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Treatment of Adolescent Cannabis Use Disorders

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INTRODUCTION

Cannabis use is common among adolescents with roughly 40% of US youth reporting any lifetime cannabis use and 15% reporting at least 1 sustained episode (1+ month) of daily cannabis use by 12th grade.[1] Roughly 4% of US youth aged 12 to 17 years met criteria in the last year for a cannabis use disorder (CUD).[2] Treating CUDs in adolescence may mitigate short- and long-term disruptions to social, academic, health, and cognitive functioning.[3,4] This review summarizes the literature on treatments shown to reduce cannabis use and/or CUD symptoms in youth (Table 1). Emphasis was placed on treatments evaluated in randomized controlled trials (RCTs) with cannabis-specific outcomes. The strongest evidence is for cognitive behavioral psychotherapies, which typically intervene upon factors that maintain cannabis use both external (eg, parental monitoring, rules, peer use) or internal (eg, expectancies, coping skills, cravings, motivation for change) to the adolescent.[4,5] The literature on pharmacotherapies for youth with CUD is also reviewed, because some medications may alleviate cannabis craving and withdrawal symptoms, facilitating reductions in cannabis use.[6,7] The article concludes by highlighting avenues for future CUD treatment research.

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The authors have nothing to disclose.

PSYCHOTHERAPIES FOR CANNABIS USE DISORDER IN ADOLESCENTS

Family-Based Therapies

Family-based interventions, which target the family system in addition to adolescent- and community-level factors, are considered well-established approaches to treating adolescent substance use.[8] A meta-analysis examining the comparative effectiveness of outpatient treatments for adolescent substance use found family-based therapies to be most effective.[9] Four such therapies are summarized that have been evaluated in at least 1 RCT in which cannabis-specific outcomes were reported.

Multidimensional family therapy

Multidimensional family therapy (MDFT) encompasses 4 treatment domains: adolescent (eg, coping, emotion regulation; alternative behaviors), parent (eg, parenting skills, involvement with adolescent), interactional (eg, family conflict, communication skills), and extrafamilial (eg, family competency in adolescent's social systems).[10,11] MDFT demonstrated reductions in cannabis use frequency across several RCTs.[11–16] For example, 1 study found a 20.1-day reduction in cannabis use days in the 90 days before a 12-month follow-up in the MDFT condition and 14.9-day reduction in the CBT condition.[16] Self-reported minimal use/abstinence rates ranged from 18.2% to 64% for adolescents who received MDFT across studies (vs 14.8%–44% in comparison conditions).[11,12,16] Another study examined substance use disorder (SUD) diagnosis at 12-month follow-up and found that 18% of adolescents who received MDFT no longer met criteria for a CUD (vs 15% in the comparison group), 38% of MDFT adolescents met criteria for cannabis dependence (vs 82% at baseline, 52% in the comparison condition), and 33% met criteria for cannabis abuse (vs 22% in the comparison group).[15] In 4 RCTs,[11,13–15] MDFT demonstrated greater or more rapid improvement in cannabis outcomes than the comparison conditions (ie, adolescent group therapy, multifamily education intervention, individual CBT, individual psychotherapy, peer group therapy), with small-medium to large effect sizes observed across studies.

Brief strategic family therapy

BSFT posits that reducing maladaptive interactions and increasing the family's use of more adaptive interactional patterns will reduce an adolescent's symptoms, including substance use.[17] In an RCT comparing BSFT to an adolescent-only group treatment,[18] a significant decrease in cannabis use was found for BSFT (41% no longer using at termination) compared with control (13%). Robbins and colleagues (2011)[19] compared BSFT with usual care in community-based adolescent outpatient drug abuse programs (where two-thirds of youth met criteria for CUD at baseline) and found no differences between the 2 conditions in substance use. A long-term follow-up of this study revealed no differences in cannabis or other substance use between treatments 3 to 7 years later.[20]

Multisystemic therapy

Multisystemic therapy (MST) leverages protective factors and targets risk factors across multiple levels of a youth's ecology to reduce substance use.[21] In an RCT comparing MST

with usual community services, juvenile offenders reported a significant reduction in self-reported cannabis and alcohol use at posttreatment, but this reduction was not maintained at the 6-month follow-up and no significant between-group treatment effects were found.[22] A 4-year follow-up of this RCT revealed no significant change in self-reported substance use; however, those who had been in the MST condition had significantly higher rates of cannabis abstinence (55%) than those in the usual community services condition (28%).[23] In another RCT evaluating (1) MST, (2) MST + contingency management (CM), (3) family court usual services, and (4) drug court usual services, cannabis use significantly decreased from pretreatment to 4 month and this decrease persisted at 12 months across treatments, with juvenile offenders in the 2 MST conditions reporting less cannabis use (3.7 and 6.8 days over the past 90 days) than those in the family court usual services condition (13.4 days).[24] In addition, juvenile offenders in the MST (28%) and MST + CM (18%) conditions had a significantly lower percent of positive cannabis drug screens than in the drug court usual services (69%) between pretreatment to 4 months and 4 months to 12 months (MST: 7%, MST + CM: 17%, usual services: 45%). Overall, adolescents receiving MST with and without CM reported less cannabis use and had greater rates of cannabis abstinence than the usual community services conditions.

Functional family therapy

Functional family therapy (FFT) concentrates on reducing substance use by identifying and modifying maladaptive family patterns related to adolescent substance use and integrating cognitive behavioral techniques.[25] Only 1 RCT on FFT examining cannabis-specific outcomes was identified. Findings from this RCT, which compared individual CBT, FFT, combined individual CBT + FFT, and a psychoeducational group intervention, revealed a significant decline in days using cannabis over time for the FFT (55% to 25% of days over the past 90 days) and combined conditions at 4-month follow-up (57% to 38%).[26] This reduction was maintained at the 7-month follow-up for the combined condition (36% of days) but not in the FFT condition (40%). A significant change from heavy to minimal use (ie, reported use <10% of days) was also observed in the FFT and combined group from pretreatment to 4-month follow-up and from pretreatment to 7-month follow-up.

Individual-Focused Psychotherapies

Several individual-focused psychotherapies (vs family/environment focused) have been studied, including cognitive behavioral therapy (CBT), motivational enhancement therapy (MET), and CM. These models–specifically individual and group-delivered CBT and MET/CBT–were deemed well-established treatments for adolescent SUDs in a prior review, with multicomponent packages involving CM (eg, MET/CBT + CM) identified as probably efficacious pending further investigation.[8] RCTs examining individual-focused psychotherapies for adolescents with cannabis use are described in later discussion.

Individual cognitive behavioral therapy

CBT is a structured approach that includes exploring an adolescents' substance use patterns and applying skills (eg, cognitive restructuring, refusal skills, negative mood regulation) to reduce substance use.[27] Three RCTs[11,16,28] found that adolescents receiving individual CBT demonstrated significant reductions in cannabis use at posttreatment, 6-month, and

12-month follow-ups, and 26% of adolescents in 1 study had negative urine drug screens (UDS) for cannabis at follow-up.[16] However, in another RCT, adolescents receiving CBT did not show a significant decrease in number of days using cannabis over time.[26] Although a significant change from heavy to minimal use (ie, reported use <10% of days) from pretreatment to 4 months was found for the individual CBT condition, this change was not maintained at 7-month follow-up but was maintained for the FFT and FFT + CBT conditions. Across all 4 RCTs reviewed, CBT was found to be similarly efficacious to the comparison treatments, which were often other evidence-based treatments (eg, MDFT, FFT).

Motivational enhancement therapy/cognitive behavioral therapy

MET/CBT combines CBT and MET, which applies motivational interviewing skills to resolve adolescents' ambivalence and increase their motivation to reduce substance use while also conducting a functional analysis of their substance use behavior.[29,30] Several RCTs have examined MET/CBT using varying numbers of sessions and formats (ie, group, individual). MET/CBT5 (2 individual MET sessions plus 3 group CBT sessions) has demonstrated an increase in days of abstinence from cannabis and other substance use over 12 months, resulted in 23% to 27% of adolescents in "recovery" (ie, no past month substance use and living in the community) at 12 months in 2 trials, and performed similarly to other treatments (MDFT, MET/CBT12, MET/ CBT12 + family components, adolescent community reinforcement approach [A-CRA]).[12] One RCT found that 44% of adolescents receiving MET/CBT7 (ie, MET/CBT5 plus 2 family sessions) were in "recovery" from all substances at 12 months.[31] MET/CBT12 extends MET/CBT5 with 7 additional group CBT sessions. In 2 RCTs,[12,32] MET/CBT12 demonstrated a significant reduction in cannabis use frequency during treatment and showed increased abstinence days over 12 months, with 17% of adolescents in "recovery" at 12 months in 1 study.[12]

Adolescent community reinforcement approach

A-CRA focuses on increasing an adolescent's engagement in the community through engaging with family, peers, school, work, and extracurricular activities that are incompatible with substance use and support recovery.[12,33] In 1 RCT, A-CRA showed an increase in abstinence days over 12 months and 34% of adolescents who received A-CRA were in "recovery" (ie, no past month cannabis or other substance use problems and living in the community) at 12 months.[12] In 2 RCTs comparing the effectiveness of assertive continuing care (ie, A-CRA plus case management) to usual continuing care, both studies found that adolescents in the assertive continuing care group were more likely to be abstinent from cannabis (52% vs 31% at 3 months; 41% vs 26% at 9 months).[33,34]

Contingency management

CM has been studied in several RCTs, often as an adjunct to other treatments. CM implementation varies, including on level of caregiver involvements. Two RCTs examined a point-and-level system version of CM, whereby youth could select rewards from a menu in response to negative urine screens; rewards included both natural incentives provided by the caregiver (eg, access to cell phone) and therapist-delivered payments to purchase prizes (up to $100–$150 per youth). Adolescents in the CM condition demonstrated a significant decrease in positive UDS at follow-up assessment,[35,36] although this finding did not persist

at 12-month follow-up in 1 RCT.[36] In a comparison of this CM component with family engagement strategies with usual drug court substance abuse treatment services, adolescents in the CM condition demonstrated a larger decrease in cannabis use, with the odds of a positive cannabis drug screen result increasing 94% for usual treatment and decreasing 18% for CM when comparing months 7 to 9 with months 1 to 3.[35]

In a voucher-based CM model, adolescents can earn incentives for negative UDS using an escalating schedule with vouchers increasing in amount with each consecutive negative drug screen. In 1 study, MST enhanced with voucher-based CM yielded reductions in cannabis use from pretreatment to 4- and 12-month follow-ups, with MST and MST + CM having a significantly lower percent of positive UDS between pretreatment to 4 months (18% MST + CM, 28% MST) and 4 months to 12 months (17% MST + CM, 7% MST) compared with usual community services (69% and 45%).[24] Two RCTs evaluated a clinic-delivered abstinence-based CM component that also entailed a caregiver-delivered home-based CM component, which involved developing a substance monitoring contract (SMC) wherein positive and negative consequences were implemented for substance abstinence and use.[32,37] In both studies, MET/CBT + abstinence-based CM/SMC showed greater continuous cannabis abstinence during treatment than the other treatments (eg, MET/CBT, MET/CBT + attendance-based CM). Adolescents in an MET/CBT + abstinence-based CM/SMC + family management group had greater mean weeks of cannabis abstinence (7.6 vs 5.1) and were more likely to achieve 8 or more weeks (53% vs 30%) and 10 or more weeks of continuous abstinence (50% vs 18%) compared with adolescents in an MET/CBT + attendance-based CM treatment.[37] MET/CBT + CM/SMC with or without a parent training curriculum had a larger proportion of adolescents achieve 2+ and 4+ weeks of abstinence compared with MET/CBT without CM.[32] Importantly, both studies also found that improvements observed during treatment did not persist at follow-up.

In the Fishbowl CM method[38] youth earn prize draws per an escalating schedule based on evidence of target behaviors (eg, negative UDS). Although no differences in cannabis abstinence rates were observed between treatments in an RCT evaluating (1) MET/CBT + abstinence-based CM/SMC + weekly behavioral parent training and (2) MET/CBT + attendance-based incentives, the abstinence-based condition had a significantly lower mean percentage of cannabis use days than the attendance-based condition at 36-week follow-up (27% vs 37%).[39] Another RCT compared CM + standard community treatment with a control group (ie, standard community treatment plus 2 prize draws for each drug screen submission independent of result) and did not find significant differences between groups in percent of negative UDS submitted (57% vs 42%) and sustained negative UDS (5.3 vs 5.1).[40]

Overall, CM seems to enhance cannabis use treatment outcomes, particularly when added to an evidence-based intervention and tied to cannabis use, but several studies show limited maintenance of effects once incentives are discontinued.[32,36,37]

Integrated Psychotherapies

Adolescents with SUDs frequently experience co-occurring psychiatric disorders.[41,42] Emerging evidence supports the safety and efficacy of integrated treatments designed to

address both substance use and psychiatric disorders. Notably, several of the family-based therapies reviewed earlier have shown effects on externalizing problems in addition to cannabis and other substance use.[13,14,16,20]

Risk Reduction through Family Therapy (RRFT) is an integrative, ecologically informed, exposure-based treatment that addresses co-occurring trauma-related symptoms and risk behaviors, including substance use.[43] In an RCT comparing RRFT with treatment as usual (TAU) in adolescents with substance use and posttraumatic stress disorder (PTSD) symptoms, both conditions showed improved PTSD symptoms.[44] The RRFT group showed greater reductions than TAU in any cannabis use from baseline to 6 (−54% vs −21%), 12 (−71% vs −34%), and 18 months (−67% vs −1%). For number of cannabis use days, greater reductions were observed in the RRFT group from baseline (−4.4 days at 12 months and 18 months) compared with the TAU group (−0.7 days at 12 months, +2.1 days at 18 months).

Esposito-Smythers and colleagues (2011)[45] examined a family-based integrated CBT intervention (I-CBT) for adolescents with co-occurring SUD and suicidality compared with enhanced treatment-as-usual. The I-CBT condition showed a greater reduction in cannabis use days, less cannabis problems over time, and lower rates of overall SUDs (27% vs 77%) at the 18-month follow-up than the comparison group. Another RCT explored the effectiveness of home-based I-CBT relative to enhanced treatment-as-usual on substance use and psychiatric symptoms, but study findings were limited due to low power to detect effects.[46]

PHARMACOTHERAPIES FOR CANNABIS USE DISORDER IN ADOLESCENTS

To date, no medication has approval from the Food and Drug Administration for the treatment of CUD. Two drugs have been investigated in adolescents: *N*-acetylcysteine (NAC) and topiramate. NAC is an antioxidant derived from L-cysteine that may help youth quit using cannabis when combined with other therapeutic interventions. Gray and colleagues[47] conducted an open-label trial demonstrating NAC 1200 mg twice a day was safe and tolerable among youth (aged 18–21 years) with CUD. A subsequent RCT of NAC (1200 mg twice daily) combined with CM and brief weekly cessation counseling was conducted in treatment-seeking youth (aged 15–21 years) with cannabis dependence.[48] Among youth who received NAC, 40.9% of urine cannabinoid test results over the treatment period were negative compared with 27.7% of the placebo group (odds ratio [OR], 2.4; 95% confidence interval [CI], 1.1–5.2), with an estimated number needed to treat of 7.3. By 4-week posttreatment follow-up, negative urine tests decreased to 19.0% for the NAC group and 10.3% for the placebo group (OR, 2.4; 95% CI, 0.8–7.5). End of treatment abstinence favored NAC, although differences were not statistically significant (OR, 2.3; 95% CI, 1.0–5.4). A second RCT of NAC in treatment-seeking adults with CUD found no difference in negative UDS between treatment groups.[49] NAC is available as tablets or capsules and an oral solution. Anecdotally, in settings in which pill forms are not available (ie, inpatient hospitalization), most adolescents are not compliant with the liquid form due to taste intolerability.

Topiramate is a carbonic anhydrase inhibitor that results in potentiation of γ-aminobutyric acid (GABA) signaling and inhibition of glutamate and voltage-gated sodium and calcium

channels.[50] Although primarily used for seizure disorders, migraines, and other chronic pain, clinical trials of topiramate have demonstrated reductions in alcohol, cocaine, and nicotine use in adults.[51–55] Miranda and colleagues[56] conducted a randomized placebo-controlled pilot study of topiramate combined with MET in individuals (aged 15–24 years) who were treatment-seeking heavy cannabis users (cannabis use at least twice weekly and 1 or more symptoms of CUD). Topiramate was titrated over 4 weeks and continued at 200 mg daily for 2 weeks. Although youth in the topiramate group reported greater reductions in grams of cannabis smoked per day, there were no differences in abstinence rates. Furthermore, only 48% of the topiramate group completed the study, compared with 77% of the placebo group, with adverse drug events being the most common reason for discontinuation. Secondary analysis found that memory difficulties were a predominant predictor of dropout in the topiramate group, in addition to other common cognitive side effects of topiramate (slow thinking, word finding difficulties, confusion).[57] Interestingly, youth with greater cannabis problems were less likely to drop out of the topiramate group. These findings suggest further investigation may be warranted for the targeted use of topiramate in heavy cannabis-using youth who are also experiencing impairing cannabis-related problems, although the side effect burden may limit topiramate's utility.

Numerous other drugs have been investigated for the treatment of CUD and/or cannabis withdrawal in adults.[6,7] First, 2 medications have been associated with a reduction in cannabis use: quetiapine and nabilone, a Schedule II synthetic tetrahydrocannabinol (THC) derivative. A recent RCT of quetiapine 300 mg daily versus placebo found quetiapine was associated with transition of heavy cannabis use (5–7 d/wk) to moderate use (2–4 d/wk).[58] However, at a dose of 200 mg/d, quetiapine was previously shown to increase cannabis craving and self-administration during relapse.[59] Second, cannabinoid agents may attenuate cannabis craving and withdrawal. Nabilone 8 mg/d was associated with reductions in amount of cannabis used and attenuation of cannabis withdrawal.[60] Other cannabinoid agents, including dronabinol (40–80 mg/d),[6,61] a THC derivative, and nabiximols,[62] a *Cannabis sativa* extract that contains both THC and CBD, have been shown to attenuate cannabis craving and withdrawal, respectively. Third, mirtazapine, a noradrenergic antidepressant, was shown to improve sleep, a common reason that individuals relapse to cannabis use, and food intake during abstinence in a human laboratory trial (30 mg/d).[63] Finally, multiple medications including noradrenergic agents atomoxetine, bupropion, and venlafaxine and GABAergic agents depakote and baclofen were poorly tolerated, resulting in high study attrition.[6,7] None of these agents have yet been studied in adolescent samples.

DISCUSSION

There are several evidence-supported treatment options available for youth with CUDs. These programs vary in their focus, intensity, and availability in the community, but they share an emphasis on addressing common maintaining factors for cannabis use. Many of the trials reviewed here were conducted before dramatic changes in the national landscape around cannabis use (eg, state-level legalization, proliferation of more potent cannabis products). THC concentrations in herbal cannabis and cannabis resin have increased steadily over the last 5 decades,[64] and many of the solutions, waxes, and concentrates used in e-cigarettes contain much higher THC concentrations (up to 80%) than dried cannabis

leaves.[65] The use of vaporizers has made it easier for youth to use cannabis discretely in public spaces including schools.[66] Moreover, cannabis is increasingly viewed as safe and acceptable among adolescents.[67] Higher THC concentrations, coupled with greater ease of use and more permissive attitudes about cannabis use, may contribute to increased cannabis dependence and greater need for accessible, effective treatments.[68] Established interventions should continue to be tested for their efficacy to determine what adaptations may be needed in the current context. Interventions also should address key barriers to care, such as behavioral health workforce shortages.[69] New digital platforms that deliver evidence-based treatment components (eg, CBT, CM, behavior monitoring) to youth may be especially helpful if shown to facilitate treatment progress while also reducing clinician burden.[70] Given the potential for technology to improve the accessibility and effectiveness of interventions, more research in adolescent samples is sorely needed.

There is need for additional research into treatments designed specifically to address cannabis use, because few studies focused specifically on reducing cannabis use or CUD remission.[12,15,16,32,37,40] Although many risk and protective factors contribute to substance use broadly, directly addressing mechanisms uniquely associated with CUD may yield better effects. In addition, although existing treatments often produce improvements during treatment, there was frequently poor sustainment of effects, and not all adolescents responded to treatment. There is a lack of long-term follow-ups across studies, with most follow-up assessments concluding at or before 1 year. Considered together, these findings signal a need for further research into tailored interventions designed specifically to yield clinically meaningful, durable reductions in cannabis use in adolescents.

Clinical leaders and researchers should also consider implementation factors that may impact outcomes when selecting and testing CUD treatments. These considerations include costs and cost-effectiveness of delivering the treatment, the time and resources needed to achieve high treatment fidelity (eg, workshops, ongoing supervision or consultation, treatment manual), organizational barriers (eg, organizational culture, leadership), and external policies and regulations.[71] For example, Henggelerand colleagues (1999)[22] cited low treatment fidelity as a potential reason for smaller MST effects in 1 study. Such findings underscore the importance of addressing provider-, agency-, and system-level factors that can influence treatment outcomes so that interventions can achieve optimal effects. Where cost-effectiveness was examined in the RCTs reviewed here, MET/CBT was found to be the most cost-effective intervention option, which may increase the likelihood that the model will be adopted broadly.[12,31] Nearly all reviewed studies were conducted in outpatient settings, but youth with CUD may benefit from participating in treatments in other contexts like schools, primary care, and juvenile justice. The unique implementation challenges of each setting should be addressed either through adaptations to existing treatment models or through development of new interventions designed specifically for “nontraditional” settings.

Few pharmacotherapies have been tested for the treatment of CUD in adolescents, and fewer still have demonstrated efficacy. Although data on NAC are encouraging, more research is needed to determine for whom and under what conditions these therapies are likely to be most helpful in addressing CUD symptoms in youth. Several studies in adults showed

negative effects of medications for cannabis use. Although it is common for research on pediatric psychopharmacology to lag behind adult studies (due to safety concerns, and so on), it is notable that for NAC, treatment effects were observed in adolescents but not in adults. It may be appropriate in some cases to develop and study medications specifically meant for youth with CUD even when positive effects on cannabis use or CUD symptoms are not observed in adults. If found to be safe and effective, such medications could have enormous impact on population health and well-being by curtailing the harms and costs associated with addiction early in development.

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REFERENCES

1. MTF MtF. 1975-2021 data for in-school Surveys of 8th, 10th, and 12th Grade students. University of Michigan. 2021. http://monitoringthefuture.org/data/21data.htm. [Accessed 15 January 2022].
2. Quality CfBHSa. National survey on drug Use and health, 2019 and Quarters 1 and 4, 2020. SAMHSA. https://www.samhsa.gov/data/sites/default/files/reports/rpt35323/NSDUHDetailedTabs2020/NSDUHDetailedTabs2020/NSDUHDetTabsSect5pe2020.htm. [Accessed 15 January 2022].
3. Silins E, Horwood LJ, Patton GC, et al. Young adult sequelae of adolescent cannabis use: an integrative analysis. The Lancet Psychiatry 2014;1(4):286–93. [PubMed: 26360862]
4. Kosty DB, Seeley JR, Farmer RF, et al. Trajectories of cannabis use disorder: risk factors, clinical characteristics and outcomes. Addiction 2017;112(2):279–87. [PubMed: 27515021]
5. Oshri A, Rogosch FA, Burnette ML, et al. Developmental pathways to adolescent cannabis abuse and dependence: Child maltreatment, emerging personality, and internalizing versus externalizing psychopathology. Psychol Addict Behaviors 2011;25(4):634–44.
6. Brezing CA, Levin FR. The current state of Pharmacological treatments for cannabis Use disorder and withdrawal. Neuropsychopharmacology 2018;43(1):173–94. [PubMed: 28875989]
7. Kondo KK, Morasco BJ, Nugent SM, et al. Pharmacotherapy for the treatment of cannabis Use disorder. Ann Intern Med 2020;172(6):398–412. [PubMed: 32120384]
8. Hogue A, Henderson CE, Becker SJ, et al. Evidence Base on outpatient behavioral treatments for adolescent substance Use, 2014–2017: outcomes, treatment delivery, and promising Horizons. J Clin Child Adolesc Psychol 2018;47(4):499–526. [PubMed: 29893607]
9. Tanner-Smith EE, Wilson SJ, Lipsey MW. The comparative effectiveness of outpatient treatment for adolescent substance abuse: a meta-analysis. J Substance Abuse Treat 2013;44(2):145–58.
10. Liddle HA, Rodriguez RA, Dakof GA, et al. Multidimensional family therapy: a science-based treatment for adolescent drug abuse. Handbook Clin Fam Ther 2005;128–63.
11. Liddle HA, Dakof GA, Turner RM, et al. Treating adolescent drug abuse: a randomized trial comparing multidimensional family therapy and cognitive behavior therapy. Addiction 2008;103(10):1660–70. [PubMed: 18705691]
12. Dennis M, Godley SH, Diamond G, et al. The Cannabis Youth Treatment (CYT) Study: main findings from two randomized trials. J Subst Abuse Treat 2004;27(3): 197–213. [PubMed: 15501373]
13. Liddle HA, Dakof GA, Parker K, et al. Multidimensional family therapy for adolescent drug abuse: results of a randomized clinical trial. Am J Drug Alcohol Abuse 2001;27(4):651–88. [PubMed: 11727882]
14. Liddle HA, Rowe CL, Dakof GA, et al. Early intervention for adolescent substance abuse: pretreatment to posttreatment outcomes of a randomized clinical trial comparing multidimensional

family therapy and peer group treatment. J Psychoactive Drugs 2004;36(1):49–63. [PubMed: 15152709]

15. Rigter H, Henderson CE, Pelc I, et al. Multidimensional family therapy lowers the rate of cannabis dependence in adolescents: a randomised controlled trial in Western European outpatient settings. Drug Alcohol Depend 2013;130(1–3):85–93. [PubMed: 23140805]
16. Hendriks V, van der Schee E, Blanken P. Treatment of adolescents with a cannabis use disorder: main findings of a randomized controlled trial comparing multidimensional family therapy and cognitive behavioral therapy in The Netherlands. Drug Alcohol Depend 2011;119(1–2):64–71. [PubMed: 21684088]
17. Szapocznik J, Kurtines WM. Breakthroughs in family therapy with drug abusing and problem youth. Breakthroughs in family therapy with drug abusing and problem youth. New York: Springer Publishing Company; 1989. xiii, 191.
18. Santisteban DA, Coatsworth JD, Perez-Vidal A, et al. Efficacy of brief strategic family therapy in modifying Hispanic adolescent behavior problems and substance use. J Fam Psychol 2003;17(1):121–33. [PubMed: 12666468]
19. Robbins MS, Feaster DJ, Horigian VE, et al. Brief strategic family therapy versus treatment as usual: results of a multisite randomized trial for substance using adolescents. J Consult Clin Psychol 2011;79(6):713–27. [PubMed: 21967492]
20. Horigian VE, Feaster DJ, Robbins MS, et al. A cross-sectional assessment of the long term effects of brief strategic family therapy for adolescent substance use. Am J Addict 2015;24(7):637–45. [PubMed: 26359441]
21. Henggeler SW, Schoenwald SK, Borduin CM, et al. Multisystemic therapy for antisocial behavior in children and adolescents. New York: Guilford Press; 2009.
22. Henggeler SW, Pickrel SG, Brondino MJ. Multisystemic treatment of substance-abusing and-dependent delinquents: outcomes, treatment fidelity, and transportability. Ment Health Serv Res 1999;1(3):171–84. [PubMed: 11258740]
23. Henggeler SW, Clingempeel WG, Brondino MJ, et al. Four-year follow-up of Multisystemic therapy with substance-abusing and substance-dependent juvenile offenders. J Am Acad Child Adolesc Psychiatry 2002;41(7):868–74. [PubMed: 12108813]
24. Henggeler SW, Halliday-Boykins CA, Cunningham PB, et al. Juvenile drug court: enhancing outcomes by integrating evidence-based treatments. J Consult Clin Psychol 2006;74(1):42–54. [PubMed: 16551142]
25. Alexander J, Parsons BV. Functional family therapy. Functional family therapy. Carmel, CA: Brooks/Cole Publishing Company; 1982. x, 188–x, 188.
26. Barrett H, Slesnick N, Brody JL, et al. Treatment outcomes for adolescent substance abuse at 4- and 7-month assessments. J Consulting Clin Psychol 2001;69(5):802–13.
27. Beck AT, Wright FW, Newman CF, et al. Cognitive therapy of substance abuse. New York: Guilford Press; 1993.
28. Azrin NH, Donahue B, Teichner GA, et al. A controlled evaluation and Description of individual-cognitive problem Solving and family-behavior therapies in Dually-Diagnosed Conduct-Disordered and substance-dependent youth. Article. J Child Adolesc Substance Abuse 2001;11(1):1.
29. Sampl S, Kadden R. Motivational enhancement therapy and cognitive behavioral therapy for adolescent cannabis users: 5 sessions, cannabis youth treatment (CYT) Series, vol. 1. Rockville, MD: Center for Substance Abuse Treatment, Substance Abuse and Mental Health Services Administration; 2001.
30. Webb C, Scudder M, Kaminer Y, et al. Motivational enhancement therapy and cognitive behavioral therapy Supplement: 7 sessions of cognitive behavioral therapy for adolescent cannabis users, cannabis youth treatment (CYT) Series, vol. 2. Center for Substance Abuse Treatment, Substance Abuse and Mental Health Services Administration; 2002.
31. Godley SH, Garner BR, Passetti LL, et al. Adolescent outpatient treatment and continuing care: main findings from a randomized clinical trial. Drug Alcohol Depend 2010;110(1–2):44–54. [PubMed: 20219293]

32. Stanger C, Ryan SR, Scherer EA, et al. Clinic- and home-based contingency management plus parent training for adolescent cannabis use disorders. J Am Acad Child Adolesc Psychiatry 2015;54(6):445–453 e2. [PubMed: 26004659]
33. Godley MD, Godley SH, Dennis ML, et al. The effect of assertive continuing care on continuing care linkage, adherence and abstinence following residential treatment for adolescents with substance use disorders. Addiction 2007;102(1):81–93. [PubMed: 17207126]
34. Godley MD, Godley SH, Dennis ML, et al. Preliminary outcomes from the assertive continuing care experiment for adolescents discharged from residential treatment. J Substance Abuse Treat 2002;23(1):21–32.
35. Henggeler SW, McCart MR, Cunningham PB, et al. Enhancing the effectiveness of juvenile drug courts by integrating evidence-based practices. J Consult Clin Psychol 2012;80(2):264–75. [PubMed: 22309470]
36. Letourneau EJ, McCart MR, Sheidow AJ, et al. First evaluation of a contingency management intervention addressing adolescent substance Use and Sexual risk behaviors: risk reduction therapy for adolescents. J Subst Abuse Treat 2017;72:56–65. [PubMed: 27629581]
37. Stanger C, Budney AJ, Kamon JL, et al. A randomized trial of contingency management for adolescent marijuana abuse and dependence. Drug Alcohol Depend 2009;105(3):240–7. [PubMed: 19717250]
38. Petry NM. A comprehensive guide to the application of contingency management procedures in clinical settings. Drug and Alcohol Dependence 2000;58(1):9–25. [PubMed: 10669051]
39. Stanger C, Scherer EA, Babbin SF, et al. Abstinence based incentives plus parent training for adolescent alcohol and other substance misuse. Psychol Addict Be-hav 2017;31(4):385–92.
40. Killeen TK, McRae-Clark AL, Waldrop AE, et al. Contingency management in community programs treating adolescent substance abuse: a feasibility study. J Child Adolesc Psychiatr Nurs 2012;25(1):33–41. [PubMed: 22299805]
41. Armstrong TD, Costello EJ. Community studies on adolescent substance use, abuse, or dependence and psychiatric comorbidity. J Consulting Clin Psychol 2002;70(6):1224–39.
42. Chan Y-F, Dennis ML, Funk RR. Prevalence and comorbidity of major internalizing and externalizing problems among adolescents and adults presenting to substance abuse treatment. J Substance Abuse Treat 2008;34(1):14–24.
43. Danielson CK, Adams ZA, Hanson R. Risk reduction through family therapy (RRFT): exposure-based treatment for co-occurring PTSD and substance use problems among adolescents. In: Vujanovic AA, Back SE, editors. Posttraumtic stress and substance Use disorders: a Comprehensive clinical Handbook. Routledge; 2019. p. 165–82.
44. Danielson CK, Adams Z, McCart MR, et al. Safety and efficacy of exposure-based risk reduction through family therapy for Co-occurring substance Use problems and Posttraumatic stress disorder symptoms among adolescents: a randomized clinical trial. JAMA Psychiatry 2020;77(6):574–86. [PubMed: 32022827]
45. Esposito-Smythers C, Spirito A, Kahler CW, et al. Treatment of co-occurring substance abuse and suicidality among adolescents: a randomized trial. J Consult Clin Psychol 2011;79(6):728–39. [PubMed: 22004303]
46. Wolff J, Esposito-Smythers C, Frazier E, et al. A randomized trial of an integrated cognitive behavioral treatment protocol for adolescents receiving home-based services for co-occurring disorders. J Subst Abuse Treat 2020;116:108055. [PubMed: 32741505]
47. Gray KM, Watson NL, Carpenter MJ, et al. N-acetylcysteine (NAC) in young marijuana users: an open-label pilot study. Am J Addict 2010;19(2):187–9. [PubMed: 20163391]
48. Gray KM, Carpenter MJ, Baker NL, et al. A double-blind randomized controlled trial of N-acetylcysteine in cannabis-dependent adolescents. Am J Psychiatry 2012;169(8):805–12. [PubMed: 22706327]
49. Gray KM, Sonne SC, McClure EA, et al. A randomized placebo-controlled trial of N-acetylcysteine for cannabis use disorder in adults. Drug and Alcohol Dependence 2017;177:249–57. [PubMed: 28623823]

50. Shank RP, Gardocki JF, Streeter AJ, et al. An overview of the preclinical aspects of topiramate: pharmacology, pharmacokinetics, and mechanism of action. Epilepsia 2000;41(S1):3–9. [PubMed: 10768292]
51. Johnson BA, Ait-Daoud N, Bowden CL, et al. Oral topiramate for treatment of alcohol dependence: a randomised controlled trial. Lancet 2003;361(9370):1677–85. [PubMed: 12767733]
52. Miranda R Jr, MacKillop J, Monti PM, et al. Effects of topiramate on urge to drink and the subjective effects of alcohol: a preliminary laboratory study. Alcohol Clin Exp Res 2008;32(3):489–97. [PubMed: 18215213]
53. Johnson BA, Ait-Daoud N, Wang XQ, et al. Topiramate for the treatment of cocaine addiction: a randomized clinical trial. JAMA psychiatry 2013;70(12):1338–46. [PubMed: 24132249]
54. Kranzler FIR, Covault J, Feinn R, et al. Topiramate treatment for heavy drinkers: moderation by a GRIK1 polymorphism. Am J Psychiatry 2014;171(4):445–52. [PubMed: 24525690]
55. Oncken C, Arias AJ, Feinn R, et al. Topiramate for smoking cessation: a randomized, placebo-controlled pilot study. Nicotine Tob Res 2014;16(3):288–96. [PubMed: 24057996]
56. Miranda R, Treloar H, Blanchard A, et al. Topiramate and motivational enhancement therapy for cannabis use among youth: a randomized placebo-controlled pilot study. Addict Biol 2017;22(3):779–90. [PubMed: 26752416]
57. Gray JC, Treloar Padovano H, Wemm SE, et al. Predictors of topiramate Tolerability in heavy cannabis-using adolescents and young adults: a secondary analysis of a randomized, double-blind, placebo-controlled trial. J Clin Psychopharmacol 2018;38(2):134–7. [PubMed: 29424802]
58. Mariani JJ, Pavlicova M, Jean Choi C, et al. Quetiapine treatment for cannabis use disorder. Drug and Alcohol Dependence 2021;218:108366. [PubMed: 33153828]
59. Cooper ZD, Foltin RW, Hart CL, et al. A human laboratory study investigating the effects of quetiapine on marijuana withdrawal and relapse in daily marijuana smokers. Addict Biol 2013;18(6):993–1002. [PubMed: 22741619]
60. Flaney M, Cooper ZD, Bedi G, et al. Nabilone decreases marijuana withdrawal and a laboratory measure of marijuana relapse. Neuropsychopharmacology 2013;38(8):1557–65. [PubMed: 23443718]
61. Levin FR, Mariani JJ, Brooks DJ, et al. Dronabinol for the treatment of cannabis dependence: a randomized, double-blind, placebo-controlled trial. Drug and Alcohol Dependence 2011;116(1–3):142–50. [PubMed: 21310551]
62. Allsop DJ, Copeland J, Lintzeris N, et al. Nabiximols as an agonist replacement therapy during cannabis withdrawal: a randomized clinical trial. JAMA psychiatry 2014;71(3):281–91. [PubMed: 24430917]
63. Flaney M, Hart CL, Vosburg SK, et al. Effects of baclofen and mirtazapine on a laboratory model of marijuana withdrawal and relapse. Psychopharmacology (Berl) 2010;211(2):233–44. [PubMed: 20521030]
64. Freeman TP, Craft S, Wilson J, et al. Changes in delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD) concentrations in cannabis over time: systematic review and meta-analysis. Addiction 2021;116(5):1000–10. 10.1111/add.15253. [PubMed: 33160291]
65. Meier MH, Docherty M, Leischow SJ, et al. Cannabis concentrate Use in adolescents. Pediatrics 2019;144(3):e20190338. [PubMed: 31451609]
66. Ramamurthi D, Chau C, Jackler RK. JUUL and other stealth vaporisers: hiding the habit from parents and teachers. Tob Control 2019;28(6):610.
67. Schulenberg JE, Patrick ME, Johnston LD, et al. Monitoring the Future national survey results on drug use, 1975–2020: Volume II, College students and adults ages 19–60. 2021. http://www.monitoringthefuture.org/pubs/monographs/mtf-vol2_2020.pdf. [Accessed 15 January 2022].
68. Freeman TP, Winstock AR. Examining the profile of high-potency cannabis and its association with severity of cannabis dependence. Psychol Med 2015;45(15):3181–9. [PubMed: 26213314]
69. U.S. Department of Health and Human Services HRaSA, National Center for Health Workforce Analysis. State-level Projections of supply and Demand for behavioral health Occupations: 2016–2030 2018.

70. Hammond AS, Sweeney MM, Chikosi TU, et al. Digital delivery of a contingency management intervention for substance use disorder: a feasibility study with DynamiCare Health. J Substance Abuse Treat 2021;126:108425. 10.1016/j.jsat.2021.108425.

71. Damschroder LJ, Aron DC, Keith RE, et al. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implementation Sci 2009;4(1):50.

KEY POINTS

- Individual and family-based psychotherapy and behavioral interventions, such as CBT, have the strongest evidence for treatment of adolescents with cannabis use disorder.
- *N*-acetylcysteine (NAC) has been shown to be effective in promoting abstinence during treatment.
- Although few medications for cannabis use disorder have been tested in adolescents, several promising candidates warrant further research.

CLINICS CARE POINTS

- Manualized psychotherapies, including MET/CBT and various family-based treatments, target internal and external maintaining factors of cannabis use and can be effective in addressing CUD symptoms in adolescents when delivered with fidelity.
- Many treatments directly address youth ambivalence and/or directly reinforce engagement in treatment activities, so patients do not need to be committed to reducing or abstaining from cannabis use to be referred to treatment.
- Pharmacotherapies should be considered alongside psychotherapies to help youth with CUD manage cravings.

Table 1

Evidence-based psychotherapy and pharmacotherapy treatments for adolescent cannabis use disorder

Individual-Focused Therapies	**Description**
A-CRA	An individual-focused intervention that aims to increase an adolescent's engagement in their community and activities that are incompatible with substance use to reinforce and support recovery. Consists of weekly sessions over 12–14 wk that include 10 adolescent, 2 caregiver, and 2 family sessions and case management
CBT	An individual-focused, structured approach that concentrates on identifying patterns of substance use and learning and applying skills and strategies to reduce use. Treatment typically entails 12–20 weekly sessions
CM	Behavioral intervention typically delivered as an adjunct component along with other evidence-based interventions (ie, MET/CBT) in which rewards are provided for positive behaviors (eg, abstinence, attendance). Delivery of CM with adolescents includes clinic-delivered and/or caregiver-delivered CM, and CM methods include the Fishbowl method, voucher method, or point-and-level system
MET/CBT	An individual-focused intervention that combines CBT and MET, which involves the use of motivational interviewing to resolve ambivalence and increase motivation to reduce substance use. Treatment ranges from 5 to 12 weekly sessions in individual and/or group formats
Family-Based Therapies	**Description**
BSFT	Family-based intervention that focuses on improving family functioning to reduce adolescent substance use and other problems. Consists of 12–16 family sessions with services delivered in the home, clinic, and other community settings
FFT	Family-based intervention that entails modifying maladaptive family patterns and cognitive behavioral techniques. Treatment includes around 12–14 weekly sessions that can be delivered in the clinic or home
Family-based I-CBT	Family-based, integrated intervention for co-occurring substance use disorder and suicidality. Treatment includes adolescent, caregiver, and family sessions. Session delivery and length vary depending on adolescent clinical presentation and insurance
MDFT	Family-based intervention that focuses on 4 treatment domains: adolescent, parent, family environment and relationships, and extrafamilial. Sessions are conducted 1 to 3 times per week over 3–6 mo and include adolescent, caregiver, and family sessions
MST	Family-based intervention in which individual, family, peers, school, and community factors are addressed to reduce adolescent substance use. Treatment is intensive with sessions delivered one to several times per week in home and community settings across 3–5 mo and therapists available 24/7 to families
RRFT	An integrative treatment that addresses co-occurring trauma-related symptoms and risk behaviors (eg, substance use, risky sexual behavior). Treatment includes 16–20 weekly individual sessions with caregiver and family sessions conducted as needed
Pharmacotherapies[a]	**Description**
NAC	A well-tolerated antioxidant derived from L-cysteine used in combination with other therapeutic interventions to reduce cravings and withdrawal symptoms

Abbreviations: A-CRA, adolescent community reinforcement approach; BSFT, brief strategic family therapy; CBT, cognitive behavioral therapy; CM, contingency management; CUD, cannabis use disorder; FDA, US Food and Drug Administration; FFT, functional family therapy; I-CBT, integrated CBT intervention; MDFT, multidimensional family therapy; MET/CBT, motivational enhancement therapy/cognitive behavioral therapy; MST, multisystemic therapy; NAC, N-acetylcysteine; RRFT, risk reduction through family therapy.

[a]There are currently no FDA-approved pharmacotherapies for CUD in adolescents.