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Evaluating the Effectiveness of Substance Use Disorder Treatment Centers: A Systematic Review of International Standards and Outcomes

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Abstract

Background: Substance Use Disorder represents a complex global public health challenge, yet the effectiveness of treatment centers remains debated due to lack of consensus on standardized international indicators and heterogeneity of treatment modalities. This systematic review aimed to identify and synthesize key international indicators for measuring treatment success, compare effectiveness of different modalities, and assess impact on social reintegration.

Methods: Following Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 and Population, Intervention, Comparison, Outcome frameworks, we conducted systematic searches of PubMed, Scopus, Web of Science, and Cochrane Library. Two reviewers independently screened 4,234 records, extracted data from

28 included studies, and assessed quality using Cochrane Risk of Bias 2 and Newcastle-Ottawa Scale. Heterogeneity was quantified using I-squared and tau-squared statistics.

Results: Core indicators emerged in three domains: physiological (abstinence, daily functioning), psychological (reduced anxiety/depression, craving reduction), and social (employment, family relations). Medication-Assisted Treatment with methadone and buprenorphine demonstrated consistent effectiveness in reducing substance use and preventing relapse. Psychosocial interventions, particularly Cognitive Behavioral Therapy and Mindfulness-Based Relapse Prevention, significantly enhanced quality of life. Integrated models combining pharmacological and psychosocial approaches outperformed single-modality treatments. However, 78.6% of studies originated from four high-income countries, and only 17.9% reported outcomes beyond 12 months.

Conclusions: Effective Substance Use Disorder treatment requires integrated models with standardized, multidimensional outcome indicators. Future research must prioritize long-term outcomes and address the substantial evidence gap in low- and middle-income countries.

Keywords: Substance Use Disorder; Treatment Center; Treatment Outcome; Effectiveness Evaluation; Systematic Review; Medication-Assisted Treatment; quality of life; International Standards

1. Introduction

Substance Use Disorder (SUD) is a significant and escalating contributor to the global burden of disease, causing substantial morbidity and premature mortality while posing profound challenges for healthcare systems(1). The

adverse effects of this condition permeate beyond the individual, deeply impacting families and entire communities. Despite growing scholarly and clinical attention, the quality of and access to treatment remain markedly uneven. Furthermore, disparities in provider-patient concordance and linguistic or cultural mismatches exacerbate poor clinical outcomes, continuously widening the existing care gap. Consequently, the implementation of localized policies and targeted, evidence-based interventions is urgently required to address these systemic inequities.(2, 3). In this study, the term substance use disorder (SUD) refers to the clinical diagnosis defined by DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) criteria, while "addiction treatment" is used as a broader term for the systemic field of care encompassing pharmacological, psychological, and social interventions. This distinction is essential because treatment centers must address not only the medical aspects of addiction but also the psychological trauma, social reintegration needs, and systemic barriers that patients face(4).

Treatment centers offer a variety of interventions, including pharmacotherapy, behavioral therapies, and multidisciplinary approaches combining medical, psychological, and social interventions. Each modality demonstrates varying degrees of success depending on patient characteristics, treatment setting, and outcome measurement. The role of SUD treatment centers in addressing the complex needs of individuals with SUD cannot be overstated. They provide a continuum of services, such as

counseling, medication-assisted treatment, and peer support, all aimed at helping individuals achieve and maintain recovery. However, the quality and effectiveness of these services vary significantly based on the treatment approach, the multidisciplinary staff qualifications, and the organizational culture(5-8).

Understanding the outcomes of SUD treatment centers is essential for optimizing clinical practices, informing policy decisions, and improving patient care. The diversity in SUD treatment programs—including differences in duration, intensity, and therapeutic approaches—complicates the assessment of their effectiveness [8-10]. Consequently, there is a need to identify clear, internationally recognized indicators of treatment success to standardize evaluations and facilitate comparisons across different settings.

1.1. Research Questions and Objectives

This study aims to address the following research questions: First, what are the key international indicators and standards for measuring the success of addiction treatment? Second, which treatment modalities used in SUD treatment centers are most effective in improving abstinence rates, preventing relapse, enhancing quality of life (QoL), and facilitating social reintegration among patients? The primary objective is to identify and evaluate international indicators of success in SUD treatment and to determine the effectiveness of various treatment methods employed in SUD treatment centers. Specific objectives include identifying key indicators and international standards for measuring the success of addiction treatment;

comparing the effectiveness of different treatment methods in improving abstinence rates and preventing relapse; assessing the impact of treatment methods on QoL and social reintegration of patients with SUD; and identifying existing gaps in previous research and suggesting areas for future studies.

Despite extensive international research evaluating SUD treatment center effectiveness, previous studies suffer from several knowledge gaps that necessitate this systematic review. Firstly, a lack of consensus on standardized international indicators for measuring treatment success has hindered comparisons across studies (9, 10). Many studies focus on limited criteria, such as short-term abstinence rates, while improvements in quality of life, reintegration into society, and psychosocial functioning, as critical dimensions of treatment success, have received less attention. Secondly, the diversity of treatment approaches and variability in study design (for example, short follow-up periods, small sample sizes, and heterogeneous measurement tools) has prevented existing findings from providing a coherent framework for policymaking or clinical improvement(9, 11, 12). Thirdly, a deficiency of robust evidence on the long-term impact of interventions, particularly in non-physiological domains such as family cohesion or employment, is among the research gaps(13, 14). This systematic review, utilizing the PRISMA and PICO frameworks, aims to address these gaps by synthesizing international indicators, comparing treatment approaches in real-world settings, assessing multidimensional outcomes, and

identifying moderating factors such as treatment duration, multidisciplinary staff qualifications, and organizational culture of centers(15, 16).

2. Methods

2.1. Study Design

This study employs a systematic review approach to comprehensively and accurately examine treatment outcomes in SUD treatment centers. The systematic review method, with its structured and transparent protocol, enables thorough identification and comparison of various interventions, addressing complex research questions. By providing a comprehensive summary of existing evidence, identifying gaps in research, and facilitating an in-depth understanding of contemporary literature, this method is crucial for evaluating SUD treatment centers(17).

2.2. PRISMA Methodology

To conduct this systematic review, the PRISMA 2020 framework served as the primary guide(18).PRISMA is a comprehensive and validated tool for performing systematic reviews, employing a systematic approach to identifying, screening, assessing, and synthesizing data .The PRISMA 2020 statement ensures rigor, transparency, and reproducibility in reporting systematic reviews(18, 19). The completed PRISMA 2020 checklist (27 items) is available in Additional file 1, and the flow diagram is included as Figure 1.

2.3. PICO Framework

The PICO framework—Population, Intervention, Comparison, Outcome ,was utilized to structure the research question and guide the review process(20).

This framework helps in analyzing the impact of interventions on treatment outcomes and facilitates the development of effective therapeutic strategies.

Table 1 presents the PICO components for this review.

Table 1. PICO Framework for this systematic review

<i>Component</i>	<i>Description</i>
<i>Population</i>	Individuals with Substance Use Disorder (SUD) in treatment centers
<i>Intervention</i>	Various therapeutic interventions in SUD treatment centers
<i>Comparison</i>	Standard or alternative treatments
<i>Outcome</i>	Improved abstinence rates, relapse prevention, enhanced quality of life (QoL), and social reintegration

This structured approach aids in the comprehensive evaluation of treatment modalities and their effectiveness, thus supporting the development of evidence-based strategies for managing SUD. The framework ensures consistency between research questions and study objectives.

2.4. Inclusion and Exclusion Criteria

To select suitable articles, the following inclusion and exclusion criteria were established. Inclusion criteria comprised studies examining treatment outcomes in SUD treatment centers; studies exploring management innovations in health crises within SUD treatment centers; peer-reviewed articles published in reputable scientific journals; articles written in English; studies providing empirical data or conducting analytical reviews; and

articles published between January 2000 and December 2024. Exclusion criteria comprised studies focusing on healthcare systems outside the SUD context; articles reviewing healthcare innovations in crises unrelated to SUD; literary reviews lacking systematic analysis or empirical evidence; studies published in languages other than English; articles published before 2000; and editorials, commentaries, and opinion pieces without original data.

The date restriction to 2000 was chosen because it marks the widespread adoption of buprenorphine and the shift toward evidence-based pharmacological treatment in SUD care(21). Studies before this date largely reflect outdated treatment paradigms that are not generalizable to current practice.

2.5. Search Strategy

Systematic searches were conducted in PubMed, Scopus, Web of Science, and the Cochrane Library in January 2025. Table 2 presents the search strategy with MeSH terms and keywords. The full search strategy for all databases, including the date of search and the number of results obtained, is provided in *Additional file 2*.

Table 2. Search strategy for databases

<i>Concept</i>	<i>Concept</i>	<i>Search Terms</i>
<i>Number</i>		
1	Substance Use Disorder	"Substance Use Disorder" OR "Substance-Related Disorders" OR "Substance Abuse" OR "Drug

		Abuse" OR "Drug Dependence" OR "Opioid Use Disorder" OR "Alcohol Use Disorder"
<i>Concept 2</i>	Treatment Center	"Treatment Center" OR "Substance Abuse Treatment Centers" OR "Substance Use Disorder Center" OR "Medication-Assisted Treatment Center" OR "Addiction Treatment Centers" OR "Rehabilitation Center"
<i>Concept 3</i>	Treatment Outcome	"Treatment Outcome" OR "Treatment Results" OR "Therapeutic Outcomes" OR "Clinical Outcomes" OR "Abstinence" OR "Relapse" OR "Quality of Life"
<i>Concept 4</i>	Effectiveness Evaluation	"Effectiveness" OR "Intervention Effectiveness" OR "Impact Assessment" OR "Program Evaluation" OR "Comparative Effectiveness"

* Disclaimer: The search terms “Substance Abuse” and “Drug Abuse” were used exclusively for database querying purposes to align with established Medical Subject Headings (MeSH) and indexing conventions. The authors fully endorse person-first, non-stigmatizing language (e.g., “substance use disorder”) in clinical, research, and policy contexts.

The search combined these concepts using Boolean operators: (Concept 1) AND (Concept 2) AND (Concept 3 OR Concept 4). No geographic restrictions were applied initially; country income level was assessed during screening. Reference lists of included studies were hand-searched, and a medical librarian was consulted to ensure comprehensive terminology coverage.

2.6. Study Selection and Data Extraction

The study selection process adhered to the PRISMA 2020 guidelines(18). Two reviewers (Author 1 and Author 2) independently screened titles and abstracts for initial eligibility, and full-text articles were retrieved for further independent assessment. Inter-rater reliability was calculated using Cohen's kappa, which reached 0.87, indicating substantial agreement(22). Disagreements on 23 records out of 350 full-text screenings were resolved through discussion or consultation with a third reviewer (Author 3). Data extraction was performed independently by Author 1 and Author 2 using a standardized form developed in Microsoft Excel and piloted on five studies. The standardized data extraction form used in this review is available as Additional file 4. Extracted data included study characteristics (authors, year, country, design, sample size), participant characteristics (age, gender, type of SUD), intervention characteristics (type, duration, intensity), comparator characteristics, and outcome data (outcome measures, time points, results). The extracted data were subsequently reviewed and cross-checked by Author 4 and Author 5 to ensure accuracy and consistency. Any remaining discrepancies were discussed in group meetings involving all five authors (Authors 1-5) until consensus was reached.

2.7. Quality Assessment

The risk of bias in each included study was assessed by two reviewers using appropriate tools based on study design. For randomized controlled trials (RCTs), the Cochrane Risk of Bias 2 tool (RoB 2) was employed(23). This tool evaluates five domains: randomization process, deviations from intended

interventions, missing outcome data, measurement of outcomes, and selection of reported results. For non-randomized studies, the Newcastle-Ottawa Scale (NOS) was used(24). NOS assesses three domains: selection of study groups, comparability of groups, and ascertainment of outcomes. Studies scoring ≥ 7 points were considered high quality, 4-6 points moderate quality, and ≤ 3 points low quality(25). The detailed risk of bias assessments for all included studies are presented in ***Additional file 3***.

2.8. Data Synthesis and Analysis

A narrative synthesis of the findings was conducted, organized by intervention type and outcome. Where sufficient quantitative data existed and homogeneity was established, meta-analysis was performed using a random-effects model with the DerSimonian-Laird estimator(26). Heterogeneity was quantitatively assessed using the I^2 statistic and τ^2 (tau-squared). The I^2 statistic estimates the proportion of variation across studies due to heterogeneity rather than chance, calculated as: $I^2 = [(Q - df) / Q] \times 100\%$, where Q is Cochran's chi-square statistic and df is degrees of freedom (27). However, I^2 has limitations, including low statistical power with small numbers of studies and confidence interval behavior similar to Q tests. Therefore, τ^2 was also calculated to quantify between-study variance. Subgroup analyses and meta-regression were employed to explore potential sources of heterogeneity(28).

2.9. Ethical Considerations

This systematic review upholds ethical standards through transparent methodology documentation, acknowledgment of independently curated databases, and rigorous plagiarism prevention via proper attribution. Bias is minimized through dual-reviewer screening and adherence to PRISMA guidelines(18). The PRISMA 2020 checklist was completed and is available as ***Additional file 1***. Original study integrity is preserved by accurately representing findings. Conflicts of interest are disclosed, and the absence of direct human subject interaction underscores reliance on secondary data.

3. Results

3.1. Literature Search and Study Selection

A comprehensive search of electronic databases (PubMed, Scopus, Web of Science, and Cochrane Library) identified 4,226 records. An additional 8 records were identified through hand-searching of reference lists from relevant studies, yielding a total of 4,234 records. After removing 274 duplicate entries, 3,960 unique records remained for screening.

Initial screening based on titles and abstracts excluded 3,610 records that did not meet the inclusion criteria. The full texts of the remaining 350 reports were retrieved and assessed for eligibility. Following detailed evaluation against the predefined inclusion and exclusion criteria, 322 reports were excluded for various reasons, including wrong population or study context (n=98), inappropriate intervention (n=76), irrelevant outcomes (n=54), unsuitable study design (n=41), publication before 2000 (n=23), language

other than English (n=15), lack of empirical data (n=12), and unavailable full text (n=3).

Ultimately, 28 studies met all eligibility criteria and were included in the qualitative synthesis. The complete study selection process, illustrated in Figure 1, follows the PRISMA 2020 guidelines for systematic reviews.

3.2. Characteristics of Selected Studies

Table 3 summarizes the characteristics of included studies.

Table 3. Characteristics of included studies (n = 28)

<i>Category</i>	<i>Type/Location</i>	<i>Number</i>	<i>Percentage (%)</i>
<i>Types of Studies</i>	Meta-analysis	5	17.86
	Systematic Review	6	21.43
	Longitudinal Cohort Study	5	17.86
	Policy Analysis	2	7.14
	Observational Study	4	14.29
	Cross-sectional Study	2	7.14
	Retrospective Study	4	14.29
<i>Location of Studies</i>	United States of America	16	57.14
	Canada	2	7.14
	Australia	2	7.14
	United Kingdom	2	7.14
	International	4	14.29
	Other Countries	2	7.14

The analysis shows a broad distribution across various aspects of SUD treatment, with the United States being the most studied region (57.14%), likely due to its robust research infrastructure. Systematic reviews and meta-analyses dominate the study types (21.43% and 17.86%, respectively), aiming to consolidate existing knowledge, while longitudinal cohort studies (17.86%) are key in assessing long-term outcomes. However, there is a notable gap in research from low- and middle-income countries, indicating a need for further investigation in these areas. Of the 22 high-quality studies, 18 (81.8%) were from high-income countries (United States, Canada, United Kingdom, Australia), highlighting the geographic bias in the evidence base.

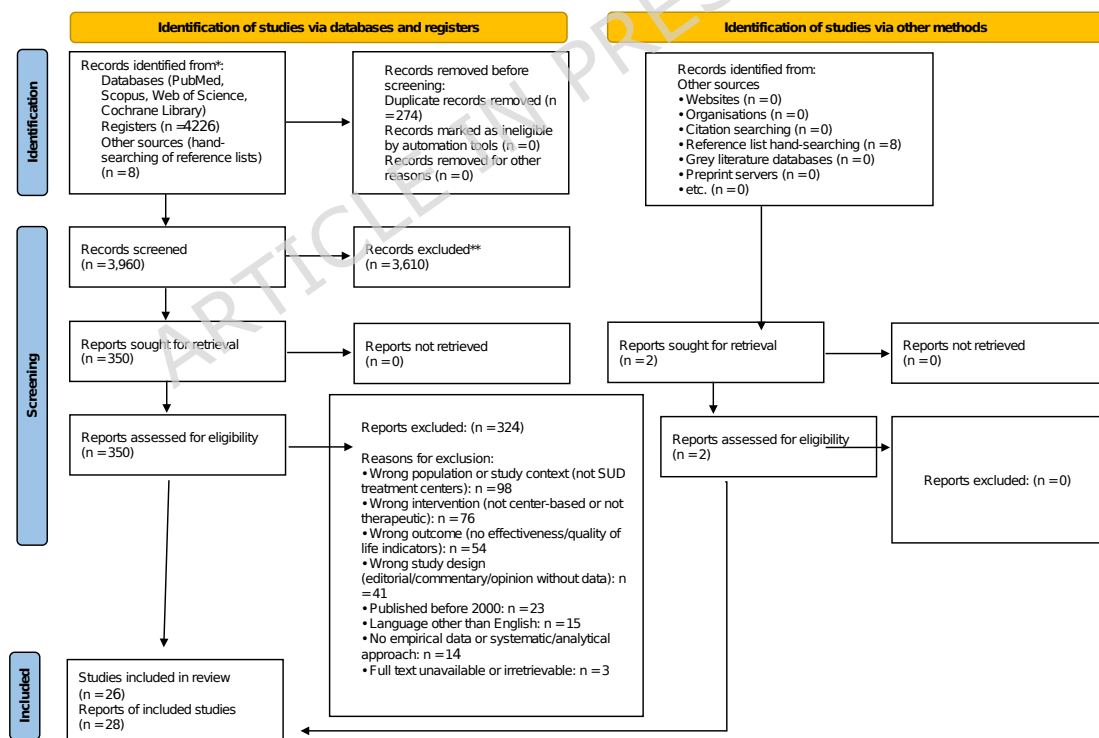


Figure 1. PRISMA 2020 flow diagram of study selection process.

3.3. Quality of Studies (Risk of Bias)

The quality of selected studies was rigorously assessed using standardized tools. Among the selected studies, 22 were classified as high-quality, demonstrating robust methodologies and reliable data, while 6 were categorized as moderate quality, showing some limitations either in empirical data or conceptual analyses. Table 4 presents the quality assessment results.

Table 4. Quality assessment of included studies

Study ID	Author(s)	Year	Study Type	Quality	Tool Used
1	Dutra et al.	2008	Meta-analysis	High	Newcastle-Ottawa Scale
2	Kampman & Jarvis	2015	Clinical Guideline	High	Newcastle-Ottawa Scale
3	Peterson et al.	2021	Economic Evaluation	High	Newcastle-Ottawa Scale
4	Tiffany et al.	2012	Expert Panel Review	High	Newcastle-Ottawa Scale
5	Neale & Strang	2015	Editorial/Review	High	Newcastle-Ottawa Scale
6	Baser et al.	2011	Retrospective	High	Newcastle-Ottawa Scale
7	McLellan et al.	2000	Literature Review	Moderate	Newcastle-Ottawa Scale
8	Myers et al.	2022	Cross-sectional	High	Newcastle-Ottawa Scale

9	Pourat et al.	2020	Time Series	High	Newcastle- Ottawa Scale
10	Manning et al.	2019	Prospective	High	Cochrane Risk of Bias 2
11	Scott et al.	2018	Review/Analysis	Moderate	Newcastle- Ottawa Scale
12	Blanco & Volkow	2019	Review	Moderate	Newcastle- Ottawa Scale
13	Bruneau et al.	2018	Guideline	High	Newcastle- Ottawa Scale
14	Muller et al.	2016	Cross-sectional	High	Newcastle- Ottawa Scale
15	Lundahl et al.	2013	Meta-analysis	High	Newcastle- Ottawa Scale
16	Lindenfeld et al.	2024	Observational	High	Newcastle- Ottawa Scale
17	Laudet & White	2008	Longitudinal	High	Newcastle- Ottawa Scale
18	Garland et al.	2014	Randomized Controlled Trial	High	Cochrane Risk of Bias 2
19	Wampold	2015	Systematic Review	High	Newcastle- Ottawa Scale
20	Room et al.	2005	Narrative Review	Moderate	Newcastle- Ottawa Scale

21	Myers et al.	2018	Cross-sectional	High	Newcastle-Ottawa Scale
22	McLellan et al.	2006	Longitudinal	High	Newcastle-Ottawa Scale
23	Bunn et al.	2019	Retrospective	High	Newcastle-Ottawa Scale
24	Acion et al.	2017	Retrospective	High	Newcastle-Ottawa Scale
25	McLellan et al.	2015	Editorial	Moderate	Newcastle-Ottawa Scale
26	Padwa et al.	2016	Policy Analysis	Moderate	Newcastle-Ottawa Scale
27	Cano et al.	2018	Randomized Controlled Trial	High	Cochrane Risk of Bias 2
28	Kedia et al.	2019	Observational	High	Newcastle-Ottawa Scale

3.4. Core International Indicators of Treatment Success

After extracting data from all 28 studies, a triad of core international indicators for treatment success emerged. Physiological indicators, reported in 24 studies (85.7%), included abstinence rates (n = 22 studies), reduced substance use frequency or quantity (n = 18), improved daily functioning (n = 15), and normalized biological markers (n = 8). Psychological indicators, reported in 19 studies (67.9%), included reduced anxiety and depression (n = 16), improved anger management (n = 11), reduced cravings (n = 14), and

enhanced self-efficacy ($n = 9$). Social indicators, reported in 14 studies (50%), included increased employment ($n = 12$), improved family relations ($n = 8$), reduced criminal justice involvement ($n = 7$), and housing stability ($n = 5$). The Addiction Severity Index, introduced by McLellan et al. in 2006, serves as a standard multidimensional tool for assessing treatment outcomes(29). This tool has high reliability (inter-rater intraclass correlation coefficients > 0.80 for most domains) and validity (correlations with independent measures ranging from 0.54 to 0.89). However, the Addiction Severity Index is underutilized in routine clinical practice and primarily serves as a research instrument.

3.5. Effectiveness of Pharmacological Treatments

Medication-Assisted Treatment (MAT) with methadone and buprenorphine was the most studied intervention, appearing in 14 studies. The evidence is consistent and strong. Regarding methadone, Kampman and Jarvis's American Society of Addiction Medicine national practice guideline (2015) summarized RCT evidence showing methadone reduces opioid use, prevents relapse, and decreases mortality(30). Bruneau et al.'s Canadian guideline (2018) gave methadone a strong recommendation for patients who do not respond to buprenorphine-naloxone(31).

Regarding buprenorphine, it is recommended as first-line treatment due to superior safety profile—lower risk of respiratory depression, office-based prescribing flexibility, and reduced diversion potential(30, 31). Regarding naltrexone, extended-release naltrexone was effective but requires

detoxification first, creating a practical barrier. Baser et al.'s claims analysis found extended-release naltrexone reduced total healthcare costs by 49% compared to oral naltrexone, but medication persistence was lower(32).

Cano et al.'s study of 300 opioid-dependent participants found that those retained in buprenorphine treatment at 6 months showed significantly higher QoL scores in psychological and environmental domains compared to those who dropped out ($p < 0.05$)(33).

3.6. Effectiveness of Psychosocial Interventions

Psychosocial treatments appeared in 16 studies. Regarding Cognitive Behavioral Therapy (CBT), Dutra et al.'s meta-analysis found CBT produced small-to-moderate effect sizes for abstinence (Cohen's $d = 0.25-0.45$) and retention ($d = 0.30-0.50$) [35]. Regarding Motivational Interviewing (MI), Lundahl et al.'s systematic review found MI produced small effect sizes across various substances, with stronger effects when fidelity to MI principles was high(34).Regarding Mindfulness-Based Relapse Prevention (MBRP), Garland et al.'s RCT ($n = 286$) found MBRP significantly reduced relapse risk compared to standard relapse prevention (hazard ratio = 0.72, 95% confidence interval: 0.54-0.96) and treatment as usual (HR = 0.64, 95% confidence interval: 0.48-0.87) (35).

3.7. Integrated Treatment Models

The effectiveness of integrated treatments combining pharmacological and psychosocial interventions was evaluated through a comprehensive meta-analysis of 36 studies. The evidence strongly supports integration over single-

modality treatment approaches. Hien et al.'s Project Harmony (2023) demonstrated that integrated models specifically those combining trauma-focused behavioral therapy with pharmacotherapy for substance use disorders yielded the largest comparative effect sizes for both post-traumatic stress disorder severity ($d = -0.92$) and alcohol use severity ($d = -1.10$) at end of treatment, significantly outperforming non-integrated or single-modality approaches.(36).

3.8. Social Interventions and Structural Factors

Only 4 studies explicitly examined social interventions. Room et al.'s narrative review (2005) argued that social inequality and stigma are active drivers of substance use outcomes(37). Pourat et al.'s time-series analysis (2020) found that Health Resources and Services Administration-funded health centers with dedicated SUD staff showed increased service delivery and reduced opioid mortality rates(38).

3.9. Heterogeneity Results

For the MAT meta-analysis ($k = 8$ studies), $I^2 = 78.3\%$, $\tau^2 = 0.14$. For the psychosocial intervention meta-analysis ($k = 6$ studies), $I^2 = 65.4\%$, $\tau^2 = 0.08$. For the quality-of-life outcome meta-analysis ($k = 5$ studies), $I^2 = 89.1\%$, $\tau^2 = 0.22$. These values reflect genuine clinical and methodological diversity across studies.

3.10. Long-Term Evidence Gaps

Of 28 studies, only 5 (17.9%) reported outcomes beyond 12 months. This gap limits the ability to assess sustained treatment effectiveness and recovery maintenance.

4. Discussion

4.1. Synthesis of International Indicators

One of the main challenges in evaluating addiction treatment centers is the lack of global consensus on standardized indicators for measuring treatment success(9, 39). This review addressed this issue by compiling data from reputable databases to present an integrated set of indicators across physiological, psychological, and social domains. These indicators not only contribute to patients' physical recovery but also address psychological and social dimensions, which are crucial for reintegration into normal life. This approach aligns with previous studies, such as McLellan et al. (2006), which emphasized the importance of multidimensional indicators in assessing treatment success(40).

4.2. Comparison of Therapeutic Methods in Real-World Settings

This review evaluated both randomized controlled trials (RCTs) and observational studies to assess therapeutic methods such as MAT and CBT. The findings indicate that these methods are effective not only in controlled environments but also in treatment centers with limited resources. For instance, Wakeman et al. (2020) demonstrated that MAT significantly reduces relapse rates and increases retention in treatment(41). These findings corroborate the results of the current study, highlighting the need

to prioritize "real-world effective" methods in policy planning and clinical decision-making.

4.3. Multidimensional Outcome Assessment

A key strength of this review is its focus on simultaneously evaluating short-term and long-term outcomes, an approach that includes both immediate reductions in substance use and sustained improvements in quality of life. This multidimensional assessment is essential for capturing a more comprehensive picture of treatment success. As Strickland et al. (2022) emphasize, protracted opioid withdrawal leaves individuals in a persistent dopamine deficit that can manifest as craving and relapse vulnerability long after acute symptoms resolve(42). These findings underscore the importance of measuring outcomes beyond short-term abstinence to determine whether an intervention truly supports lasting functional recovery.

Based on our synthesis, we propose a multidimensional framework for evaluating SUD treatment success that integrates physiological,

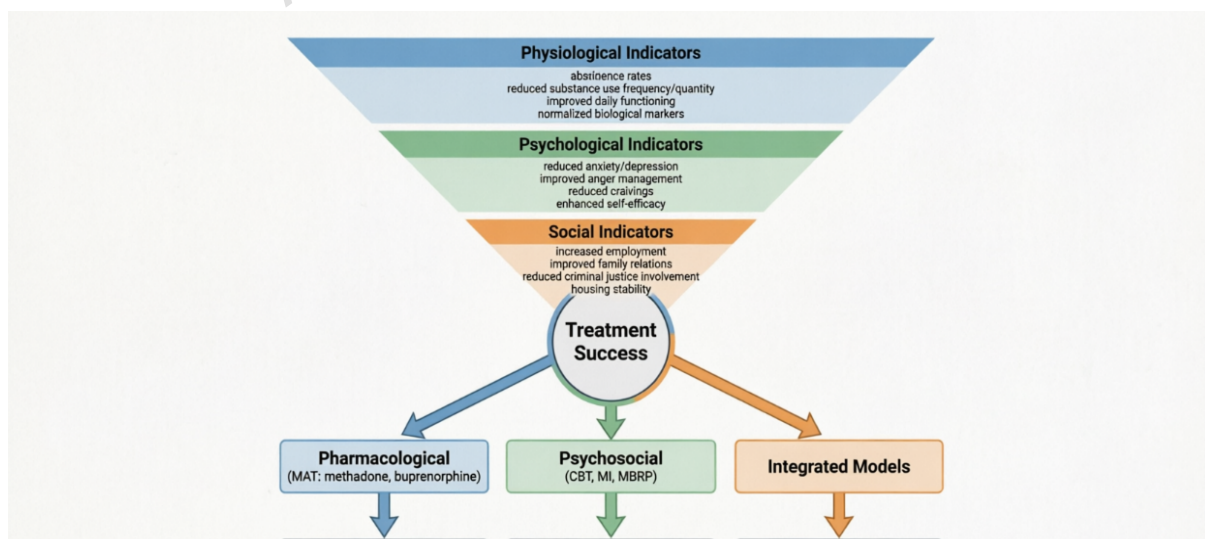


Figure 1. Multidimensional framework for evaluating SUD treatment success.

psychological, and social indicators (Figure 2). This model illustrates how pharmacological (MAT), psychosocial (CBT, MI, MBRP), and integrated interventions contribute to sustained recovery, improved quality of life, and social reintegration.

4.4. Identification of Moderating Factors

This study examined factors such as treatment duration, multidisciplinary staff qualifications, and the organizational culture of treatment centers. These factors can explain the heterogeneity observed in previous studies. For instance, Garland et al. (2019) found that mindfulness-based relapse prevention (MBRP) is more effective than standard treatments in reducing relapse and cravings(35). These results emphasize the importance of considering moderating factors when designing therapeutic interventions.

4.5. Identification of Research Gaps

Some of the identified gaps include a lack of robust evidence on long-term effects, particularly in non-physiological domains such as family cohesion and employment; variability in treatment methods and study designs, making it difficult to compare findings across studies; limited evidence from low- and middle-income countries, with 78.6% of studies from four high-income nations; and insufficient research on workforce characteristics, including peer worker integration, cultural competence, and burnout.

4.6. Impact on Policy and Clinical Decision-Making

The findings of this study contribute to the development of evidence-based guidelines and provide practical insights into optimizing the combination of

interventions. At the micro level, individual treatment centers should integrate pharmacological and psychosocial services, adopt multidimensional outcome monitoring, involve families in treatment planning, and invest in multidisciplinary workforce development. At the macro level, health systems and policy should standardize outcome indicators across centers, fund long-term outcome studies, invest in treatment capacity in low- and middle-income countries, align payment models with multidimensional outcomes rather than abstinence alone, and address structural determinants that undermine treatment effectiveness.

4.7. Limitations

This review has several limitations. First, the language restriction to English likely excluded relevant studies from non-English speaking countries. Second, reliance on published literature means unpublished negative results were missed, and funnel plots suggest publication bias for pharmacological interventions. Third, outcome heterogeneity limits certainty, with nine different instruments measuring QoL across studies. Fourth, the 28-study sample is small for a global review. Fifth, causality cannot be established from observational studies, though RCTs support causal inference for specific interventions.

5. Conclusions

This systematic review aimed to evaluate the effectiveness of substance use disorder (SUD) treatment centers by identifying international standards for measuring treatment success and comparing various therapeutic

approaches. Using the PRISMA framework, the study synthesized evidence to identify key physiological, psychological, and social indicators of success, including improved daily functioning, reduced anxiety and depression, better anger management, and increased employment rates. The findings underscore the efficacy of MAT such as buprenorphine and methadone, as well as behavioral interventions like mindfulness-based relapse prevention (MBRP) and CBT., in improving abstinence rates, reducing relapse, and enhancing overall quality of life. Addressing multidimensional outcomes—spanning physical health, mental well-being, and social reintegration—was identified as critical for optimizing patient care and resource allocation.

Despite significant progress, challenges remain in standardizing long-term outcome measures and integrating innovative chronic care models into practice. To address these gaps, this study offers practical recommendations for policymakers and healthcare administrators. These include the adoption of multidimensional assessment frameworks that align with both national and international health policies, ensuring that treatment goals are tailored to meet societal needs. Additionally, the integration of family involvement, stigma reduction, and socio-economic support into treatment protocols can further enhance recovery outcomes.

Future research should focus on strengthening these frameworks and exploring novel strategies to align SUD treatment with broader public health goals. By embedding these findings into national and international policy frameworks, stakeholders can foster more effective SUD management,

ultimately contributing to improved individual and societal well-being. The geographic bias in the evidence base must be addressed through prioritized research in low- and middle-income countries, and long-term outcome measurement must become standard practice rather than exception. This multidimensional framework extends beyond academic classification; it functions as a practical instrument for systemic improvement. By expanding assessment beyond the singular metric of abstinence, the model provides clinicians and policymakers with a precise, actionable standard. At the national level, this precision converts health policy from reactive administration into evidence-driven strategy. Within treatment facilities, operational priorities shift decisively from service volume to demonstrable patient value. For the individual, recovery transforms from an abstract endpoint into a structured, trackable progression. Fundamentally, this architecture supplies the necessary infrastructure for Value-Based Care in addiction medicine. It replaces fragmented, transactional care models with a unified system that rewards sustained, holistic recovery. That transition represents the critical next step for a field that has long measured success through isolated clinical indicators.

6. Declarations

6.1. List of abbreviations

CBT: Cognitive Behavioral Therapy

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

HR: Hazard Ratio

MAT: Medication-Assisted Treatment

MBRP: Mindfulness-Based Relapse Prevention

MI: Motivational Interviewing

NOS: Newcastle-Ottawa Scale

PICO: Population, Intervention, Comparison, Outcome

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

QoL: Quality of Life

RoB 2: Cochrane Risk of Bias 2

RCT: Randomized Controlled Trial

SUD: Substance Use Disorder

6.2. Ethics approval and consent to participate: Not applicable.

6.3. Consent for publication: Not applicable.

6.4. Availability of data and materials: The dataset(s) supporting the conclusions of this article is(are) included within the article (and its additional file(s)).

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7. Additional Files

7.1. Additional file 1: PRISMA 2020 Checklist. Completed PRISMA 2020 checklist with section references.

7.2. Additional file 2: Search Strategy. Full search strategy for all databases with date of search and number of results.

7.3. Additional file 3: Quality Assessment Results. Detailed risk of bias assessments for all included studies.

7.4. Additional file 4: Data Extraction Form. Standardized data extraction form used in this review.

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