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Impact of quitting smoking and smoking cessation treatment on substance use outcomes: An updated and narrative review

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Abstract

Background—Historically, smoking cessation was thought to negatively impact substance use outcomes among smokers who use other substances. We sought to synthesize recent reports on this association.

Methods—Google Scholar, PubMed, and Cinahl were searched for studies published from 2006 to March 29, 2016 that reported impact of smoking cessation treatment or quitting smoking on substance use or substance use disorder treatment outcomes in the general population and among those in substance abuse treatment. Studies were grouped by reported impact as follows: “positive” (i.e. improved), “null” (i.e. no change), or “negative” (i.e. worsened).

Results—Twenty-four studies were included. Eighteen reported the impact of quitting smoking and six reported the impact of smoking cessation treatment intervention, independent of quitting, on substance use outcomes. Eleven studies (46%) reported solely positive impact; four (17%) reported solely null impact; eight (33%) reported mixed positive and null impact by analysis (combined and subgroup, $n = 1$); substance ($n = 4$); length of follow-up ($n = 2$); and comparison group ($n = 1$). One study (4%) reported mixed negative and null impact by ethnic group. No studies reported increased substance use.

Conclusion—Smoking cessation does not appear to have a negative effect, and often has a positive effect on substance use outcomes. Smoking cessation advice should be offered, without hesitation, to smokers who report substance use and those in treatment for substance use disorder.

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Contributors

KM and DR designed the review. KM conducted the literature review. KM and JT selected and summarized articles for the review. KM wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of Interest

All three authors declare they have no conflicts of interest.

Keywords

smoking cessation; smoking cessation treatment; substance use; substance use disorder; substance use treatment

1. Introduction

Smoking rates are two to four times higher among adolescents and adults with substance use disorders (SUD) compared to the general population.^{1–3} Still, smoking cessation treatment is not included in most SUD treatment settings^{4,5} and there is a dearth of reporting on the impact of quitting smoking on substance use behaviors in non-treatment seeking populations. Smoking has had a steady, long-term relationship with both clinicians and patients in substance use and mental health treatment settings, making these settings less receptive to smoking cessation treatment and less supportive of quitting than providers in general medical facilities or the community.^{6,7} Historically, smoking was allowed and even encouraged in addiction treatment programs and in mental health units, the pervasive rationale being that tobacco was a lower treatment priority and/or a less harmful alternative to other substance use.^{5,8,9} Arguments proffered by treatment providers included if their patients quit tobacco they would relapse on other substances of abuse, their depression would recur and/or they would otherwise decompensate.¹⁰ Meanwhile, just below the surface, the tobacco industry was marketing cigarettes to persons with mental illness and providing tax-free cigarettes to treatment facilities¹¹ where cigarettes were provided to patients, facilitating smoking initiation, while hospitalized, for some formerly nonsmoking patients.^{12,13} Finally, many staff and clinicians in the fields of drug abuse treatment and mental health are smokers, which serves to both perpetuate the habit and stem implementation of smoking cessation programs and smoke free policies in these settings.^{14–17}

Many adults and adolescents attend 12-step fellowship meetings such as Alcoholics Anonymous or Narcotics Anonymous to achieve abstinence or as a form of relapse prevention upon completion of formal SUD treatment.^{18,19} The 12-step philosophy, which teaches that the first and primary responsibility is sobriety from alcohol, illegal drugs, and non-prescription medications,^{20–22} can further perpetuate continued smoking by recommending members focus and not make too many additional changes (i.e. quitting smoking).^{21–23} Meetings often allow or encourage smoking as a form of “fellowshipping” to enhance recovery, thereby helping to maintain smoking and nicotine dependence among individuals who report use of other substances.^{24,25}

Evidence is mounting that the harms of tobacco use far outweigh any perceived benefit in the context of substance use or SUD treatment. For example, adolescent substance users who smoke are more likely to continue smoking in adulthood²⁶ and far more deaths among adults reporting alcohol and drug use are due to smoking than to alcohol and all other drugs combined.²⁷ In 2004, a meta-analysis of smoking cessation intervention studies conducted among individuals in SUD treatment or recovery found that cessation interventions offered concurrently with addictions treatment were associated with a 25% increased likelihood of

long-term drug and alcohol abstinence.²⁸ Thus, fears associated with smoking cessation among people with SUD may be unwarranted.

Studies have increasingly addressed smoking cessation in the context of SUD treatment over the last decade. Strategies for promoting smoking cessation have included delivering cessation programs to individuals in SUD treatment and implementing and enforcing smoking bans in adult and adolescent treatment facilities.^{29–31} In 2010, two literature reviews summarized the evidence on the effects of smoking cessation in the context of SUD treatment: one among those in treatment for or in early remission from alcohol dependence³²; and one in addiction and mental health treatment settings.¹⁰ Both studies found improved rather than worsened substance use treatment outcomes related to smoking cessation intervention. In 2015, a systematic review of randomized controlled trials that included impact of smoking cessation treatment on substance use outcomes among those in early recovery from or in treatment for SUD reported either no impact on or improvement in substance use treatment outcomes.³³ With limited extant research, no reviews among adolescent populations were identified. One study (2007) conducted in adolescent residential substance use treatment programs assessed the relationship between program-level policies and client-level smoking, and showed increases in stringency of smoke-free policy were associated with decreases in smoking prevalence.³⁴ These findings suggest addressing tobacco use in the context of addiction treatment and recovery may afford patients multiple health benefits now and in the future.

Here, we provide an updated review and interpretation of the most current knowledge by reviewing reports from the last decade (January 2006 through March 2016) on the impact of formalized smoking cessation treatment or of quitting smoking/former smoker status on substance use outcomes. By synthesizing recent findings and including studies with adolescents, reports from epidemiological studies, and results from pilot studies and secondary analyses, we fill important gaps in the extant literature. Whereas reports from 2010³² and 2015³³ have addressed solely formal smoking cessation treatment interventions among those in treatment for or recovery from substance use (including alcohol) this report includes findings among non-SUD treatment seeking populations including reports published from 2015 through March, 2016 as well. This allows for a broader, more inclusive view of the overarching impact of smoking cessation and quitting smoking on substance use outcomes.

2. Methods

Articles published in print or online between January 1, 2006 and March 29, 2016 were identified through electronic searches of Google Scholar, PubMed, and Cinahl. Google Scholar was chosen for breadth and as a more novel search tool; PubMed as a standard search engine; and Cinahl for its inclusion of peer-reviewed nursing and nursing practice journals not easily identified elsewhere. Search criteria combined the terms “smoking” “cessation” “substance” “drug,” and “alcohol.” Study title, abstracts, and bodies were reviewed by KM and JT to determine study inclusion. Selection was restricted to English language studies that: (a) established temporality (i.e. cross sectional studies were excluded), (b) listed at least one outcome related to substance use, SUD, or SUD treatment, and (c)

identified quitting smoking (“former smoker status”) or a smoking cessation treatment intervention as an independent variable. To avoid duplicative reporting and in light of the similarity in conclusions drawn by the three reviews conducted over the past decade^{10,32,33} the reviews and the studies included within were omitted.

Titles of the first 100 citations in Google Scholar were scanned and 35 unique and potentially relevant citations were identified. Google Scholar has been found to have recall and precision comparable or superior to more traditional databases when the first 100 citations are considered (over 84,000 citations were identified in the instant search).³⁵ PubMed and Cinahl were then searched using the same search terms and resulted in 50 unique citations (35 and 15, respectively). No additional studies were identified through bibliographic searches. The 85 articles identified were read by JT and KM to ascertain if they met inclusion criteria and 24 studies were included in the review.

As the 24 selected studies showed considerable heterogeneity in terms of measurement of smoking cessation intervention or quit status, outcome variables, and analyses, it was not feasible to conduct a meta-analysis focused on effect size.³⁶ In accordance with the “principle of best evidence,”³⁷ we did not discard studies without the information necessary for formal quantification since they still provide valuable and relevant evidence. We then appraised each study for overall impact on substance use outcomes as positive, null, mixed, or negative. Within each study, impact was assessed for each reported substance use outcome. Overall impact was deemed “positive” if only improvements were reported on all substance-related outcomes assessed (e.g. increased length of time to relapse, decreased number of days using drugs). “Null” impact was assigned if no change in any substance use outcomes was reported. A “negative” impact was assigned if worse substance use outcomes were found (e.g. shorter term of abstinence). A “mixed” impact was assigned if there were differences in the direction of individual outcomes within a study.

3. Results

Twenty-four studies (25 study populations as one study [Lisha, et al., 2014] included two samples) reported the impact of quitting smoking (n = 18) or of smoking cessation treatment intervention, independent of quitting smoking, (n = 6) on substance use outcomes (Table 1). Fourteen studies were among SUD treatment samples (five among adolescents); two in household survey samples, one in a school-based survey sample (among adolescents); four among samples seeking smoking cessation treatment; and one each of high-needs population samples: HIV positive patients, homeless smokers, and smokers in mental health outpatient and inpatient (adolescent) treatment (Figure 1).

3.1 Positive Findings

Eleven of 24 studies (46%) reported positive findings regarding the impact of quitting smoking (n=9)³⁸⁻⁴⁶ and of smoking cessation treatment interventions (n=2)^{29,47} on substance use outcomes. Of these, five were among patients in SUD treatment-⁴²⁻⁴⁶ of which two targeted adolescents,^{43,44} four were among participants delivered smoking cessation interventions,^{29,38,41,47} of which one study targeted adolescents during psychiatric hospitalization,²⁹ and two were among adult general population samples.^{39,40} (Figure 2)

Of the 11 studies with positive findings, eight (73%) found improved alcohol-specific outcomes of fewer drinks per day,³⁸ fewer drinks per week,⁴⁷ decreased likelihood of relapse,⁴³ increased abstinence for 12 months^{40,42} and for 30 days,⁴⁵ increased likelihood of “alcohol-abstainer” trajectory membership,⁴⁴ and decreased likelihood of being diagnosed with alcohol use disorder.³⁹ Five studies (45%) reported drug-specific outcomes or general “drug” outcomes that excluded alcohol; one found increased likelihood of past year abstinence from drugs,⁴² one found decreased likelihood of being diagnosed with a drug use disorder,³⁹ two found improved marijuana-specific outcomes of reduced percent of using days⁴⁷ and decreased likelihood of relapse and longer time to relapse⁴³ and one found reduced stimulant craving.⁴⁶ Finally, among studies that reported improved combined (e.g. alcohol and other drugs) substance use outcomes (n = 4; 36%), findings of decreased likelihood of SUD diagnosis,⁴¹ past-year remission,⁴² decreased escalation of use post-treatment,²⁹ and increased likelihood of past 30-day abstinence and lower addiction severity index (ASI) scores⁴⁵ were found.

3.2 Null Findings

Four studies (17%) reported an overall null impact on substance use outcomes. Study designs varied (pro- and retrospective cohort studies and RCT) as did outcomes: drinking and drug use behavior, treatment enrollment and completion, study attendance and adherence. Sample populations also varied widely: general population adults, and adolescents, adults in SUD treatment, adolescents in SUD treatment., and adults seeking smoking cessation treatment. The studies investigated quitting smoking as well as effects of different smoking cessation interventions (implementation of a smoking ban, contingent vs. non-contingent vouchers crossed with motivational interviewing or brief advice, contingency management vs. behavioral support).

One study reported no change in the alcohol-specific outcomes of binge- and overall drinking frequency.⁴⁸ Another found no difference in SUD treatment enrollment or completion.³⁰ The third study showed no difference in reported number of heavy drinking days, number of drug use days, and instances of reported relapse.⁴⁹ The fourth study found no differences in study attendance and adherence and no difference in reported and verified substance use abstinence.⁵⁰ Given the sample sizes of 45 (Alessi & Petry, 2014), 54 (Myers & Prochaska, 2004), and 184 (Rohsenow, et al., 2015), it is possible (but not likely) that the null findings were due to small sample sizes and thus low power to detect an effect.

3.3 Mixed Findings

Nine studies (38%) reported mixed findings: eight studies (89%) reported mixed positive and null impact by analysis (combined and subgroup, n = 1)⁵¹; type of substance (n = 4)^{11,52–54}; length of follow-up (n = 2)^{55,56}; and comparison group (n = 1).⁵⁷ Six studies^{11,51–54,57} addressed quitting smoking and three were smoking cessation treatment interventions.^{55,56,58} Five were among SUD treatment seeking samples,^{51,53,54,56,58} three were among adolescents,^{54,56,57} two in general population samples,^{55,57} one among a smoking-cessation treatment-seeking (but not SUD treatment seeking) sample, and three among high-needs populations (an HIV clinic sample (of HIV+ patients), a homeless smokers sample, and a sample of smokers in mental health outpatient treatment). While all

nine reported at least one substance use outcome that was not impacted, eight reported at least one substance use outcome that was positively impacted^{11,51–57} and only one reported a negatively impacted substance use outcome.⁵⁸

Considering substance use outcomes, six reported alcohol-specific outcomes (either alone or in combination with other substance use outcomes), three of which had findings both positive and null for the same alcohol-specific outcomes, two had findings of positive impact, and one reported no impact. Both positive and no impact was reported regarding number of drinks,⁵¹ prevalence of binge drinking,⁵⁵ and odds of reporting alcohol (or illicit drug) dependence.⁵⁷ The direction of these findings depended on the group analyzed, length of follow-up, and comparison group, in that order. Two studies reported impacts resulting solely in positive alcohol-related outcomes of decreased use¹¹ and decreased number of drinks and drinking days as well as lower odds of heavy drinking.⁵² These same studies, however, found no impact on drug use or number of days using drugs, respectively. One study reported no impact on odds of reporting alcohol abstinence and positive impact/increased odds of reporting abstinence from drugs.⁵⁴

Only one study did not separate alcohol from other drug outcomes and instead reported on “substance use” outcomes.⁵⁶ Here, the positive impact of decreased number of substance use days at 3 months follow-up was not found at 6 months (no impact). There was also a single study that reported higher average percent of abstinent weeks among cocaine dependent (positive impact), but not methamphetamine dependent (no impact), individuals.⁵³ Finally, one study reported decreased alcohol abstinence (negative impact) for Caucasian participants who received smoking cessation treatment concurrent with alcohol use treatment compared to those who received smoking cessation treatment 6 months after alcohol use treatment, the same was not true for African American participants (no impact).⁵⁸

4. Discussion

We reviewed the published evidence from the last decade reporting the impact of quitting smoking and/or smoking cessation treatment intervention on substance use outcomes. Across 24 studies, both quitting smoking and smoking cessation treatment intervention had either a positive impact or no impact on substance use outcomes. Positive impact was reported for a range of alcohol use outcomes (e.g., number of drinks, alcohol abstinence, and alcohol use disorder diagnosis) as well as drug use outcomes (e.g., using days, relapse, remission, SUD diagnosis). Importantly, for those in SUD treatment, neither forced quit attempt (smoke-free policy) nor smoking cessation treatment intervention type (e.g. brief advice to quit, motivational interviewing, and offering vs. not offering nicotine replacement) affected treatment outcomes. Results support the broad delivery of smoking cessation intervention in accordance with clinical practice guidelines⁵⁹ (offering advice to quit, using medications, and enrollment in smoking cessation counseling) to any individual that reports alcohol or other drug use (whether recreational, disordered, or otherwise). Further, if patients are able to quit smoking, it may make it easier for them to change other substance use for a variety of reasons.

Only one study reported a negative impact of smoking cessation on a substance use outcome.⁵⁸ A secondary analysis of data from a 2004 study by Joseph and colleagues⁶⁰ found smoking cessation treatment delayed by 6 months was associated with longer alcohol abstinence than smoking cessation treatment implemented concurrently with alcohol treatment, but only for Caucasian (not African-American) participants.⁵⁸ Results cannot be generalized to the general population of smokers with alcohol use disorders.

It is evident that neither quitting smoking nor smoking cessation treatment-intervention results in worsening substance use outcomes (e.g. increased rates of relapse to alcohol or other drugs), even absent direct comparisons. For example, one study found participants who quit smoking reported less craving for stimulants (elimination of craving coupling)⁴⁶ while two others (an RCT and analysis of a large prospective cohort) found those who quit smoking were less likely to have incident SUD diagnoses.^{33, 35} Further, if patients are able to quit smoking, it may make it easier for them to change other substance use.

Some limitations of this review bear noting. First, review was restricted to studies published in English. Second, findings in reviewed studies were limited to those the authors chose to publish. Third, meta-analysis was not conducted due to heterogeneity of outcomes, measurements, and sample characteristics. Fourth, studies reporting the impact of quitting smoking, or of “former smoker” status did not differentiate between former smokers who quit on their own and those who may have participated in a formal smoking cessation treatment intervention.

5. Conclusions

When considered in conjunction with the known, undisputed harms of smoking,⁶¹ this review provides support for policies encouraging quitting among smokers in SUD treatment settings and the offering of formal smoking cessation treatment or advice to quit, including cessation aids, to smokers who report use of other substances, whether or not they are seeking SUD treatment. Additionally, since provider barriers to offering smoking cessation treatment options and strategies to patients is often cited,^{62,63} this review also provides support for broad delivery of clinician training in smoking cessation treatment and support. The integration of such practices and policies will improve the health and wellbeing not only of substance using populations, but also of their families and friends- now and for future generations. Failing to do so is tantamount to increased harm.

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Highlights

- Quitting smoking/smoking cessation has a positive effect on substance use outcomes
- Improvement in a range of alcohol and drug use outcomes was reported
- Smoke-free policy nor cessation intervention worsened SUD treatment outcomes
- Smoking cessation aid should be offered to any individual who reports substance use
- Not offering smoking cessation in SUD treatment is tantamount to increased harm

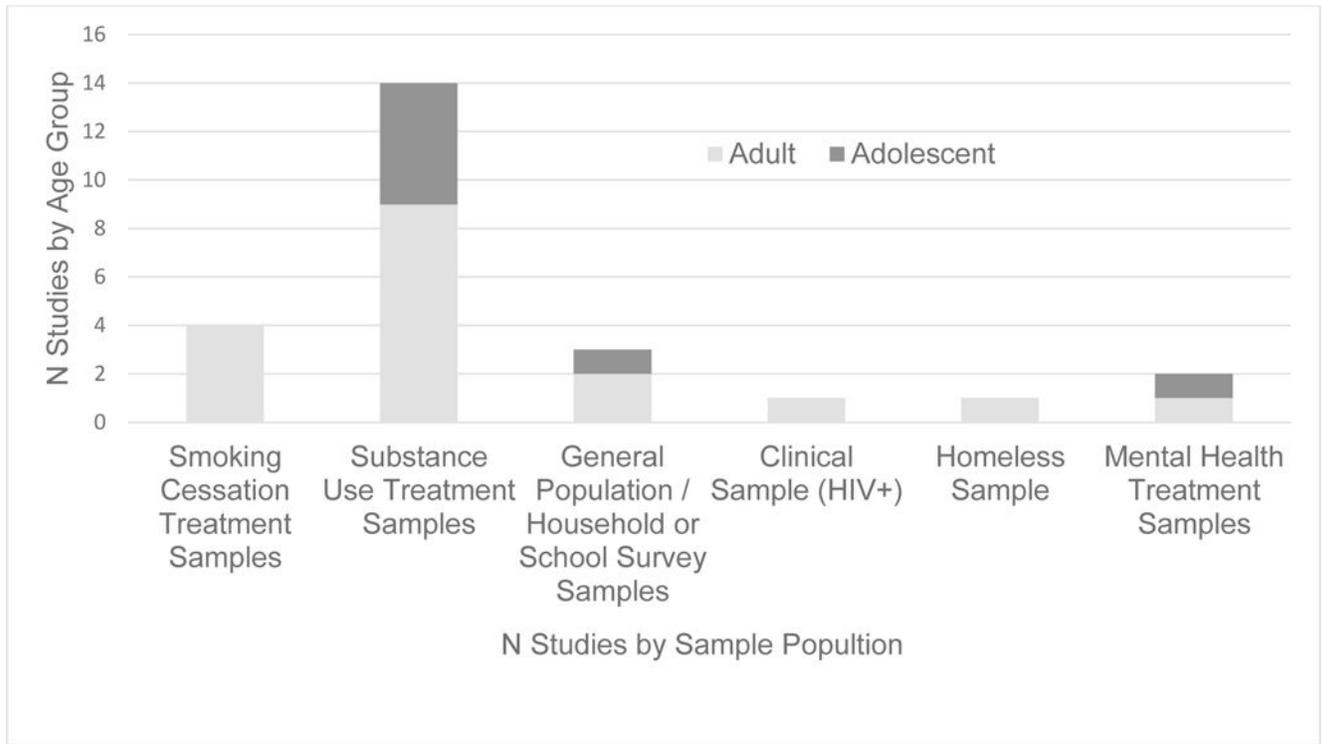


Figure 1. Overview of included studies by sample populations and age group (N=24*)
 *Chart adds to 25 study sample populations as one study included two samples (Lisha et al., 2014)

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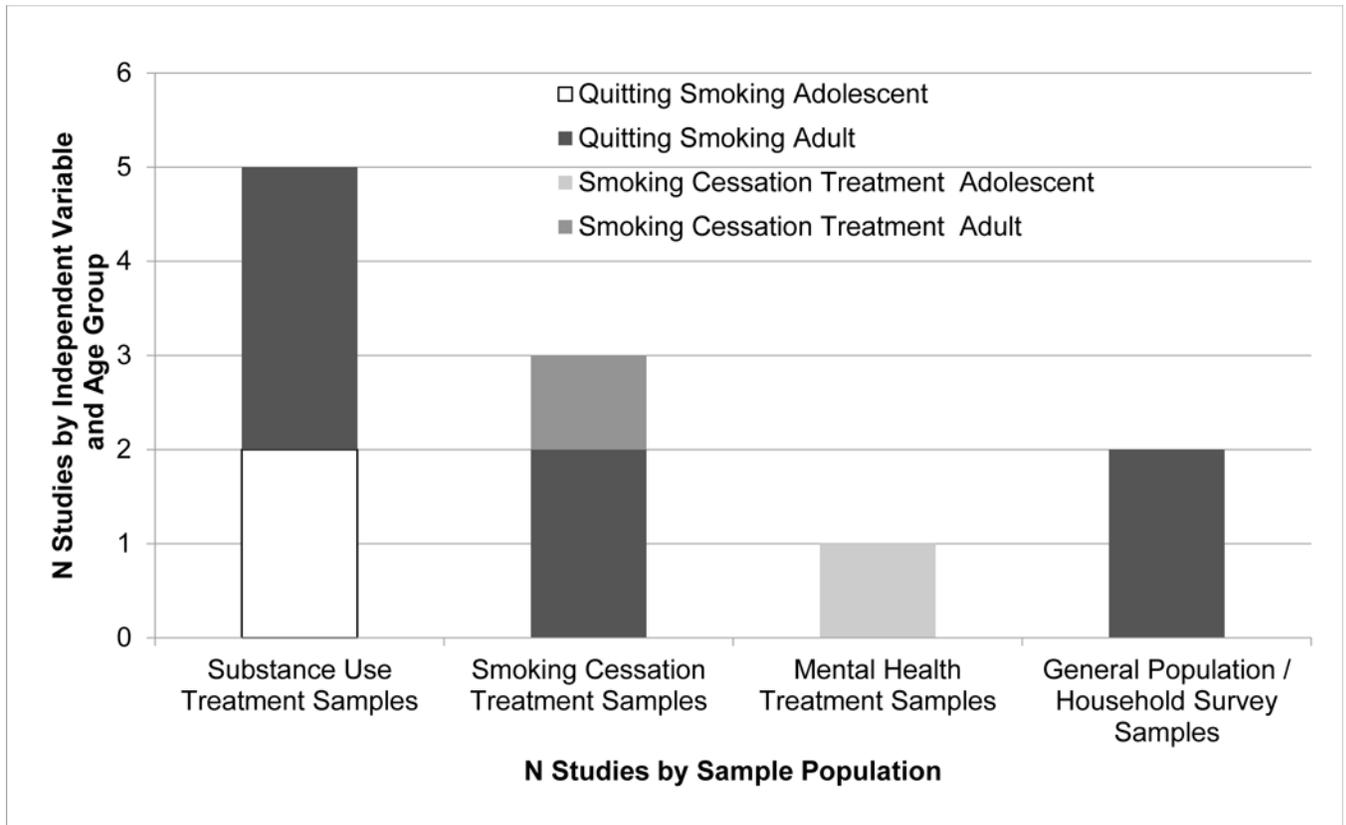


Figure 2. Positive findings by sample population, independent variable (Quitting smoking or Smoking cessation treatment intervention), and age group (n=11)

Table 1

Studies examining the effect of tobacco cessation or quitting smoking on substance use outcomes (N=24)

Authors (Year)	Study Design	Sample Description*	Smoking Variable Assessed	SU Outcome of Interest	Cessation/Treatment	Synopsis of Findings
<i>Positive Impact</i>						
1. Berg, Piper, Smith, Fiore, Jorenby (2015)	Secondary analysis of RCT, bupropion, NRT, counseling	N=1,301, mean age 45, 59% female, 84% white, 48% history alcohol abuse, 10% history of alcohol dependence, smokers	N/A, investigated changes pre and post target quit date	Mean number of drinks per day 2 weeks pre and post target quit date	Smoking Cessation	<i>Positive</i> Generally, alcohol use decreased post-target quit date. Smokers who reported less pre-quit alcohol use, as well as smokers who were female, non-white, and had a history of alcohol dependence tended to use less alcohol post-quit
2. Magee, Winhusen (2015)	Secondary analysis of multisite RCT, SUD treatment with or without smoking cessation treatment, counseling, bupropion, contingency management	N=538, mean age 36, 48% female, adults with cocaine or methamphetamine SUD	N/A, investigated impact of smoking cessation intervention	Stimulant craving	Smoking Cessation	<i>Positive</i> Smoking cessation eliminated coupling between nicotine craving and stimulant craving, $\gamma = -.07, p = .39$. Conclusions: Contrary to concerns about nicotine abstinence during substance dependence treatment, increases in nicotine craving may be associated with later reductions in stimulant craving and use
3. Cavazos-Rehg, Breslau, Hatsukami, Krauss, Spitznagel, Grucza, Salyer, Hartz, Bierut (2014)	Prospective cohort, NESARC	N=4,853, adults, 48% female, 77% white	Usual number of cigarettes per day, self-report	Past year diagnosis DSM-IV alcohol use disorder or drug use disorder	Smoking Cessation	<i>Positive</i> Among daily smokers who had current or lifetime history diagnosis of the outcome of interest at Wave 1, quitting by Wave 2 predicted a decreased risk of mood/anxiety disorder (aOR 0.6, 95% CI 0.4, 0.9) and alcohol disorder (aOR 0.7, 95% CI 0.5, 0.99) at Wave 2. Among daily smokers with no lifetime history

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						diagnosis of the outcome of interest at Wave 1, quitting smoking by Wave 2 predicted a decreased risk of drug use disorder at Wave 2 aOR 0.3, 95% CI 0.1, 0.9).
4. Dawson, Goldstein, Grant (2013)	Prospective cohort	N=14,885, adult past-year monthly drinkers	Smokers at baseline but not during year preceding follow-up, self-report	One year alcohol abstinence	Smoking Cessation	<i>Positive</i> Smoking cessation associated with drinking cessation over follow-up, OR=2.82 (95% CI=1.62-4.92) to 3.45 (2.20-5.39)
5. Piper, Rodoock, Cook, Schlam, Fiore, Baker (2013).	RCT, bupropion, NRT, counseling	N=1,470, mean age 45, 58% female, 84% white, smokers	7-day point prevalence abstinence, biochemically verified (breath CO)	Past year SUD diagnosis	Smoking Cessation	<i>Positive</i> Participants who were smoking at the Year 3 follow-up were more likely to have developed and maintained a substance use or major depressive disorder by that time than were individuals who were abstinent at Year 3
6. Metrik, Spillane, Leventhal, Kahler (2011)	RCT, counseling, NRT, brief alcohol intervention	N=216, mean age 42, 45% female, 91% white, heavy drinkers seeking smoking cessation treatment	N/A, investigated impact of smoking cessation intervention	Number of drinks/week, percent of marijuana use days	Smoking Cessation Treatment Intervention	<i>Positive</i> All participants made large reductions in weekly alcohol consumption during the trial, with weekly marijuana users also reducing their marijuana use. Frequent marijuana smokers may benefit from smoking cessation even when not explicitly discussed
7. Tsoh, Chi, Mertens, Weisner (2011)	Retrospective cohort/chart review	N=1,951, adults, 39% female, 75% white, Kaiser patients from 1994-98	Current cigarette smoking, self-report	1 year alcohol or drug abstinence at 5, 7, and 9 years; past-year remission SUD	Smoking Cessation	<i>Positive</i> Stopping smoking during the first year after substance use treatment intake predicted better long-term substance use

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8. Brown, Strong, Abrantes, Myers, Ramsey, Kahler (2009)	RCT, motivational interviewing, brief advice	N=191, adolescents mean age 15, 62% female, 95% white, mental hospital inpatients	N/A, investigated impact of smoking cessation intervention	Percentage of days with substance use (alcohol and illicit drugs)	Smoking Cessation Treatment Intervention	<p>outcomes through 9 years after intake</p> <p><i>Positive</i> The results of this study suggest that MI for smoking cessation had a significant effect in preventing an increase in substance use during the first 6 months following hospitalization</p>
9. de Dios, Vaughan, Stanton, Niaura (2009)	Multi-site prospective cohort	N=1,779, adolescents mean age 16, 30% female, 57% white, in SUD treatment	Current cigarette smoking, self-report	Relapse to alcohol and marijuana; time to relapse to alcohol and marijuana	Smoking Cessation	<p><i>Positive</i> Persistent smokers and smoking initiators had significantly greater odds of alcohol and marijuana relapse and shorter periods to marijuana relapse at follow-up compared with quitters</p>
10. Myers, Doran, Brown (2007)	Prospective cohort, secondary analysis	N=123, adolescents, mean age 16, 41% female, 81% white, in SUD treatment	Smoking abstinence for > 1 year, self-report	Alcohol use trajectory (abstainers, infrequent drinkers, worse over time, frequent drinkers)	Smoking Cessation	<p><i>Positive</i> Larger proportion of quitters (> persistent smokers) were alcohol abstainers compared to frequent drinkers</p>
11. Satre, Kohn, Weisner (2007)	Prospective cohort	N=598, smokers: n=315, mean age 36, 44% female, 76% white, non-smokers: n=283, mean age 40, 42% female, 71% white, Kaiser, CA, admitted 1997–1998, health plan members	Current cigarette smoking, self-report	Addiction Severity Index scores, 30 day abstinence from alcohol and drugs	Smoking Cessation	<p><i>Positive</i> Smokers were less likely to be abstinent from alcohol and drugs in the prior 30 days (48.3% vs. 64.0%), and had higher Addiction Severity Index scores</p>
12. Alessi and Petry (2014)	RCT, frequent monitoring and behavioral support or that plus contingency management	N=45 – behavioral support: N=21, 100% male, mean age 37, 43% Black, 48% European American; contingency management: N=24, 100% male, mean age 38, 17% Black, 79% European American	Percent of days CO-negative (biochemically validated)	Study attendance, study adherence, days of self-reported drug use (biochemically validated)	Smoking Cessation Treatment Intervention	<p><i>Null Impact</i> No study withdrawals, no difference by treatment arm for adherence, days of self-reported substance use, or drug-positive urine tests.</p>

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13. Kahler, Borland, Hyland, McKee, O'Connor, Fong, Cummings (2010)	Prospective cohort	N=3,614, mean age 42, 47% female, 95.8% adult daily smokers from AU, CA, UK, US	Smoking abstinence for > 6 months, self-report	Drinking frequency, number of drinks per day and heavy or "binge" drinking frequency	Smoking Cessation	<i>Null</i> No difference in reduction in drinking by quitters compared to non-quitters
14. Callaghan, Brewster, Johnson, Taylor, Beach, Lentz (2007)	Retrospective cohort, NRT available on request	N=520, adolescents mean age 17, 57% female, 39% Aboriginal ancestry, in SUD treatment	N/A, investigated impact of smoking ban at SUD treatment facility	SUD treatment enrollment and treatment completion	Smoking Cessation	<i>Null</i> The total smoking ban was not associated with a lower proportion of adolescent smokers seeking treatment or a lower treatment completion rate among smokers compared to nonsmokers
15. Rohsenow, Tidey, Martin, Colby, Sirota, Swift, Monti (2015)	RCT, contingent vouchers, motivational interviewing, brief advice	N=184, mean age 35, 55% female, 83% white, smokers in SUD treatment	N/A, investigated impact of smoking cessation intervention	Number of heavy drinking days and biochemically verified number of drug use days at each follow up and relapse at 1 year	Smoking Cessation Treatment Intervention	<i>Null</i> No differential effects on drug use
16. Lisha, Carmody, Humfleet, Delucchi (2014)	Secondary analysis of 2 RCTs, smoking cessation interventions, NRT, counseling, estimated both synchronous (within day) and lagged (across day) forecasts between smoking and alcohol use	N=302, mean age 48, 9% female, 50% white, adults with HIV & adults in alcohol use disorder treatment	Number of cigarettes, timeline follow-back, 7-day point prevalence abstinence, biochemically verified (breath CO)	Alcohol use number of drinks	Smoking Cessation	<i>Positive & null by subgroup/Null overall</i> In the overall sample, there was no difference in alcohol use between those who stopped smoking (even for one day) and those who never stopped ($t(300) = 0.08, p = .93$). When broken up by study there was a significant reduction in the alcohol dependent sample: $t(137) = 2.88, p < .0001$. The mean number of drinks was 29.76 ($SD = 90.9$) for those who stopped v. 131.7 ($SD = 324.5$) for those who did not.

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17. Reitzel, Nguyen, Eischen, Thomas, Okuyemi (2014)	Secondary analysis of RCT, NRT, self-help guide, counseling	N=427, mean age 44, 25% female, 35% white, homeless adult daily smokers interested in quitting smoking	7-day point prevalence abstinence, biochemically verified (breath CO)	Number of drinking days of 30; drinks per drinking day; number of heavy drinking days; number of days cocaine or m/ hash or heroin and any drug	Smoking Cessation	<i>Positive (alcohol)/Null (drugs)</i> Smoking abstinence (CO-verified) was associated with fewer drinking days (P = 0.03), fewer drinks consumed on drinking days (P = 0.01), and lower odds of heavy drinking (P = 0.05), but not with differences in the number of days of cocaine, marijuana/ hashish, heroin or any drug use
18. Winhusen, Kropp, Theobald, Lewis (2014)	Secondary analysis of multisite RCT, SUD treatment with or without smoking cessation treatment, counseling, bupropion, contingency management	N=249, baseline demographics reported by follow-up smoking status, continued smoking: N=174, mean age 38, 49% female, 61% white, smoking abstinence: N=75, mean age 36, 37% female, 55% white, adults with cocaine or methamphetamine SUD	7-day point prevalence abstinence, biochemically verified (breath CO)	Stimulant abstinence (biochemically verified)	Smoking Cessation	<i>Positive (cocaine)/Null (methamphetamines)</i> A significant effect was found for the cocaine-dependent subsample (N=147) in which participants who stopped smoking were abstinent for illicit stimulants an average of 78.2% of the post-smoking-quit weeks (weeks 4-10) relative to 63.6% in participants who continued smoking ($\chi^2(1)=8.55$, $p<.01$, $d=0.36$). No significant effects were found for the sample as a whole (N=249) or for the methamphetamine-dependent subsample (N=102).
19. Stahre, Toomey, Erickson, Forster, Okuyemi, Ahluwalia (2013)	RCT, counseling	N=755, mean age 45, 67% female, African American adults	7-day point prevalence abstinence, self-report	Prevalence and frequency of past 30-day binge drinking and average daily alcohol consumption	Smoking Cessation	<i>Positive (short term)/Null (long term)</i> Individuals who quit smoking within the first 8 weeks of the study reported lower past 30-day binge drinking prevalence at week 8 than those who did not quit during the first 8 weeks (P = .035), but the effect was

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20. Campbell, Chi, Sterling, Kohn, Weisner (2009)	Prospective cohort	N=419, adolescents mean age 16, 34% female, 49% white, recruited when entering SUD treatment	Abstinence for previous 6 or 12 months, self-report	SU self-report follow-up data validated on subsample at 12 months w/ urinalysis, abstinence from drugs and alcohol	Smoking Cessation	<i>Positive (drugs)/Null (alcohol)</i> Self-initiated tobacco cessation at 6 months, and at both 6 and 12 months, were related to higher odds of drug abstinence but not alcohol abstinence
21. Myers, Prochaska (2008)	RCT, group counseling	N=54, adolescents mean age 16, 22% female, 69% white, outpatient SUD treatment in Southern California	N/A, investigated impact of smoking cessation intervention	Total days of substance use at the 3-and 6-month follow up time points	Smoking Cessation Treatment Intervention	<i>Positive (short term)/Null (long term)</i> Participants who received smoking cessation intervention had significantly fewer days of substance use than controls at the 3-months, but not at 6-months follow-up
22. Prochaska, Hail, Tsouh, Eisendrath, Rossi, Redding, Rosen, Meisner, Humfleet, Gorecki (2008)	RCT, smoking cessation intervention, computer-based intervention, counseling	N=322, depressed smokers in mental health outpatient treatment	7-day point prevalence abstinence, biochemically verified (breath CO)	Alcohol, mj, stimulant, opiate use (y/n) between follow-ups		<i>Positive (alcohol)/Null (drugs)</i> Participants who successfully stopped smoking reported less alcohol use than did participants who continued smoking. No difference in drug use
23. Brook, Balka, Ning, Brook (2007)	Prospective cohort	N=473, adolescents mean age 14, 51% female, 51% black, 49% Puerto Rican	Current cigarette smoking, self-report	Alcohol dependence, illicit drug dependence, alcohol and illicit drug dependence	Smoking Cessation	<i>Positive (quitters v. early starters & continuous)</i> <i>Null (quitters v. late starters)</i> Early starting continuous smokers more likely than quitters report alcohol dependence (OR 3.72) and illicit drug dependence (3.21). There was no difference between late-starting smokers and quitters

Mixed Impact (negative and null)

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Fu, Kodl, Willenbring, Nelson, Nugent, Gravely, Joseph (2008)	Secondary analysis of RCT, smoking cessation intervention, NRT, counseling (concurrent or delayed smoking cessation treatment)	N=459, mean age 40, 30% female, 83% white, adults in alcohol use disorder treatment	7-day point prevalence abstinence, self-report (25% subsample biochemically verified)	6-months alcohol abstinence @ 6, 12, 18 months; time to first alcohol use; black/white differences	Smoking Cessation Treatment Intervention	For whites: alcohol abstinence outcomes were consistently worse in concurrent group than delayed group, but not for blacks