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Screening, brief intervention, and referral to treatment (SBIRT) for cannabis: A scoping review

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ABSTRACT

Introduction: Screening, brief intervention, and referral to treatment (SBIRT) has been used to change substance use behavior. Despite cannabis being the most prevalent federally illicit substance, we have limited understanding of use of SBIRT for managing cannabis use. This review aimed to summarize the literature on SBIRT for cannabis use across age groups and contexts over the last two decades.

Methods: This scoping review followed the a priori guide outlined by the PRISMA (Preferred Reporting Items for Scoping Reviews and Meta-Analyses) statement. We gathered articles from PsycINFO, PubMed, Sage Journals Online, ScienceDirect, and SpringerLink.

Results: The final analysis includes forty-four articles. Results indicate inconsistent implementation of universal screens and suggest screens assessing cannabis-specific consequences and utilizing normative data may increase patient engagement. Broadly, SBIRT for cannabis demonstrates high acceptability. However, the impact of SBIRT on behavior change across various modifications to intervention content and modality has been inconsistent. In adults, patients with primary cannabis use are not engaging in recommended treatment at similar rates to other substances. Results also suggest a lack of research addressing referral to treatment in adolescents and emerging adults.

Discussion: Based on this review, we offer several to improve each component of SBRIT that may increase implementation of screens, effectiveness of brief interventions, and engagement in follow-up treatment.

1. Introduction

Screening, brief intervention, and referral to treatment (SBIRT) is a therapeutic strategy that first emerged to address alcohol use (Saitz, 2007). SBIRT has since been applied to a broad range of substance use patterns and health behaviors including depression, anxiety, and oral health (Cuevas & Chi, 2016; SAMHSA, 2011), in a variety of settings (e.g., primary care, schools), across the lifespan, and using different modalities (e.g., in-person, computerized). SBIRT comprises three components: an initial screen of the target behavior; a brief review of screening results and an intervention targeting the behavior; and referral to additional treatment when appropriate. Benefits of SBIRT include increased detection of risky substance use, reduced health care costs, and decreased provider bias regarding substance use (e.g., Barbosa et al., 2015; Lukowitsky et al., 2021; Moberg & Paltzer, 2021). Potential barriers to SBIRT include inconsistent screening and application of brief interventions (BIs), inconsistent provider training, and difficulty managing patient ambivalence (Hammond et al., 2021; McAfee et al., 2022).

Broadly, best practices for substance use indicate that the screening component should be universally applied to all patients using a validated assessment instrument. Items on screeners may capture quantity, frequency, and/or consequences associated with substance use. Generally, individuals meeting pre-defined thresholds are presented with an opportunity to engage in a BI and/or referral to future treatment. The intervention component can take many forms. Commonly for substance use, a brief negotiated interview (BNI) using a motivational interviewing approach is used to solicit patient utterances that support behavior change (SAMHSA, 2011). Other approaches include brief (1 to 2 sessions) CBT for substance use, motivational enhancement therapy, mindfulness, and coping skills building (e.g., Aldridge et al., 2017; Fuster et al., 2016; McCarty et al., 2019).

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1.1. SBIRT for cannabis use

Meta-analyses and systematic reviews of SBIRT have produced inconsistent findings with regard to substance use behaviors (e.g., Barata et al., 2017; Mitchell et al., 2013; Steele et al., 2020). However, much of the literature in these reviews and meta-analyses has primarily focused on alcohol-related outcomes and we know less about the utility of SBIRT for other substances. Cannabis has several unique considerations that differentiate it from other substances (e.g., alcohol, cocaine), and may influence the impact of SBIRT on use. Perhaps most importantly, many individuals and medical providers view cannabis as an effective tool for managing physical (e.g., Piper et al., 2017; Gali et al., 2021) and mental health concerns (e.g., Kilwein et al., 2020; Rup et al., 2022). Although extant literature suggests that at moderate-to-high levels of use, cannabis is associated with deleterious outcomes such as decreased respiratory fitness, cognitive impairment, and prolonged mental health symptoms (e.g., Campeny et al., 2020; Figueiredo et al., 2020; Mammen et al., 2018), relative to nicotine and alcohol (e.g., Quintana et al., 2013; Roerecke et al., 2019; To et al., 2016), literature assessing long-term effects of cannabis use is lacking. Further, given its variable legal status, assessing the utility of SBIRT for cannabis use is difficult as some individuals may be legally prescribed cannabis while others may be in an environment without any legalized form of cannabis.

As research continues to evaluate the potential risks and benefits of cannabis and SBIRT continues to spread as a tool to identify and modify health risk behaviors, research should assess the effectiveness of SBIRT as a tool for detection of risky cannabis use and initial intervention. Given the unique challenges that cannabis presents, a scoping literature review examining SBIRT for cannabis use is crucial in elucidating whether this approach is effective in its current form or if modifications are needed to maximize its utility. A scoping review of the literature on SBIRT serves to provide an overview of the available research, review modifications to components of SBIRT, and provide recommendations for future work using an SBIRT approach (Munn et al., 2018). The primary purpose of the current review is to evaluate the extant literature applying SBIRT to cannabis use. Specifically, each component of SBIRT (screening, brief intervention, and referral to treatment) is synthesized separately for adult samples and adolescent and emerging adult samples. Additionally, a second goal of this review is to discuss studies evaluating mechanisms implicated in the adoption and implementation of SBIRT such as feasibility, acceptability, and fidelity.

2. Method

2.1. Selection criteria

The authors agreed on a set of a priori inclusion and exclusion criteria. The inclusion criteria required the articles: (1) were published in peer-reviewed journals between 2000 and 2022, (2) were published in English or translated into English, (3) included SBIRT, (4) included analyses specific to cannabis use (e.g., cannabis using sample, cannabis-specific indicator or outcome), and (5) articles used quantitative, qualitative, or mixed methods. The exclusion criteria were: (1) review papers (e.g., systematic reviews, meta-analyses), (2) results not specific to or not including SBIRT, and (3) articles lack analyses specific to cannabis use.

2.2. Search strategy

Fig. 1 depicts the article selection process following the recommendation by the Preferred Reporting Items for Scoping Reviews and Meta-Analyses (PRISMA) Statement. The team used keywords (SBIRT* OR screening, brief intervention, and referral to treatment* OR motivational interviewing) AND (cannabis* OR marijuana*). We searched for these keywords in PsycINFO, PubMed, Sage Journals Online, ScienceDirect, and SpringerLink. Two co-authors independently screened titles, abstracts, and the full articles within the above databases and evaluated

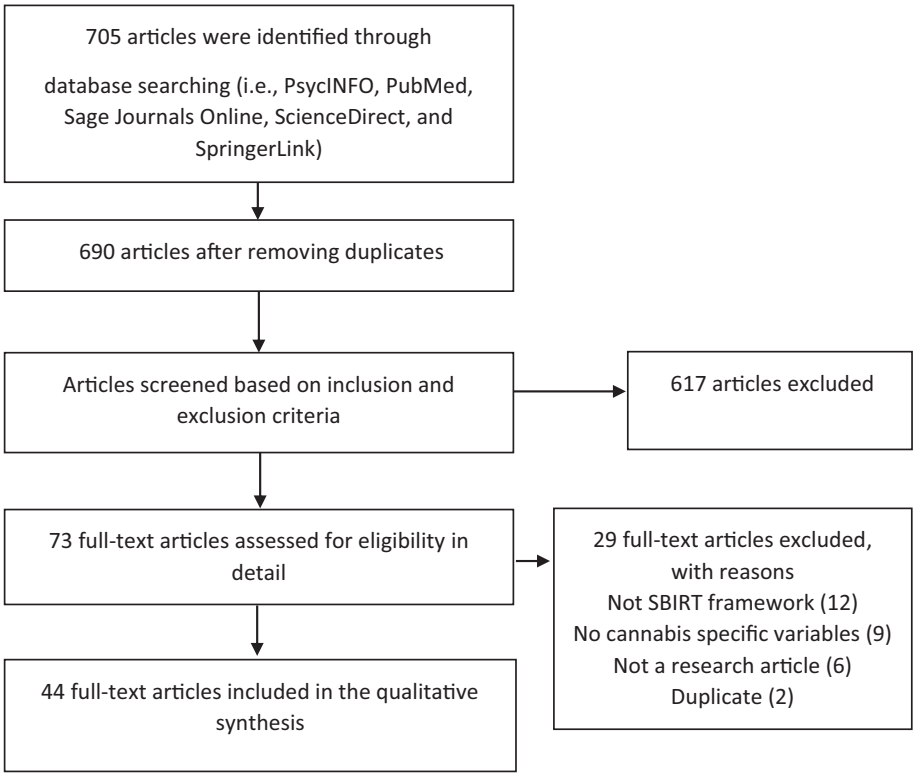

Fig. 1. Flow diagram summary of the article selection process as recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Guidelines.

articles based on the inclusion and exclusion criteria detailed above. The lead author conducted a second review of the included articles for accuracy and appropriateness for the scope of this review and consulted with the co-authors as necessary.

3. Results

The team identified an initial total of 705 articles. After adjusting for duplicates (n = 15), 690 remained. The initial screen by reviewers resulted in the removal of 617 articles as a result of failing to meet the inclusion and exclusion criteria. The full text of the remaining 73 articles were examined in more detail. Upon further examination, we excluded 28 articles for not fully meeting inclusion or exclusion criteria, 12 for not using an SBIRT framework, 9 for not having a cannabis-specific indicator or outcome variables, 6 for not being a research article (e.g., commentary, review), and we removed 2 duplicates. In total, the scoping review includes 44 articles. The reviewed literature used the terms "marijuana" and "cannabis"; the term "cannabis" is used throughout this review for consistency. Given the included studies had a wide range of substances included in their analyses, this review only reports on cannabis-related outcomes related to SBIRT components, considerations for different age groups, contexts, or specialty populations, and modifications to SBIRT that may be particularly efficacious when considering cannabis. See Table 1 for review of the included literature.

3.1. Screening

3.1.1. Screening in adult samples

Among the reviewed literature, 20 articles discussed the screening component of SBIRT in adults with six studies providing cannabis-specific outcome data. The included studies used 18 different assessments with adult samples. Commonly used screening instruments include the Alcohol, Smoking and Substance Involvement Screening Text (ASSIST; Humeniuk et al., 2006), timeline follow-back (Sobell & Sobell, 1992), and the Short Inventory of Problems – Modified for Drug Use (SIP-D; Alterman et al., 2009; see Table 1 for review of screening measures). Looking at screening and discussion procedures, Moore et al. (2021) examined a nationally representative primary care sample of individuals who used cannabis in the past year (N = 36,374) via electronic health records. Those who used cannabis had higher odds of being screened than those without past-year cannabis use. Among those using any cannabis, compared to those reporting recreational use only or recreational and medicinal use, those reporting medicinal-only use had higher odds of being screened and of having a discussion about their use regardless of whether or not they were screened. Further, residing in a state with legal cannabis was associated with higher odds of being screened. Several demographic patterns emerged with regard to screening procedures. Specifically, being age 26–34 compared to 18–25; being in poverty compared to >2× poverty income; having private v. no insurance; and having increased chronic health conditions were all associated with greater odds of being screened for cannabis use. Among those screened, being age 26–34 compared to 18–25; being age 35–49 or 50+ compared to 18–25; White race compared to Hispanic; having public compared to private insurance; and having increased chronic health conditions were associated with higher odds of having a discussion about cannabis use. Importantly, the studies did not screen 27 % of individuals meeting criteria for a cannabis use disorder.

Given the changing legal status of cannabis use, Richmond et al. (2013) assessed if rates of positive cannabis screens in primary care settings in Colorado have increased post-medicinal cannabis legalization. Per electronic health records, the studies screened a total of 108,907 patients with 13,340 screening positive for cannabis use. The number of positive cannabis screens significantly increased post-legalization. Additionally, the study found a significant increase in ASSIST scores post-legalization and this increase was most pronounced among younger men. To improve the efficiency and accuracy of screening feedback, Papinczack and colleagues (2021) developed the iAx tool. This tool utilizes a computer-based screening that provides feedback on normative behaviors with graphic representations of the patient's responses that can be included in computerized or clinician delivered feedback. The iAx tool resulted in greater understanding of the screening results (p = .03).

In addition to general adult samples, SBIRT has been applied to specialty population. Observing rates of positive cannabis screens in HIV clinics over time, Graham et al. (2016) found that positive screens have ranged from 6 % to 16 % between 2008 and 2013 compared to the NIDA benchmark 7 % of the general population. Further, mean ASSIST scores for cannabis rose overtime reaching a mean of 5.5 in 2013. Importantly, Gette et al., (2022) found that individuals with HIV/AIDS who report using only cannabis had significantly lower odds of accepting a BNI following screening compared to other patterns of illicit substance use. Comparison of clinician and computer delivered SBIRT for cannabis use in an HIV clinic found no significant impact of intervention. However, those initially at low-risk group for cannabis had significantly *higher* ASSIST scores at follow-up with a mean change of 3.13 points (Dawson-Rose et al., 2017). A nonsignificant reduction in ASSIST scores occurred at follow-up for individuals in the moderate-risk category at baseline.

3.1.2. Screening in adolescent and emerging adult samples

Studies in adolescent and emerging adult samples used 17 different screening and assessment tools, most commonly timeline follow-back (Sobell & Sobell, 1992) and in-house measures (see Table 1 for review of all assessments). Of the reviewed literature, eight studies have examined the screening component of SBIRT in adolescent and emerging adult populations with two studies providing outcome data. Work by Lee et al. (2021) aimed to address gaps in screening by developing a cannabis-specific screening tool, the Marijuana Consequences Checklist (MCC). Through a series of three independent studies, these authors developed the MCC and evaluated its utility and validity. Commonly endorsed consequences of use included getting the munchies, concentration and memory impairment, acting "goofy," and dry mouth. The MCC demonstrated convergent and discriminant validity and evinced incremental validity in predicting cannabis consequences over and above frequency of use and demographics. To increase implementation of screening among adolescents in outpatient care, Alinsky et al. (2020) engaged 9 primary care providers in an SBIRT screening training. Following training, the study found a significant increase in provider confidence and knowledge about SBIRT, total screens, and positive screens. Importantly, a significant increase occurred in the use of validated assessment instruments and a significant increase of patients receiving a BNI post-training.

3.2. Brief intervention

3.2.1. Brief intervention in adult samples

The BI component of SBIRT garnered the most attention in the reviewed literature with 14 articles providing outcome data on BIs in general adult samples and five providing outcomes in adult specialty populations. Of these articles, two did not include a control or comparison group and 12 had a control group only, multiple interventions, or both. BIs were predominately clinician delivered with 22 clinician delivered conditions and seven computerized conditions across these studies. BIs ranged from one to two sessions with sessions lasting between 5 and 90 min. Examining a subset of 120,000 adults (n = 2176, cannabis use sample = 1044) in an emergency department that received a screen and BNI, Woodruff et al. (2013) assessed changes in cannabis use abstinence rates and use days via electronic health records. Prevalence of any cannabis use and cannabis use days per month significantly decreased using the full sample and when examining just those completing the follow-up (n = 672). Similarly, Madras et al. (2009) examined the utility of SBIRT across 6 large health care settings using

Table 1
Summary of articles included in final review.

Article	Population	Sample Size	SBIRT Components	Modality	Provider	Cannabis Variables	Relevant Assessments	Fidelity Procedure
Aldridge et al., 2017	Multisite adults; outpatient, inpatient, and emergency medical settings	Full sample: 7632 Cannabis sample: 2554	BI	In-person	Varied by cite	Cannabis use days pre- and post-intervention	TLFB[a], GRPA[b]	Not described
Alinsky et al., 2020	Adolescents and providers, outpatient medical setting	Providers: 9 Patients: 120	S	Electronic or paper/pencil	Physicians, NPs, PAs	Positive cannabis screens	CRAFFT	Not described, no intervention
Appel et al., 2015	Adults, abortion clinic setting	N = 100	S, BI, RT	In-person	Research team	Acceptability and attitudes about cannabis screening	Likert-like acceptability items	Not described, no intervention
Baumeister et al., 2014	Adults, primary care	*N* = 259 analyzed at follow-up; cannabis sample = 137	BI	Hybrid	Primary care providers	Pre- and post-scores stratified by substance	ASSIST[d]; Short-Form Health Survey	Not described, scripted
Bertholet et al., 2020	Adults, primary care	N = 61 Cannabis sample = 43	S, BI	In-person	Health educators; Masters level clinicians	Pre- and post-use days, consequences	TLFB[a], SIP-D[c], ASSIST[d]	Not described
Blow et al., 2017	Adults, emergency care	*N* = 780 Cannabis sample = 687	BI	In-person or computerized	Master's level clinicians	Pre- and post-use days	TLFB[a], ASSIST[d]	Audio recording with MITI[e] and the Clinical Skill/ Competence Scale coding
Bonar et al., 2021	Emerging adults, emergency care	*N* = 63	BI	Hybrid	Counselors	Pre- and post-joints per month	TLFB[a], Likert-like acceptability items	Audio recording, supervision by MINT[f] member
Bucci et al., 2010	Adolescents and emerging adults, early psychosis	N = 58	S, BI	In-person	Staff therapists	Pre- and post-intervention daily frequency	Opiate Treatment Index, Global Assessment of Functioning	Peer supervision
Chan et al., 2014	Adults, behavioral health clinic	*N* = 2373 Cannabis sample = 582	RT	EMR review	Varied	Post-intervention treatment referral and utilization	Global Assessment of Individual Needs – Short Screener	Not described, no intervention
D'Amico et al., 2018	Adolescents, primary care	*N* = 153 Cannabis sample = 242	BI	In-person	Bachelor's and Master's level	Pre- and post-use days, consequences, peer norms	NIAAA scree; quantity, frequency, and consequences items	Audio recording with MITI coding and fidelity checklist
Dawson-Rose et al., 2017	Adults, HIV primary care	*N* = 208	S, BI	In-person or computerized	Trained staff member	Pre- and post-ASSIST scores stratified by substance	ASSIST[d]	Written documentation, supervision
De Oliveira Christoff & Boerngen-Lacerda, 2015	College students, volunteers	*N* = 815 Intervention sample = 333	S, BI	In-person or computerized	Research team	Pre- and post-ASSIST scores stratified by substance	ASSIST[d]	Not described
de Gee et al., 2014	Adolescents, outpatient	*N* = 119	BI	Hybrid	Prevention worker	Pre- and post-severity scores	CUPIT; Severity of Dependence Scale	Audio recording, supervision with MINT member
Field et al., 2020	Adults, trauma center	*N* = 395 Cannabis sample = 348	S, BI	In-person, telephone boosters	Research team	Pre- and post-use days	Toxicology screen, TLFB[a]	Audio recording with MITI coding, supervision with MINT member
Fischer et al., 2013	College students	*N* = 134	BI	In-person	Research team	Pre- and post-use days	Cannabis Use Disorders Identification Test, researcher-developed questions	Not described
Fuster et al., 2016	Adults, primary care	*N* = 167	BI	In-person	Bachelor's or Master's-level provider	Pre- and post-use days, problems	SIP-D[c], TLFB[a], ASSIST[d]	Audio recording, supervision
Gette et al., 2022	Adults, HIV clinic	N = 331 Cannabis sample = 101	S, BI	Hybrid	Social Worker	Engagement in BNI	DAST	Not described, no intervention
Graham et al., 2016	Adults, HIV clinic	*N* = 1616	S, BI, and RT	In-person	Bilingual educator	Positive cannabis screens, ASSIST scores	ASSIST[d], binary items	Not described
		N = 359	BI				ASSIST[d]	None

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Table 1 (*continued*)

Article	Population	Sample Size	SBIRT Components	Modality	Provider	Cannabis Variables	Relevant Assessments	Fidelity Procedure
Gryczynski et al., 2015	Adults, community health centers			In-person or computerized	Master's level clinician			
Gryczynski et al., 2021	School-based health centers	*N* = 300 Cannabis sample = 233	BI	In-person or computerized	Nurse practitioner	Pre- and post-use days and cannabis-problems	TLFB[a], CRAFFT, ASSIST[d]	Not described
Gunderson et al., 2020	Providers, high school-based health centers	*N* = 12	S, BI, and RT	In-person	Research team	Semi-structured interviews on SBIRT for cannabis implementation	Qualitative outcomes	Not described, no intervention
Hides et al., 2013	Adolescents and emerging adults, primary care	N = 61	BI	Hybrid	Doctoral-level psychologists	Pre- and post-use days, distress	TLFB[a], Kessler Distress Scale	Not described
Karno et al., 2021	Adults, medical centers	*N* = 718	S, BI, and RT	In-person	Research team, Master's-level clinician	Pre- and post-use days, DAST, distress scores	ASSIST[d], DAST, Kessler Distress Scale, TLFB[a]	Audio recording, supervision, session content checklist
Kim et al., 2017	Adults, primary care	N = 528 Cannabis sample = 333	RT	In-person	Health educators, Master's-level clinician	Post-intervention referral rates	ASSIST[d]	Audio recording with MITI coding, fidelity checklist
Lee et al., 2021	College students and emerging adults	Study 1 *N* = 207 Study 2 *N* = 410 Study 3 *N* = 336	S	Online	N/A	Use days, consequences, CUD symptoms	CUDIT-R, Marijuana Consequences Checklist, quantity/frequency items	Not described, no intervention
Lerch et al., 2017	Adults on probation or parole	N = 316	BI, RT	In-person or computerized	Counselors	Use days, treatment attendance	TLFB	Not described
Madras et al., 2009	Adults, medical centers	*N* = 459,599 Follow-up analyses = 12,284	S, BI, and RT	Varied by site	SAMHSA-trained personnel	Positive screens, BNI use, referrals, and frequency at follow-up	Chart review, GRPA[b]	Not described, no intervention
Martin & Copeland, 2008	Adolescents, general community	*N* = 40	BI	In-person	therapist	Pre- and post-use days, quantity, DSM-IV symptoms	TLFB[a], Global Assessment of Individual Needs, Severity of Dependence Scale	Audio recording, fidelity ratings
Martino et al., 2018	Adults, reproductive health clinic	*N* = 439 Cannabis sample = 90	S, BI	Computerized or in-person	Nurses, social workers, OBGYN	Pre- and post-use days	ASSIST[d], TLFB[a]	Audio recording, fidelity ratings, supervision
Maslowsky et al., 2017	Adolescents, school-based	*N* = 2513 Cannabis sample = 242	S, BI	Hybrid	Bachelor's-level health educators	Post-intervention use intentions and SBIRT acceptability	CRAFFT, Likert-like intention to use and acceptability items	Audio recording, live observation, supervision
Matheson et al., 2018	Adults, primary care	N = 906	S, BI	In-person	Primary care physicians	Positive screens	ASSIST[d]	Not described
McCarty et al., 2019	Adolescents, school-based health centers	*N* = 148	S, BI	Hybrid	School-based Health clinicians	Positive screens, post-intention to reduce use, hours high	"Check Yourself" tool	Not described
Moore et al., 2021	Adults, medical centers	*N* = 214,505 Cannabis sample = 36,374	S, BI	Varied by site	Varied by site	Screening rates, discussion of use rates	Chart review	Not described, no intervention
Morris et al., 2021	Adolescents, school-based	*N* = 98	BI	In-person, computerized	Health educators	Pre- and post-use days	TLFB[a], Composite International Diagnostic Interview, Personal Experiences Screening Questionnaire, Drug Use Screening Inventory – Revised, readiness to change	Supervision, team meetings
Ondersma et al., 2019	Adults, pregnant persons	N = 45	BI	Electronic and/or text messages	Computerized intervention authoring system	Acceptability ratings	Patient satisfaction scale, ASSIST[d]	Computerized
Ondersma et al., 2007	Adults, postpartum	N = 107 Cannabis sample = 90	BI	Electronic	Computerized program	Pre- and post-use days	ASSIST[d], readiness to change scale	Computerized

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Table 1 (*continued*)

Article	Population	Sample Size	SBIRT Components	Modality	Provider	Cannabis Variables	Relevant Assessments	Fidelity Procedure
Papinczak et al., 2021	Adults, outpatient clinic	$N = 87$	S, BI	Hybrid	Psychologists, social workers, nurses	Feasibility and intention to change	Motivation to change, Likert-like satisfaction items	None
Prendergast et al., 2017	Adults, jail	$N = 732$ Cannabis sample = 686	S, BI, RT	Hybrid	Health educators	Pre- and post-use, treatment utilization, risk level via ASSIST	ASSIST[d], readiness to change scale	Not described
Richards et al., 2019	Adults, primary care	$N = 53,133$	S, BI, RT	In-person	Licensed independent clinical social workers	Screening rates, CUD diagnoses, treatment utilization	SUD symptom checklist, chart review	Not described, no intervention
Richmond et al., 2013	Adults, multisite medical centers	$N = 108,907$	S	Varied by site	Varied by site	Positive screens, symptom severity	ASSIST[d]	Not described, no intervention
Saitz et al., 2014	Adults, primary care	N = 528 Cannabis sample = 333	S, BI	In-person	Health educators; Master's-level clinicians	Pre- and post-use days, symptom severity	ASSIST[d], TLFB[a], SIP-D[c]	Audio recording with MITI coding
Stephens et al., 2021	Adults, community recruitment	$N = 186$	S, BI	Hybrid	therapists	Pre and post-use days, hours intoxicated, cannabis problems	Readiness to change, TLFB[a], SCID, Marijuana Problems Scale	Audio recording with MITI and YAC coding, supervision
Woodruff et al., 2013	Adults, emergency departments	$N = 2436$	S, BI	In-person	Health educators	Pre- and post-use days	GRPA[b], ASSIST[d]	Not described
Woolard et al., 2013	Adults, emergency departments	N = 515	BI	In-person	Master's and doctoral level clinicians	Pre and post-use days, consequences, and related injuries	Alcohol, marijuana, and drug use index; noteworthy index of problems; injury behavior checklist	Audio recording, supervision

Note. If "Cannabis sample" is specified, outcome analyses specific to cannabis use were conducted for the subsample.
[a] TLFB = timeline follow-back.
[b] GRPA = government Performance and Results Act assessment tool.
[c] SIP-D = The Short Inventory of Problems – Modified for Drug Use.
[d] ASSIST = The Alcohol, Smoking and Substance Involvement Screening Test.
[e] MITI = Motivational Interviewing Treatment Integrity.
[f] MINT = Motivational Interviewing Network of Trainers.

electronic health records. They selected a subsample of 12,284 for follow-up analyses at 6-months. Of the subsample, 32.9 % endorsed any cannabis use at baseline compared to 12.1 % at follow-up ($p < .001$) and the study found significant reductions across all gender, age, and racial groups. Among the 32.9 % endorsing cannabis use at baseline, 29.1 % continued to endorse use at follow-up ($p < .001$).

The remaining reviewed BI literature assessed the utility of BIs compared to a control group and/or alternative intervention. Comparison of in-person v. computerized-BI on a sample of 359 adults (cannabis sample = 316) in primary care found no significant differences in positive hair analyses at 6- or 12-months (Gryczynski et al., 2015). The study found a significant reduction in ASSIST scores at 12-month follow-up for the full sample, with the computerized sample demonstrating larger treatment gains at 6-months, but equivalent gains at 12-months. Among concurrent users of alcohol and cannabis in an emergency setting ($N = 515$), 2-session BI resulted in significant reduction of concurrent use at 3- and 12-month follow-up, but did not result in significant decreases in cannabis use compared to a control group (Woolard et al., 2013). Comparison of clinician delivered BNIs following use of pencil-and-paper v. electronic screening and feedback using the iAx tool (Papinczak et al., 2021) among 87 individuals reporting cannabis use found a significant interaction of time and condition such that the iAx group demonstrated higher motivation to change compared to the pencil and paper group over time ($p = .03$). No significant differences occurred in intervention satisfaction; over a 10-month period, use of the iAx tool was estimated to have saved the clinic $13,160.

When brief MI was compared to a BI comprising CBT and motivational enhancement therapy (MET) in primary care ($N = 3218$), no significant difference occurred in cannabis frequency for the CBT-MET group compared to the brief MI group ($\beta = -0.13$, $p > .10$; Aldridge et al., 2017). Comparison of a brief MI (BI, 2 sessions) to extended MI (brief treatment, 6 sessions) for individuals using cannabis at least 15 times per week found that readiness to change was crucial in reducing use days and problems (Stephens et al., 2021). Specifically, those in the preparation stage demonstrated the greatest decreases in cannabis use days at 6-week and 3-month follow-up. Those in the pre-contemplation stage did not demonstrate significant reductions in use but had significantly fewer cannabis problems at baseline and follow-up, suggesting that the lack of problems results in minimal incentive to change use patterns. Over time, the 6-session condition had significantly greater reductions in use sessions per day but not in use days than the 2-session condition. No main effect of intervention occurred on use days, sessions per day, or consequences.

Several studies examined the MOTIV protocol in several settings as a modification to BNI (Bertholet et al., 2020; Fuster et al., 2016; Saitz et al., 2014). MOTIV is a BI combining traditional BNI with values and self-efficacy building. Comparison of MOTIV, BNI, and control groups in primary care ($N = 528$; cannabis sample $n = 331$) found no significant differences in cannabis use days, consequences, emergency room visits, or self-help group utilization as a function of intervention group at 6-month follow-up (Saitz et al., 2014). Additionally, no significant interaction occurred of intervention group and readiness to change on outcomes. Looking at low-risk cannabis users, as defined by an ASSIST score of 2–3, Bertholet et al. (2020) compared three groups ($N = 57$; 40 primary users of cannabis): a control group, BNI group, and the MOTIV group. At 6-month follow-up, no main effect of condition existed on use days or consequences. Fuster et al. (2016) examined the utility of MOTIV in a sample of adults in primary care with high-risk cannabis use (i.e.,

21+ use days in the past month and an ASSIST score of 4+). These authors compared BNI, MOTIV, and a control group. At 6-week and 6-month follow-up, no significant effects of intervention condition existed on use days or problems. The lack of significant findings remained when patients were stratified by readiness-to-change level. Together, the MOTIV protocol did not outperform BNI or controls, regardless of risk severity. Though most research has focused on use outcomes, Baumeister et al. (2014) examined a sample of 261 individuals in primary care with a positive substance use screen at 3-month follow-up to assess for changes in mental and physical quality of life. Of these individuals, 136 patients' highest ASSIST score was for cannabis. For this subset, no significant differences in mental or physical quality of life occurred at follow-up after receiving a BI compared to controls. Recent literature has examined the inclusion of phone-based follow-ups. In a sample of 395 adults at a trauma center (cannabis use sample = 348), Field et al. (2020) compared a control group to BNI and BNI with a phone booster. The study found an overall significant increase in abstinence rates at 12-month follow-up; however, no significant effect of intervention type occurred. Comparison of computer- v. provider-delivered BI with or without boosters in an emergency room sample found that the control group and the provider-delivered BI without boosters yielded significant decreases in cannabis use days at 12-month follow-up (Blow et al., 2017). No significant reductions occurred for any condition using booster sessions or employing computerized BI; however, the therapist-delivered BI without boosters ($d = -0.24$) and computer-delivered without boosters ($d = -0.17$) evinced small, significant effect sizes. Comparison of general health education to BNI in 718 adults in primary care found that the BNI was ineffective for reducing cannabis use (Karno et al., 2021). In fact, at 6- and 12-month follow-up, patients in the BNI group were significantly *more* likely to use cannabis compared to the control group.

Examination of SBIRT in reproductive clinics found that among pregnant persons reporting pre-pregnancy cannabis use ($N = 45$), no significant differences existed in self-reported satisfaction, likeability, or helpfulness when comparing electronically administered SBIRT with or without daily booster texts (Ondersma et al., 2019). Further, those with higher perceived risk of cannabis use during pregnancy reported significantly higher satisfaction with SBIRT regardless of condition. In an abortion clinic with pregnant persons seeking abortion consultations ($N = 100$), patients reported high acceptability and low embarrassment of engaging in SBIRT for cannabis use (Appel et al., 2015). Notably, Black women reported significantly lower acceptability of SBIRT in this setting ($p = .002$). Looking at changes in cannabis use behavior in a sample of persons at a reproductive health clinic, Martino et al. (2018) compared electronic SBIRT, in-person SBIRT, and a control group. The study found a significant reduction in cannabis use across all conditions but no main effect of treatment condition. Similarly, in a sample of 107 post-partum persons that used substances prior to pregnancy ($N = 107$), no significant change occurred in cannabis use following electronic SBIRT compared to a control group and no significant moderation effects of motivation to change, self-efficacy, or IQ (Ondersma et al., 2007).

Two studies examined use of SBIRT in justice-involved adults. Prendergast et al. (2017) assessed the utility of SBIRT for 732 individuals currently in jail. At follow-up (12 months post- release), no significant differences occurred in cannabis use risk category, use days, days to first use, or treatment utilization in the SBIRT group compared to the control group. In a sample of adults completing parole or probation intakes ($N = 316$), Lerch et al. (2017) compared in-person brief-MI and computerized-MI (MAPIT) to standard intake procedures. At six-month follow-up, those in the MAPIT condition were *more* likely to report cannabis use compared to the control group ($d = 0.25$). Intent-to-treat analyses found no significant differences in cannabis use by treatment condition at 2- or 6-month follow-up.

3.2.2. Brief intervention in adolescent and emerging adult samples

Brief interventions have been the primary focus on studies of SBIRT in adolescent and emerging adult samples with 19 of the reviewed works examining this component with 15 providing outcome data. Of these studies, 12 have reported outcomes using clinician delivered BIs and three with computerized BIs. Broadly, BIs among adolescents and emerging adults have shown inconsistent utility in reducing cannabis use. Comparison of 119 Dutch adolescents randomly assigned to an MI-based BI or control found that at 3-month follow-up, no significant differences occurred in cannabis quantity, frequency, or CUDIT scores between conditions. When the intervention group was stratified to compare high frequency use (i.e., 14 or more joints per week) to low frequency use, those in the high frequency group showed greater reductions in use than those in the low frequency use group. Examination of adolescents in primary care deemed as "at-risk" for alcohol use ($N = 294$) randomly assigned to either a 15-min BI focused on normative data and MI or control group found that at 3- at 6-month follow-up, no significant differences existed in cannabis frequency or consequences by group (D'Amico et al., 2018). However, at 12-month follow-up, the intervention group demonstrated significantly greater reductions in consequences, but not use, compared to the control group. At all three time points, the intervention group had significantly lower perceived peer use of cannabis.

Emerging adults ($N = 61$) at a mental health clinic with high distress at baseline were assigned to either MI or "Quick Fix," a single-session intervention incorporating MI, personalized feedback, and coping skills training (Hides et al., 2013). The "Quick Fix" sample demonstrated significantly greater reductions in cannabis use frequency at 3-month ($p = .01$) and 6-month ($p = .03$) than the MI-only group. Additionally, the "Quick Fix" group had greater reductions in psychological distress than the MI-only group ($p = .04$). In an emergency room sample of emerging adults endorsing both past-month cannabis use and condomless sex, Bonar et al. (2021) examined absolute reductions in cannabis use following BI. Their BI was comprised of identification of primary motives for use with specific tools for addressing those motives with text message boosters. Participants in the intervention group rated the text boosters as helpful and likeable. The intervention group had absolute reductions of 31.91 use days (36.96 % reduction) at 1- and 2-month follow-up compared to a reduction of 26.10 use days (54.75 % reduction) in the control group. Among teens at-risk of psychosis or in first-episode psychosis ($N = 58$), 19 screened positive for cannabis use and received a BI (Bucci et al., 2010). Among those screening positive for cannabis, a significant decrease in cannabis use days ($p < .01$) and polysubstance use days ($p < .01$) occurred at 12-month follow-up. Of the 10 patients returning for follow-up, 7 were abstinent.

School-based SBIRT has garnered attention as a means for early prevention and intervention. In a large sample of high school students screened for substance use, 9.6 % ($n = 242$) screened positive for cannabis use (Maslowsky et al., 2017). All students engaged in SBIRT regardless of use status with the BI modified to address intention to use among students with no prior cannabis use. On a 0 to 7 scale, with higher values representing intention to continue abstinence following SBIRT, the mean rating among those with no use history was 6.67. Intention to reduce use among those who have used cannabis was 5.57. However, no data regarding levels of use or use intentions prior to intervention was available. Alternatively, McCarty et al. (2019) compared the "Check Yourself" tool to a control group of 428 high school students that screened as at-risk for alcohol and cannabis. This tool integrates screening with normative feedback by age and gender, strategies targeting individuals' specific motives, and creates discrepancy between use and goals. Students in the "Check Yourself" condition were significantly more likely to receive school-based counseling and to discuss their cannabis use with their provider and reported higher intention to change their cannabis use. At follow-up, no significant differences existed in cannabis use days or hours of cannabis intoxication by group. Comparison of computer-delivered v. nurse practitioner-delivered BI v.

archival assessment only data in high school-based health centers found no significant impact of condition or time by condition interaction on cannabis use frequency or ASSIST scores at 3- or 6-month follow-up. The study found a significant impact of treatment v. assessment at 3-months when the treatment conditions were combined; significance was not retained at 6-months. In a version of SBIRT for Native American youth that accounts for Native American identity and resilience, a comparison of brief advice, feedback with MI, and feedback with MI and booster sessions found that the feedback with MI and booster group showed significantly greater reductions in cannabis use at 3-month follow-up than the brief advice condition ($\beta = -0.11$, $p < .01$).

Comparison of screening only, online screening with BNI, and in-person screening with BNI among Brazilian college students found no significant differences in ASSIST scores for cannabis use at 90 day follow-up by condition (de Oliveira Christoff & Boerngen-Lacerda, 2015). Males in the in-person screen with BNI showed significant reductions in cannabis use days. Assessing individual items of the ASSIST found significant reductions in past month use days for the in-person condition and negative problems of use for both treatment groups. In a sample of Canadian college students, no significant reductions occurred in cannabis use days as a function of completing oral BI, written BI, oral control, or written control (Fischer et al., 2013). However, those in the combined intervention sample demonstrated reductions in deep inhalation practices and driving while intoxicated. Within the intervention conditions, the oral BI group had significant reductions in deep inhalation practices and the written BI group had reductions in driving while intoxicated.

3.3. Referral to treatment

Of the articles reviewed, nine discussed referral to treatment, with one study supplying outcome data in a general adult population. Kim et al. (2017) examined treatment engagement among 528 (331 with primary cannabis use) adults in primary care referred to treatment following screening and BI. Those with primary cannabis use were significantly less likely to seek services compared to primary cocaine, opioids, or other substance use ($ps < 0.01$) and these results were maintained when stratified by ASSIST scores.

3.4. Feasibility and acceptability

Two studies examined of the acceptability and feasibility of SBIRT for cannabis use in adult settings. A study of a sample of adults in the United Arab Emirates ($N = 906$, cannabis use sample $n = 10$) found that though providers reported increased positive attitudes about SBIRT and willingness to screen patients following an SBIRT training, no significant increase occurred in the number of screens conducted (Matheson et al., 2018). Of those screening positive for cannabis use at follow-up, none received a BI. Limited knowledge about cannabis and discomfort with screening for substances emerged as barriers to cannabis screening (Richards et al., 2019). The study reviewed electronic records of 53,133 patients in a large hospital to assess changes in substance use screens and treatment to evaluate utility of a provider training and inclusion of prompts when charting. The study screened approximately half of patients (57 %) for cannabis use, 15.7 % of which endorsed use. Following training, cannabis use disorder diagnoses rose from 5 per 10,000 to 17 per 10,000 ($p < .0001$); however, the study found no significant increases in treatment for CUD.

In an adolescent sample, several qualitative themes emerged when assessing barriers for provision of SBIRT interventions for cannabis use in high schools (Gunderson et al., 2020). Specifically, these authors identified six general themes: 1) cannabis use is a sign of mental health concerns; 2) BIs are not effective; 3) cannabis use is less risky than alcohol use; 4) difficulty balancing trust versus authority; 5) providers lack skills and/or knowledge about cannabis use and intervention; 6) cannabis use is a low risk behavior.

4. Discussion

Broadly, the reviewed literature suggests that more work is needed to advance screening tools for high-risk cannabis use, ensure brief interventions are delivered with fidelity, and improve the referral to treatment process (e.g., use of warm handoffs) to increase the utility of SBIRT for cannabis. Though some work did find significant reductions of use, the effect appears small as studies with significant findings utilized the largest samples and did not include comparison groups (e.g., Madras et al., 2009; Woodruff et al., 2013). Further, many studies demonstrating reductions in use did not document significant differences between the intervention and control groups, suggesting that changes in behavior may not be attributable to the intervention(s). Despite limited impact on behavior, the reviewed literature offers important considerations for all SBIRT components and future research.

Reviewed literature found that although studies did not universally apply validated assessment instruments, implementation of provider trainings served to increase the frequency of screens, use of validated instruments, and detection of cannabis use disorders (Alinsky et al., 2020; Richards et al., 2019). Importantly, many commonly used screening tools (e.g., DAST, timeline follow-back), do not capture nuanced information important to understanding cannabis use patterns. Cannabis screens should aim to include items capturing form (e.g., loose leaf, concentrations), method of use (e.g., inhalation, ingestion), and potency of cannabis use to better understand unique patterns of use and subsequent risk.

In addition to increasing implementation and specificity of screens, modifications have been made to screening strategies (e.g., iAx, [Papinczak et al., 2021],"Check Yourself" [McCarty et al., 2019]) that incorporate real-time normative feedback or integrate motives for use with future personal goals to foster cognitive dissonance. The Marijuana Consequences Checklist (Lee et al., 2021) highlighted cannabis-related consequences often not captured in commonly used screening tools (e.g., the "munchies", concentration problems) that could help patients and providers to better understand consequences of use. Shifts to incorporate cannabis-specific screening may help patients to contextualize their use and serve as motivation to change when use exceeds norms (Blevins, Walker, et al., 2018) and could increase patient engagement in the BI. For example, Gette et al. (2022) found that individuals using cannabis but no other illicit substances had lower odds of engaging in the BNI regardless of symptom severity. This finding may be due to provider and/or patient bias or lack of understanding about the potential risks of cannabis. Increased understanding of results and subsequent motivation may help to bridge the gap from screening to BI and referral to treatment for at-risk individuals.

Studies examined a number of modifications to the BI component, to mixed success. Generally, modifications to BIs did not yield significantly greater change in outcomes compared to an MI-based BNI or control group. Further, no differences occurred in outcomes whether SBIRT was conducted virtually, in-person, or hybrid (Blow et al., 2017; Field et al., 2020; Gryczynski et al., 2015, 2021). This finding suggests that modality is not responsible for lack of significant findings. Rather, the implementation and content of BIs for cannabis warrant further examination. Implementation may be a critical starting point as extant literature has found inconsistent implementation of SBIRT. In fact, many studies lack fidelity assessments to the SBIRT protocol that may be crucial in determining its success, given it can take several training and coaching sessions to reach SBIRT mastery (see McAfee et al., 2022 and Madson et al., 2018 for review). Further, lack of fidelity assessments, particularly for motivational approaches, may be responsible for lack of significant behavior change as it is unclear if the brief interventions are being presented to patients as intended with adherence to the principles of motivational interviewing. Of the reviewed literature, 17 of 32 studies utilizing provider administered BIs included a description of fidelity procedures. Of the 17 describing fidelity procedures, 10 used a standardized coding protocol (e.g., the Motivational Interviewing Treatment

Integrity protocol). Future studies applying SBIRT should include a description of these efforts to ensure treatments are being conducted to fidelity.

Generally, participants self-report finding SBIRT helpful, likeable, and acceptable across contexts and age groups. One exception occurred in a study of acceptability at an abortion clinic (Appel et al., 2015) in which Black women were significantly less likely to view discussion of their substance use as acceptable. This finding may be due to historical bias toward women of color in reproductive health settings (e.g., Prather et al., 2018) and/or racial disparities in substance use treatment (e.g., Farahmand et al., 2020). This finding warrants further examination in future studies of brief interventions. Despite being broadly acceptable, these ratings do not translate into significant behavior change. Reviewed studies examining intention to change following SBIRT found significantly higher motivation or intention in the intervention groups but no significant changes in behavior at follow-up (Maslowsky et al., 2017; McCarty et al., 2019). Overall, SBIRT may be a good tool for introducing discussion of cannabis use, but additional work is needed to maximize its potential for behavior change. In their current form, BIs for cannabis use may best serve to get individuals thinking about goals or motives, but follow-up is likely needed to sustain change. Future SBIRT interventions may benefit from expanding the BIs to include multiple sessions or broadening the criteria for referral to treatment.

The referral to treatment component has garnered the least amount of examination. Of the reviewed literature, two studies of adults (Kim et al., 2017; Prendergast et al., 2017) examined engagement in treatment following BI. These studies found that individuals in an intervention group were not significantly more likely to attend treatment than the control group (Prendergast et al., 2017) and that compared to other substances, individuals with primary cannabis use are less likely to attend follow-up treatment than individuals with other primary substances regardless of symptom severity (Kim et al., 2017). Several potential reasons may exist for these gaps. First, cannabis may be perceived as less harmful than other substances by both provider and patient, which could lead to decreased discussion about future treatment (e.g. Gunderson et al., 2020; Philpot et al., 2019). Second, a large time gap may exist between the BI session and subsequent referral appointments that could attribute to no-shows or lack of interest in treatment. This time lag due to availability along with contextual barriers (e.g., transportation, insurance) could result in lack of follow-up care for cannabis use (Blevins, Rawat, et al., 2018). Importantly, no adolescent or emerging adult literature had outcome data for the referral to treatment component, highlighting a large gap in the literature. Notably, in an SBIRT model, the referral to treatment component is meant to connect individuals to additional treatment in instances of moderate- to severe-risk and/or in response to patient desire to change their behavior. Among those at moderate- to high-risk, it is not expected that the brief intervention component alone will result in significant, lasting change without follow-up care. As such, it is crucial to our understanding of SBIRT to understand aspects of the referral to treatment process including who is referred and under what circumstances; the length of time from referral to first session; access to care; and mechanisms implicated in follow-up such as patient and provider attitudes. Importantly, absence of effective, widely utilized referral to treatment could attenuate the effects of the brief intervention component of SBIRT.

4.1. Limitations and future directions

One limitation of the reviewed literature is the inconsistency in screening and outcome measurement. The majority of studies used frequency as the primary outcome. However, other studies used outcomes such as abstinence, quantity, and consequences. Though each outcome adds nuance to our understanding of cannabis use behavior change following SBIRT, use of many instruments and outcomes makes it difficult to compare SBIRT across studies. Future studies on SBIRT for cannabis use should include multiple measures of cannabis behavior to facilitate comparison across several outcomes. Importantly, though the majority of the reviewed literature did not find changes in frequency of use, several studies found decreases in cannabis-related consequences following intervention, particularly among adolescents and emerging adults (e.g., D'Amico et al., 2018; Fischer et al., 2013). Assessing consequences as a metric of intervention success is an important consideration for future work on SBIRT for cannabis use. Further, studies varied widely in the duration of BIs with BIs lasting from 5 to 90 min and occurring over one or two sessions, making it difficult to directly compare the effectiveness of BIs.

Additionally, cannabis has varying medicinal and recreational laws across states and countries. In some instances, individuals may possess medical cannabis cards or prescriptions from a medical provider. However, only one study assessed rates of recreational v. medicinal use of cannabis (Moore et al., 2021). To effectively apply SBIRT, it is critical understand reasons for use. Evaluation of use for recreational v. medicinal purposes, including mental health management, and the presence of medical cannabis cards and prescriptions should be included in screening tools and as a variable of interest in SBIRT outcome studies.

Regarding the BIs, development of cannabis-specific interventions is arguably the most critical direction for future research. Use of normative data and assessing motives for use have shown promise as screening tools (Bonar et al., 2021; McCarty et al., 2019; Papinczak et al., 2021). Future work should assess if applying norms and motives into BIs results in behavior change. Additional future research avenues include assessing the effectiveness of multi-session BI and incorporation of BI into routine care. Notably, though the current review sought to evaluate the literature on SBIRT for cannabis use, the review found several brief interventions outside of the SBIRT framework that have demonstrated promise in reducing cannabis use and associated consequences in adults and emerging adults compared to control groups (see DiClemente et al., 2017; Halladay et al., 2019; and Parmar & Sarkar, 2017 for reviews). Applying findings from these works could serve to improve outcomes from the brief intervention component of SBIRT.

Further, improvements to the referral component are necessary. As noted, none of the included research assessed referral to treatment in adolescent or emerging adult populations. It is important to understand how SBIRT relates to treatment engagement for these age groups in particular, as adolescents are more vulnerable to adverse effects of cannabis (e.g., Levine et al., 2017; Lorenzetti et al., 2020) and emerging adults have the highest prevalence rates of cannabis use and cannabis use disorder (Hasin et al., 2015; Johnston et al., 2016). In response to qualitative work highlighting gaps in provider knowledge about cannabis use and comfort discussing use with patients, it would be beneficial for providers with expertise in SBIRT and cannabis to provide training and coaching sessions with providers less familiar with SBIRT in order to increase their confidence. Notably, few studies examined all components of SBIRT simultaneously, limiting the ability to evaluate the SBIRT framework as a whole for cannabis use.

4.2. Conclusion

In its current form, research provides inconsistent support for SBIRT as a framework for modifying cannabis use behaviors. This held true across a myriad of contexts and ages. Despite limited behavior change, feasibility research demonstrates that participants find SBIRT likeable and helpful. However, a disconnect between feasibility and subsequent behavior change is apparent. This disconnect may be due in part to inconsistent provision of SBIRT. Further, traditional BNIs may not be appropriate for addressing cannabis use. Given the unique considerations relevant to cannabis (e.g., medicinal use, varying legality), we recommend developing a cannabis-specific screening and brief intervention rather than attempting to fit traditional SBIRT approaches to cannabis. Additionally, the field needs to pay greater attention to fidelity, use of validated screening tools, and the referral to treatment process.

CRediT authorship contribution statement

Jordan A. Gette: Conceptualization, Methodology, Data Curation, Writing – original draft and revisions.

Timothy Regan: Methodology, Data Curation, Writing – Reviewing and Editing.

Julie A. Schumacher: Conceptualization, Methodology, Supervision, Writing – Reviewing and Editing.

Declaration of competing interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.josat.2023.208957.

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