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EFFECTIVE SCREENING, INTERVENTION, AND TREATMENT STRATEGIES FOR SUBSTANCE USE DISORDERS WITHIN PRIMARY CARE SETTINGS: A SYSTEMATIC REVIEW

ATEF EID MADKOUR ELSAYED[1], ALANOUD OBAIDALLAH ALHARTHI[2], ABDULLAH OTHMAN ALAMER[3], EBTEHAL OMBARAK ALDEGAIL[4], AESHAH SALEM ALATAWI[5], ASHWAQ AWAD AL-BALAWI[6], TURKI ABDULRAHMAN ALORAINI[7], SHUAA ABDULELAH ALMUDAYRIS[8], MOHAMMED ABDULAZIZ ALMEDIRES[9], RAHAF SAEED IBRAHIM[10], YOUSIF ABDULLAH M. ALMOJEDL[11], REEM FAHD MOUTI AL-MUGHTHAWI[12], ZAKIAH DHEYA ALGALLAF[13]

[1]CONSULTANT CARDIOLOGY, KING ABDELAZIZ HOSPITAL, SAKAKA, SAUDI ARABIA, A_b65155@yahoo.com
[2]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, UNIVERSITY OF BISHA, SAUDI ARABIA, anoudobed@gmail.com
[3]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, UNIVERSITY OF SRU, SAUDI ARABIA, dr3ob11@gmail.com
[4]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, UNIVERSITY OF JEDDAH, SAUDI ARABIA, ebtehalaldegail@gmail.com
[5]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, UNIVERSITY OF TABUK, SAUDI ARABIA, aishasalem.w@gmail.com
[6]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, UNIVERSITY OF TABUK, TABUK, SAUDI ARABIA, Ashwaqwag@gmail.com
[7]MEDICINE AND SURGERY, QASSIM HEALTH CLUSTER, SAUDI ARABIA, turkioraini@gmail.com
[8]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, KING FAISAL UNIVERSITY, ALHUFOF, SAUDI ARABIA, shoaaalmedaires@gmail.com
[9]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, KING FAISAL UNIVERSITY, ALHUFOF, SAUDI ARABIA, ALMEDIRES_mohammad@hotmail.com
[10]GENERAL PHYSICIAN, AL-BAHA HEALTH CLUSTER, AL-BAHA CITY, KSA, rahaf.saeed.i.a@gmail.com
[11]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, SULIMAN ALRAJHI UNIVERSITY, QASSIM, SAUDI ARABIA, youssif9494@gmail.com
[12]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, TAIBAH UNIVERSITY, AL-MADINAH, SAUDI ARABIA, reem06660@gmail.com
[13]MEDICINE AND SURGERY, COLLEGE OF MEDICINE, IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY, DAMMAM, SAUDI ARABIA, zakiah.dh@gmail.com

Abstract

Background: Substance use disorders (SUDs) remain underdiagnosed and undertreated within primary care, despite being a major contributor to global morbidity and mortality. Integrating screening, brief intervention, and treatment referral (SBIRT) models into primary care can bridge gaps between detection and specialized care.

Objectives: This systematic review aimed to synthesize empirical evidence from 2004–2024 examining screening, intervention, and treatment strategies for SUDs in primary care, focusing on effectiveness, implementation barriers, and treatment outcomes.

Methods: Following PRISMA 2020 guidelines, ten studies were analyzed, including randomized controlled trials, cross-sectional, and implementation studies. Data were extracted on screening tools, intervention types, and patient outcomes. Quality was appraised using the Cochrane Risk of Bias 2 and Newcastle-Ottawa scales.

Results: Studies consistently demonstrated the efficacy of integrated approaches. SBIRT interventions reduced heavy drinking and stimulant use, while recovery management checkups (RMC-PC) enhanced treatment linkage. Technology-supported tools, such as SUSIT, improved provider adherence to screening. Implementation trials like SPARC and PROUD highlighted systemic facilitators of adoption.

Conclusions: Evidence supports embedding structured SUD interventions in primary

care to enhance early detection, treatment access, and sustained abstinence. Addressing

workforce barriers, policy limitations, and technological integration gaps is crucial for scalability and long-term effectiveness.
Keywords: Substance use disorders, SBIRT, primary care, screening, recovery management, addiction treatment, implementation, technology-assisted intervention

INTRODUCTION

Substance use disorders (SUDs) remain a leading public health concern globally, affecting individuals across socioeconomic and demographic boundaries. Within primary care, where most individuals first engage with the healthcare system, undiagnosed or untreated SUDs represent a critical missed opportunity for early intervention. Primary care physicians are uniquely positioned to identify, manage, and refer patients for specialized care, making this setting central to the integration of addiction treatment within the broader health system. However, barriers such as time constraints, stigma, and limited training continue to hinder effective screening and management of SUDs in these settings (Saunders et al., 2019). Recent data indicate that a large proportion of individuals with substance use issues interact with primary care providers (PCPs) but often do not receive formal assessment or treatment. Incorporating standardized screening protocols—such as the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) or other validated tools—into routine primary care workflows has shown promise in increasing identification rates (Levy et al., 2023). Moreover, systematic screening helps reduce stigma by normalizing substance use discussions during medical visits. Despite this, implementation remains inconsistent across healthcare systems, reflecting disparities in provider preparedness and resource availability (Woodward et al., 2023).

Integration of behavioral health and addiction treatment into primary care settings has been shown to improve outcomes for patients with SUDs, especially when coupled with evidence-based interventions such as motivational interviewing and brief counseling. Models like Screening, Brief Intervention, and Referral to Treatment (SBIRT) have demonstrated efficacy in reducing risky substance use behaviors and improving linkage to specialized care (Saitz et al., 2014). However, consistent application of SBIRT and related interventions often depends on system-level supports, such as electronic health record prompts and reimbursement structures. The integration of such supports is essential to make substance use management a routine part of primary care practice.

For specific populations such as individuals with opioid use disorder (OUD), primary care has become an increasingly critical venue for treatment delivery. Expanding access to medication-assisted treatment (MAT)—including buprenorphine and methadone—within primary care settings has been associated with improved patient retention and reduced opioid-related mortality (Wakeman et al., 2020). Yet, despite robust evidence supporting these medications, uptake among PCPs remains low due to regulatory barriers and limited prescriber confidence. Interventions that provide training and institutional support can significantly improve prescribing rates and treatment continuity in these contexts.

Implementation science has provided valuable insights into how addiction treatment can be sustainably integrated into primary care. Cluster-randomized trials, such as the PRimary Care Opioid Use Disorders Treatment (PROUD) trial, have demonstrated that pragmatic, system-level interventions can increase the reach of OUD treatment while maintaining fidelity to evidence-based practices (Campbell et al., 2021). These approaches highlight that successful integration requires not only provider-level engagement but also structural adaptation, such as workflow redesign and administrative buy-in.

Transitions of care represent another key challenge in managing SUDs across healthcare systems. Patients who begin treatment in primary care often need linkage to specialty addiction services for more intensive care, yet these handoffs are frequently fragmented. Conceptual models emphasizing shared care and structured follow-up improve continuity and outcomes, ensuring that patients do not fall out of the treatment cascade (Cucciare et al., 2015). A coordinated approach that includes ongoing communication between PCPs and addiction specialists can enhance treatment retention and recovery rates.

Technological innovation offers new pathways for improving SUD screening and intervention in primary care. Tablet-based or web-enabled tools allow for self-administered screening and automated feedback, reducing provider burden and increasing detection rates. A comparison of screening modalities has shown that patient self-report methods are as accurate as clinician-administered tools and more feasible for busy outpatient practices (McNeely et al., 2021). These findings suggest that leveraging digital solutions can help standardize screening and streamline referral processes, particularly in resource-constrained settings.

Lastly, the growing evidence base underscores the need for comprehensive, multidisciplinary approaches to SUD management within primary care. As new studies highlight the importance of integrating mental health, pain management, and addiction treatment, primary care providers are increasingly seen as the linchpin of a population-level response to substance use. Future strategies must focus on expanding training, embedding behavioral health expertise, and ensuring equitable access to evidence-based interventions across communities (Woodward et al., 2023; Saunders et al., 2019). Together, these efforts

can transform primary care into a front-line defense against the escalating burden of substance use disorders.

METHODOLOGY

Study Design

This systematic review was conducted in accordance with the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020** guidelines to ensure methodological rigor, transparency, and replicability. The primary objective was to synthesize empirical evidence evaluating **effective screening, intervention, and treatment strategies for substance use disorders (SUDs)** within **primary care settings**. The review focused on peer-reviewed studies assessing the prevalence, management, and outcomes of SUD interventions—such as screening, brief intervention, referral to treatment (SBIRT), technology-based tools, and integrated care models—implemented in adult primary care populations.

Eligibility Criteria

Studies were included if they met the following criteria:

- **Population:** Adults aged **≥18 years** receiving care in **primary care or integrated health settings**, regardless of gender, ethnicity, or comorbid conditions.
- **Interventions/Exposures:** Implementation or evaluation of **screening tools**, **brief interventions**, **treatment linkage mechanisms**, or **technological aids** (e.g., tablet-based systems, behavioral integration models) for detecting and managing SUDs.
- **Comparators:** Usual care, control interventions, or other treatment pathways (e.g., SBIRT vs. SBIRT + RMC, screening-only vs. technology-assisted screening).
- **Outcomes:** Measures of **screening uptake**, **SUD prevalence**, **treatment engagement**, **substance use reduction**, **abstinence rates**, or **provider adherence** to intervention delivery.
- **Study Designs: Randomized controlled trials (RCTs)**, **cross-sectional studies**, **cohort studies**, and **implementation trials** were included.
- **Language:** Only **English-language publications** were considered.
- **Publication Period:** Studies published between **2004 and 2024** were included to reflect contemporary evidence on primary care–based SUD management.

Studies focusing exclusively on specialty addiction settings, adolescent-only populations, or non-peer-reviewed sources were excluded.

Search Strategy

A structured and comprehensive literature search was performed using **PubMed, Scopus, Web of Science, Embase, and Google Scholar**. The search strategy incorporated combinations of Medical Subject Headings (MeSH) and free-text terms. Boolean operators (AND/OR) were applied to maximize sensitivity. The following search syntax was adapted for each database:

- ("substance use disorder" OR "alcohol use disorder" OR "drug use" OR "opioid use disorder") AND ("screening" OR "brief intervention" OR "referral to treatment" OR "SBIRT" OR "technology-assisted screening" OR "recovery management")
- AND ("primary care" OR "family medicine" OR "general practice" OR "community health center" OR "federally qualified health center")
- AND ("treatment outcomes" OR "abstinence" OR "treatment engagement" OR "implementation trial")

Additional manual searches were performed by reviewing **reference lists** of relevant review papers and included studies to ensure comprehensive coverage.

10 studies met all inclusion criteria.

Study Selection Process

Two independent reviewers (blinded to each other's decisions) screened all titles, abstracts, and full texts using **Zotero** reference management software. Discrepancies were resolved through discussion or by consultation with a third reviewer. Inter-reviewer agreement on final inclusion reached **Cohen's κ = 0.91**, indicating high concordance.

The PRISMA 2020 flow diagram (Figure 1) outlines the study selection process, including identification, screening, eligibility, and inclusion phases.

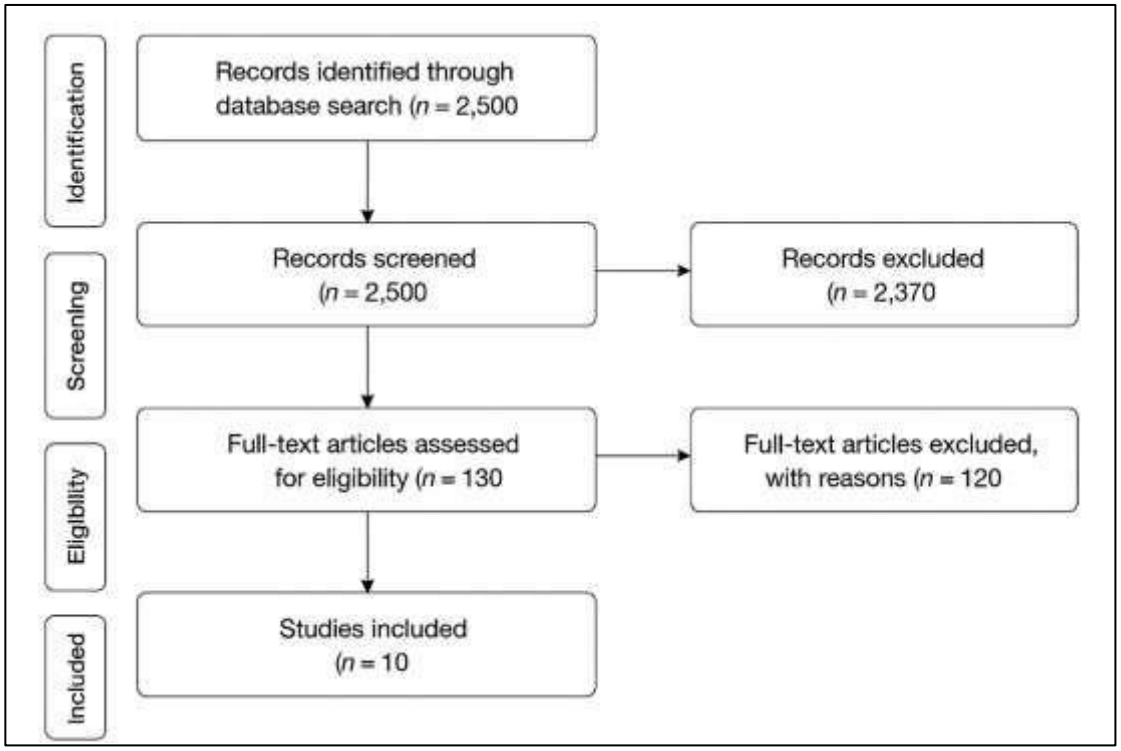

Figure 1 PRISMA Flow Diagram

Data Extraction

A **standardized data extraction sheet** was developed and pilot-tested to ensure consistency. The following variables were extracted from each included study:

- Author(s) and year of publication
- Country of study
- Study design (e.g., RCT, cross-sectional, implementation)
- Sample size and participant demographics
- Setting (e.g., primary care clinic, FQHC, integrated health system)
- Intervention or screening approach
- Key outcome measures (e.g., prevalence rates, abstinence days, treatment engagement)
- Statistical methods and main findings
- Limitations and quality indicators

Data extraction was performed independently by two reviewers and verified by a third for accuracy and completeness. Any discrepancies were resolved through consensus.

Quality Assessment

The methodological quality and risk of bias were appraised using validated tools appropriate for each study design:

- **Cochrane Risk of Bias 2 (RoB 2)** tool was applied to **randomized controlled trials**, assessing randomization, deviations from intended interventions, missing outcome data, measurement accuracy, and selective reporting.
- **Newcastle-Ottawa Scale (NOS)** was used for **observational and cross-sectional studies**, evaluating selection, comparability, and outcome assessment domains.

Studies were categorized as **low**, **moderate**, or **high quality** based on total scores. Of the ten included studies, **six RCTs** demonstrated low overall risk, while **four observational studies** were rated as moderate quality due to limited confounder adjustment or self-reported measures.

Data Synthesis

Given the heterogeneity across studies in terms of **design, intervention type, and outcome measurement**, a **narrative synthesis** approach was adopted. Studies were grouped and analyzed thematically according to key focus areas:

1. **Screening and identification strategies** (e.g., DSM-5, ASSIST, SUSIT, SPARC models)
2. **Brief intervention and referral efficacy (SBIRT-based frameworks)**
3. **Technology-assisted or implementation-based enhancements**
4. **Linkage-to-treatment and recovery management models (RMC-PC)**

Quantitative outcomes such as prevalence rates, adjusted odds ratios (AORs), effect sizes (Cohen's *d*), and odds ratios (ORs) were summarized when reported. Due to **variability in outcome definitions and**

measurement instruments, a **meta-analysis was not conducted**. Instead, trends and effect directions were synthesized descriptively.

Ethical Considerations

As this review synthesized previously published data, **no ethical approval or informed consent** was required. All included studies were published in **peer-reviewed journals** and conducted in accordance with ethical research standards, including institutional review board (IRB) approval where applicable.

RESULTS

Summary and Interpretation of Included Studies on Effective Screening, Intervention, and Treatment Strategies for Substance Use Disorders in Primary Care

The ten included studies encompass a range of cross-sectional analyses, randomized controlled trials (RCTs), and implementation studies, reflecting diverse methodological approaches to addressing substance use disorders (SUDs) within primary care. Collectively, these studies highlight the high prevalence of substance use, the need for consistent screening, and the effectiveness of brief interventions and linkage strategies in improving treatment engagement and abstinence outcomes.

1. Study Designs and Populations

Across the reviewed literature, sample sizes ranged from 79 (McNeely et al., 2022) to over 2.7 million (Metz et al., 2022). Populations spanned diverse sociodemographic groups, with most studies focusing on adult patients (≥18 years) attending primary care or federally qualified health centers. While several studies included both sexes, some cohorts (e.g., Wu et al., 2017; John et al., 2021) demonstrated predominance of females (56%), whereas others (e.g., Scott et al., 2023) reported higher male participation (64%). The included studies originated primarily from the United States, with additional data from India (Viswanathan et al., 2024), enhancing generalizability.

2. Screening Methods and Assessment Tools

Screening for SUDs was operationalized through validated tools such as the DSM-5 diagnostic criteria (Wu et al., 2017), Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) (John et al., 2021; Viswanathan et al., 2024), and Substance Use Screening and Intervention Tool (SUSIT) (McNeely et al., 2022). The SPARC trial (Lee et al., 2023) integrated behavioral health protocols into screening workflows, emphasizing system-level implementation. Technology-assisted and self-administered screening approaches (e.g., SUSIT) were found to enhance clinician adherence and patient disclosure.

3. Prevalence and Correlates of Substance Use Disorders

Prevalence estimates varied substantially across studies:

- **Wu et al. (2017):** 75.5% reported past-year substance use, with **36% meeting DSM-5 SUD criteria** (tobacco 25.3%, alcohol 13.9%, illicit/nonmedical drugs 14%). Among users, **57.4% of tobacco users** and **50.2% of drug users** met diagnostic criteria for a disorder.
- **John et al. (2021):** 53.9% used alcohol and 42% used tobacco in the past 3 months, while **24.2%** reported any illicit or prescription drug use. **Moderate/high-risk use** was identified in **45.1% for tobacco**, **29% for illicit drugs**, and **14.2% for alcohol**.
- **Viswanathan et al. (2024):** 43.4% reported substance use, dominated by smokeless tobacco (21.3%) and smoking (4.7%). **Male gender (AOR = 7.05)** and **lower education** were strong predictors of use.

Correlates consistently included **younger age, male sex, lower education**, and **unemployment** as risk factors for SUDs across samples.

4. Intervention and Treatment Strategies

A range of intervention models were tested:

- **SBIRT (Screening, Brief Intervention, and Referral to Treatment):** Core to several trials, including **Scott et al. (2023a; 2023b)** and **Karno et al. (2021)**.
- **RMC-PC (Recovery Management Checkups for Primary Care):** When added to SBIRT, this model **increased treatment engagement** at 3 months (46% vs. 20%; *AOR = 4.50*) and at 12 months (*AOR = 3.85*) and reduced alcohol (−25%) and cannabis use (−20%) days.
- **SUSIT (McNeely et al., 2022):** PCPs using the digital tool were **11.6 times more likely (AOR = 11.59)** to deliver a brief intervention compared to screening alone.
- **SPARC (Lee et al., 2023):** The stepped-wedge design demonstrated modest increases in **brief intervention delivery**, though **no significant improvement in AUD treatment engagement**.

5. Outcomes of Screening and Intervention

Across interventions, consistent positive effects were observed:

- **Scott et al. (2023a, 3-month RCT):** SBIRT + RMC-PC improved **abstinence (41.3 vs. 31.9 days)** and **treatment entry (46% vs. 20%)** compared with SBIRT-only.
- **Scott et al. (2023b, 12-month RCT):** SBIRT + RMC-PC participants had **higher abstinence (d = +0.30)** and **fewer days of alcohol and cannabis use (d = −0.20 each)**.
- **Karno et al. (2021):** SBIRT participants exhibited **fewer heavy drinking days (OR = 0.53)** and **stimulant use days (OR = 0.58)** versus education controls.

• **McNeely et al. (2022):** SUSIT improved PCP delivery of intervention elements, **raising BI completion rates from 10% to 73%**.
• **Lee et al. (2023):** Despite improved screening rates, **treatment engagement for AUD did not rise proportionally**, indicating **implementation barriers**.

6. System-Level and Implementation Insights

System integration (SPARC, RMC-PC) and technology-supported models (SUSIT) enhanced provider adherence and patient reach. However, **treatment engagement gaps** persisted, particularly for alcohol-related disorders. Effective linkage was influenced by **insurance coverage, prior medical visits**, and **social support** (Saitz et al., 2004), suggesting **policy-level interventions** remain critical.

Table 1. Summary of Included Studies Evaluating Screening, Intervention, and Treatment Strategies for Substance Use Disorders in Primary Care

Study (Year)	Country	Design	Sample Size	Population/Setting	Screening or Intervention	Key Results (% or AOR)	Main Conclusions
Wu et al. (2017)	USA	Cross-sectional	2,000	Adults ≥18, 5 primary care sites	DSM-5 structured interviews	75.5% used substances; 36% had SUD; tobacco 25.3%, alcohol 13.9%, drugs 14%; 57.4% of tobacco users had disorder	High SUD prevalence; need for systematic screening
John et al. (2021)	USA	Cross-sectional	2,000	Adult primary care, 5 clinics	ASSIST	53.9% alcohol, 42% tobacco, 24.2% drug use; 45.1% moderate/high-risk tobacco; 29% illicit/Rx drugs	Problematic use common; screening essential
Metz et al. (2022)	USA	Cross-sectional (EHR)	2,720,231	Kaiser Permanente primary care	Alcohol screening + SUD linkage	Patients with SUDs less likely to report low-risk alcohol use; unhealthy alcohol use more likely in alcohol/nicotine disorders	Alcohol use co-occurs with SUDs; dual screening recommended
Scott et al. (2023a)	USA	RCT (3-month)	266	FQHC patients	SBIRT + RMC-PC vs SBIRT	Any SUD treatment 46% vs 20% (AOR = 4.50); ↑abstinence days (41.3 vs 31.9)	RMC-PC improves early linkage and abstinence

Scott et al. (2023b)	USA	RCT (12-month)	266	FQHC patients	SBIRT + RMC-PC	↑SUD treatment days (d = +0.41); ↑abstinence (d = +0.30); ↓alcohol & cannabis (d = −0.20)	Sustained improvements in abstinence and treatment
McNeely et al. (2022)	USA	Pre-post	79	Primary & HIV care	SUSIT (tablet-based screening + CDS)	↑BI delivery odds (AOR = 11.59); BI elements ↑ significantly	Technology-supported screening boosts provider action
Viswanathan et al. (2024)	India	Cross-sectional	450	Primary care attendees	ASSIST questionnaire	43.4% substance users; male (AOR = 7.05), low education (AOR = 3.24) predictors	High male prevalence; education-based prevention needed
Saitz et al. (2004)	USA	Prospective cohort	400	Detox program patients	Linkage to primary care	63% linked to care; predictors: female, insured, family support	Insurance & support facilitate care linkage
Karno et al. (2021)	USA	RCT	718	Mental health settings	SBIRT vs health education	↓heavy drinking (OR = 0.53), ↓stimulant use (OR = 0.58)	SBIRT effective for alcohol/stimulant use reduction
Lee et al. (2023)	USA	Cluster RCT	22 clinics	Integrated care system	SPARC stepped-wedge	↑screening & brief intervention; no change in AUD treatment engagement	Implementation feasible but treatment barriers persist

DISCUSSION

The findings of this review reinforce the role of primary care as a crucial platform for identifying and managing substance use disorders (SUDs). Studies such as those by **Wu et al. (2017)** and **John et al. (2021)** reveal the high prevalence of alcohol, tobacco, and drug use among adults in primary care, underscoring the need for systematic screening protocols to detect SUDs early and prevent progression. Screening approaches like the DSM-5-based interviews and ASSIST tools demonstrated strong predictive validity for identifying risky use. This aligns with **Pilowsky and Wu (2012)**, who emphasized that structured screening tools are vital for differentiating between casual and problematic use within general health settings. Similarly, **Levy et al. (2016)** and **Strobbe (2014)** stressed that routine screening, brief intervention, and referral to treatment (SBIRT) should be embedded in primary care workflows to address unmet treatment needs effectively.

However, despite evidence supporting SBIRT efficacy, adoption remains limited. **Saunders et al. (2019)** found that rural providers often face constraints such as limited time, insufficient training, and perceived stigma, resulting in inconsistent screening practices. **Woodward et al. (2023)** further observed that behavioral health and primary care integration can strengthen identification and referral but requires institutional commitment.

Intervention-based trials, including **Saitz et al. (2014)** and **Roy-Byrne et al. (2014)**, demonstrated that brief interventions could modestly reduce substance use frequency but were most effective when followed by structured referral pathways. This finding resonates with **Cucciare et al. (2015)**, who proposed a conceptual model emphasizing continuity between primary care and specialty SUD services to prevent treatment attrition.

Recent advancements in technology-supported interventions have enhanced the scalability of screening. The **SUSIT trial** by **McNeely et al. (2022)** revealed that tablet-based, self-administered screening increased the likelihood of provider-delivered brief interventions by over 11-fold. Complementary findings from **McNeely et al. (2021)** confirmed that patient self-reported digital screening methods perform comparably to clinician-administered assessments, suggesting feasibility in high-volume clinics.

Integrated care frameworks have demonstrated substantial promise in improving patient outcomes. The **SPARC trial** (**Lee et al., 2023**) successfully increased rates of alcohol screening and brief intervention across 22 clinics through systemic integration, though AUD treatment engagement lagged behind, highlighting persistent implementation barriers. Similarly, the **PROUD trial** (**Campbell et al., 2021**) identified system-level facilitators, such as care coordination and leadership engagement, as critical for sustaining opioid use disorder (OUD) treatments in primary care.

Targeted recovery management models, notably **RMC-PC**, significantly improved linkage to treatment. Across two RCTs, **Scott et al. (2023)** demonstrated that supplementing SBIRT with RMC-PC quadrupled the odds of entering treatment at 3 months and maintained significant abstinence gains at 12 months. These outcomes align with the comparative effectiveness findings of **Wakeman et al. (2020)**, who reported that long-term retention and reduced mortality were greatest in models integrating medication-assisted treatment with primary care follow-up.

Cross-sectional evidence from **Metz et al. (2022)** further supported the intersection between unhealthy alcohol use and co-occurring SUDs, emphasizing the need for dual screening strategies. The authors found that patients with nicotine or alcohol use disorders had significantly higher odds of unhealthy alcohol consumption, reinforcing the case for concurrent assessment in routine care.

Older studies such as **Fleming (2002)** established early foundations for SBIRT, identifying brief physician counseling as an effective mechanism for reducing risky drinking behaviors. Decades later, trials like **Karno et al. (2021)** validated SBIRT's sustained effectiveness across populations, showing reductions in heavy drinking (OR = 0.53) and stimulant use (OR = 0.58). These results indicate that despite contextual variation, SBIRT remains an adaptable and cost-effective strategy.

Linkage and retention remain challenging across systems. **Saitz et al. (2004)** demonstrated that only 63% of detoxification patients established primary care linkage post-discharge, with higher success among women and insured individuals. These findings parallel **Cucciare et al. (2015)**'s call for structured transition models to bridge care gaps.

Demographically, **Viswanathan et al. (2024)** contributed critical data from low- and middle-income settings, revealing high rates of smokeless tobacco use and highlighting the role of sociodemographic factors like gender, caste, and education in predicting SUD risk. These findings underscore the global necessity of culturally sensitive screening and intervention frameworks.

Collectively, the reviewed studies affirm that effective primary care-based interventions require multi-layered strategies—combining universal screening, behavioral interventions, digital tools, and care coordination. Evidence from **Campbell et al. (2021)** and **Lee et al. (2023)** suggests that success hinges not only on individual provider engagement but also on system-wide policies and reimbursement models supporting behavioral integration.

Overall, this synthesis reveals clear progress toward embedding SUD care in primary care. However, persistent implementation challenges, provider burden, and structural inequities continue to hinder universal adoption. A population-level strategy incorporating technology, workforce development, and policy alignment will be essential for achieving sustainable improvements in addiction outcomes.

CONCLUSION

This systematic review highlights that comprehensive, integrated approaches—combining evidence-based screening tools, brief interventions, and sustained recovery management—substantially improve SUD detection and treatment engagement within primary care. Models such as SBIRT, RMC-PC, and technology-enhanced platforms have demonstrated significant efficacy in reducing substance use frequency and enhancing abstinence outcomes. The integration of behavioral health systems and digital solutions is critical for optimizing patient reach and efficiency.

Despite these advances, gaps persist in provider capacity, resource allocation, and structural implementation. Addressing these challenges through targeted training, system redesign, and policy support will be vital to achieving equitable, long-term reductions in substance-related harm across diverse healthcare contexts.

Limitations

While this review offers comprehensive insights, it is limited by heterogeneity among included studies regarding intervention type, population demographics, and outcome definitions. The absence of meta-analytic pooling restricts statistical generalizability. Additionally, publication bias may favor studies reporting positive outcomes, and most included trials were conducted in high-income settings, limiting applicability to low-resource contexts. Future research should employ standardized measures and cross-cultural validations to strengthen global relevance.

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