therapeutic ingredients, and future dissemination should prioritize community partnership, cultural governance, and facilitator credibility within local traditions [6, 11, 23, 24].

Future research should move beyond feasibility by employing adequately powered study designs and adopting minimum outcome standards. Future studies should also investigate the mechanisms through which drumming-based interventions influence recovery. Incorporating physiological, behavioral, and psychosocial measures may help distinguish whether benefits arise through direct neurophysiological or affective regulation, indirect social processes, or a combination of these pathways. Experimental and longitudinal study designs are needed to better understand how these mechanisms contribute to recovery outcomes. Future evaluations should also align outcome selection with intervention intent. For culturally grounded interventions, culturally meaningful outcomes such as identity, spiritual well-being, cultural connectedness, and community belonging may be as important as conventional clinical outcomes, whereas standardized wellness-oriented interventions may be more appropriately evaluated using psychosocial and behavioral measures.

Future trials should include validated substance use and craving measures, clearly defined follow-up periods sufficient to assess durability of effects, and implementation metrics such as intervention fidelity, training requirements, and acceptability. Comparative effectiveness and mechanistic studies should examine whether structured group protocols (e.g., HealthRhythms) [22] yield similar outcomes to culturally grounded approaches (e.g., DARTNA) [6, 11, 23], and identify which intervention components (e.g., session frequency, duration, rhythmic structure, facilitator characteristics, and group processes) are most influential in promoting recovery-related outcomes. Finally, implementation-focused research is needed to evaluate cost, scalability, and reimbursement pathways to address structural barriers to integrating drumming-based interventions into substance use disorder treatment settings.

Conclusion

This review suggests that drumming-based interventions are feasible, acceptable, and associated with improvements in functioning, psychiatric symptoms, spirituality, and engagement among individuals with SUDs, particularly when delivered in group and culturally grounded formats. However, rigorous evidence for direct effects on substance use, cravings, and return to use is limited, and most studies rely on small samples and pre-post designs.

Drumming appears best understood as a whole-person, community-oriented practice.

that may enhance recovery by supporting emotional regulation, social connection, and cultural or spiritual meaning. Across the included studies, no serious intervention-related harms were described, suggesting drumming is likely well tolerated in supervised settings. Future research should test drumming within well-controlled trials that include standardized substance use outcomes and long-term follow-up, and should continue to use community-engaged methods, especially in Indigenous and other culturally distinct populations. If supported by stronger evidence, drumming-based interventions could represent safe, scalable, and culturally adaptable approaches to supporting recovery within SUD treatment.

Acknowledgements We acknowledge the Andrew Weil Center for Integrative Medicine at the University of Arizona for its support.

Author contributions ZC and DP led conceptualization. ZC, DP, and AM developed the methodology, and AM designed the literature search strategy. ZC and DP completed screening and study selection, data extraction, and quality appraisal. ZC, DP, and AM conducted the formal analysis and narrative synthesis. ZC, DP, and AM drafted the original manuscript, and ZC, DP, SD, AE, and AM reviewed and edited the manuscript. ZC and SD provided supervision, and ZC managed project administration.

Funding No funding to report.

Data availability No datasets were generated or analysed during the current study.

Declarations

Ethical approval Not applicable.

Competing interests The authors declare no competing interest.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

References

1. Statistics. Mortality in the United States. 2014.
2. Bradizza CM, Stasiewicz PR, Paas ND. Relapse to alcohol and drug use among individuals diagnosed with co-occurring mental health and substance use disorders: A review. Clin Psychol Rev. 2006;26(2):162–78.
3. Schuckit MA. Treatment of opioid-use disorders. N Engl J Med. 2016;375(4):357–68.
4. Gerbarg PL et al. Complementary and integrative treatments in psychiatric practice. 2017.
5. Van Kanegan G, Worley J. Complementary alternative and integrative treatment for substance use disorders. J PsychoSoc Nurs Ment Health Serv. 2018;56(6):16–21.
6. Dickerson DL, et al. Drum-assisted recovery therapy for Native Americans (DARTNA): Results from a feasibility randomized controlled trial. J Subst Abuse Treat. 2021;126:108439.
7. Hill JC, et al. Drumming: An innovative alternative for drug addicted individuals. J Alcohol Drug Educ. 2017;61(2):7–24.
8. Hohmann L, Bradt J, Stegemann T, Koelsch S. Effects of music therapy and music-based interventions in the treatment of substance use disorders: a systematic review. PLoS ONE. 2017;12(11):e0187363. https://doi.org/10.1371/journal.pone.0187363.
9. Winkelman M. Complementary therapy for addiction: Drumming out drugs. Am J Public Health. 2003;93(4):647–51.
10. Chase-Begay DM, et al. Traditional ceremonial practices as a strategy to reduce problem substance use in American Indian communities: A systematic review. J Integr Complement Med. 2023;29(6–7):408–19.
11. Dickerson DL, et al. Utilizing drumming for American Indians/Alaska Natives with substance use disorders: A focus group study. Am J Drug Alcohol Abuse. 2012;38(5):505–10.
12. Fancourt D, Perkins R, Ascenso S, Carvalho LA, Steptoe A, Williamon A. Effects of group drumming interventions on anxiety, depression, social resilience and inflammatory immune response among mental health service users. PLoS ONE. 2016;11(3):e0151136–0151136. https://doi.org/10.1371/journal.pone.0151136.
13. Harrison K. The social potential of music for addiction recovery. Music Sci. 2019;2.
14. Whittemore R, Knafl K. The integrative review: updated methodology. J Adv Nurs. 2005;52(5):546–53. https://doi.org/10.1111/j.1365-2648.2005.03621.x.
15. Danovitch I, Korouri S, Kaur H. The addiction consultation service for hospitalized patients with substance use disorder: An integrative review of the evidence. J Subst Use Addict Treat. 2024;163:209377–209377. https://doi.org/10.1016/j.josat.2024.209377.
16. Cloud W, Granfield R. Conceptualizing recovery capital: Expansion of a theoretical construct. Subst Use Misuse. 2008;43(12–13):1971–86. https://doi.org/10.1080/10826080802289762.
17. Sinha R, Chronic, Stress. Drug Use, and Vulnerability to Addiction. Ann N Y Acad Sci. 2008;1141(1):105–30. https://doi.org/10.1196/annals.1441.030.
18. Berking M, Margraf M, Ebert D, Wupperman P, Hofmann SG, Junghanns K. Deficits in Emotion-Regulation Skills Predict Alcohol Use During and After Cognitive-Behavioral Therapy for Alcohol Dependence. J Consult Clin Psychol. 2011;79(3):307–18. https://doi.org/10.1037/a0023421.

19. Stellern J, Xiao KB, Grennell E, Sanches M, Gowin JL, Sloan ME. Emotion regulation in substance use disorders: a systematic review and meta-analysis. Addiction (Abingdon England). 2023;118(1):30–47. https://doi.org/10.1111/add.16001.
20. Burlingame GM, McClendon DT, Yang C. Cohesion in group therapy: a meta-analysis. Psychotherapy. 2018;55(4):384–398. https://doi.org/10.1037/pst0000173.
21. Lo Coco G. Group treatment for substance use disorder in adults: A systematic review and meta-analysis of randomized-controlled trials. J Subst Abuse Treat. 2019;2019/04:99:104–16. https://doi.org/10.1016/j.jsat.2019.01.016.
22. Blackett PS, Payne HL. Health rhythms: A preliminary inquiry into group-drumming as experienced by participants on a structured day services programme for substance-misusers. Drugs: Educ Prev Policy. 2005;12(6):477–91.
23. Dickerson DL, et al. Drum-assisted recovery therapy for Native Americans (DARTNA): Results from a pretest and focus groups. Am Indian Alsk Native Ment Health Res. 2014;21(1):35–58.
24. Dickerson DL, et al. Clinical trials and American Indians/Alaska Natives with substance use disorders: Identifying potential strategies for a new cultural-based intervention. J Public Mental Health. 2014;13(4):175–8.
25. Miller. Shamanic drum journey as an adjunct to addiction treatment in chemically dependent men. 1999.
26. Ross S, et al. Music therapy: A novel motivational approach for dually diagnosed patients. J Addict Dis. 2008;27(1):41–53.
27. Ghetti C, Chen X-J, Brenner AK et al. Music therapy for people with substance use disorders. Cochrane Database Syst Rev. 2022;5(5):CD012576. https://doi.org/10.1002/14651858.CD012576.pub3.
28. Mays KL, Clark DL, Gordon AJ. Treating addiction with tunes: a systematic review of music therapy for the treatment of patients with addictions. Substance abuse. 2008;29(4):51–9. https://doi.org/10.1080/08897070802418485.
29. Stellern J, Xiao KB, Grennell E, Sanches M, Gowin JL, Sloan ME. Emotion regulation in substance use disorders: a systematic review and meta-analysis. Addiction 2023/01. 2023;118(1):30–47. https://doi.org/10.1111/add.16001.
30. Tracy K, Wallace SP. Benefits of peer support groups in the treatment of addiction. Subst Abuse Rehabil. 2016;7:143–54. https://doi.org/10.2147/SAR.S81535.
31. Lopez G, Orchowski LM, Reddy MK, Nargiso J, Johnson JE. A review of research-supported group treatments for drug use disorders. Subst Abuse Treat Prev Policy. 2021;2021/06/21(1):51. https://doi.org/10.1186/s13011-021-00371-0.
32. Burlew AK, Copeland VC, Ahuama-Jonas C, Calsyn DA. Does cultural adaptation have a role in substance abuse treatment? Social Work Public Health. 2013;28(3–4):440–60. https://doi.org/10.1080/19371918.2013.774811.
33. Hai AH, Lee CS, Abbas BT, Bo A, Morgan H, Delva J. Culturally adapted evidence-based treatments for adults with substance use problems: A systematic review and meta-analysis. Drug Alcohol Depend. 2021;226:108856. https://doi.org/10.1016/j.drugalcdep.2021.108856. 2021/09/01.
34. Wright PA. Rhythmic Drumming in Contemporary Shamanism and Its Relationship to Auditory Driving and Risk of Seizure Precipitation in Epileptics. Anthropol Conscious. 1991;2(3–4):7–14. https://doi.org/10.1525/ac.1991.2.3-4.7.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

David Pogosyan[1] · Zhanette Coffee[2,3,4] · Angela Murrell[5] · Andrew Ecker[6] · Stephen Dahmer[1,7]

✉ David Pogosyan
dpogosyan@arizona.edu

Zhanette Coffee
zcoffee@arizona.edu

Angela Murrell
angelamurrell@arizona.edu

Andrew Ecker
info@drummingsounds.com

Stephen Dahmer
stephendahmermd@arizona.edu

[1] University of Arizona College of Medicine – Tucson, University of Arizona, 1501 N Campbell Ave, Tucson, AZ 85724, USA

[2] College of Nursing, University of Arizona, Tucson, AZ, USA

[3] Comprehensive Center for Pain and Addiction, University of Arizona, Tucson, AZ, USA

[4] Harm Reduction Research Laboratory, University of Arizona, Tucson, AZ, USA

[5] Health Sciences Library –Tucson, University of Arizona, Tucson, AZ, USA

[6] Drumming Sounds, Phoenix, AZ, USA

[7] Andrew Weil Center for Integrative Medicine, University of Arizona, Tucson, AZ, USA