



Published in final edited form as:

Prev Med. 2016 November ; 92: 148–159. doi:10.1016/j.yjmed.2016.05.011.

A review of epidemiologic research on smoking behavior among persons with alcohol and illicit substance use disorders

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Abstract

Persons with alcohol use disorders (AUDs) and substance use disorders (SUDs) appear to be heavily affected by cigarette smoking. In order to address the consequences of smoking in this population, an understanding of the current state of knowledge is needed. Epidemiologic research provides the opportunity to obtain detailed information on smoking behaviors in large community samples. The aim of this paper was to synthesize the epidemiologic evidence on smoking among persons with AUDs/SUDs and suggest directions for future research. Literature searches of Medline and PubMed were used to identify articles and additional articles were elicited from publication reference lists. To be included in the review, papers had to be published in English, analyze epidemiologic data, and examine an aspect of smoking behavior in persons with AUDs/SUDs. Twenty-nine studies met inclusion criteria and were included in the review. In summary, epidemiologic evidence to date suggests greater lifetime and current smoking, nicotine dependence, and non-cigarette tobacco use; lower quitting; and differences in quit attempts and withdrawal symptoms for persons with AUDs/SUDs compared to other people. Most studies examined nationally representative data and were conducted on persons in the United States and Australia. Few publications examined outcomes by demographics (e.g., gender, age) but these

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Previous Presentations:

Portions of these data were presented in October, 2015 at the Vermont Center on Behavior and Health 3rd Annual Conference on Behavior Change, Health, and Health Disparities in Burlington, Vermont, USA.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

studies suggested that specific patterns differ by demographic subgroups. More research is needed on persons with AUDs/SUDs in order to develop the most effective public health and clinical interventions to reduce smoking behaviors, improve cessation outcomes, and reduce the harmful consequences of smoking for those with AUDs/SUDs.

Keywords

smoking; nicotine dependence; cessation; alcohol; drugs; epidemiology

Introduction

The harmful consequences of tobacco use to individuals and societies are well known. Tobacco use leads to >480,000 deaths every year in the United States (U.S.)^{1,2} and >5 million annual deaths around the world³. Smoking is causally linked to a wide range of illnesses¹ and the relative risk of death due to smoking-related causes has increased over the past fifty years^{1,4}. While the majority of smokers report that they wish to quit and many smokers attempt to quit⁵, only a minority are able to maintain long-term abstinence⁵⁻⁷. It is important to understand the smoking behavior of subgroups of the population who appear to be disproportionately vulnerable to smoking such as adults with alcohol use disorders (AUDs; alcohol abuse and dependence) and substance use disorders (SUDs; substance abuse and dependence).

Nearly one in ten (8.5%) of U.S. adults meet criteria for a past-year AUD while nearly one-third (30%) of U.S. adults meet criteria for a lifetime AUD⁸. While fewer U.S. adults use illicit substances, 2.0% of U.S. adults meet criteria for a past-year SUD and approximately one in ten (10.3%) of U.S. adults meet criteria for a lifetime SUD⁸. More than forty-six million adults in the U.S. report using both alcohol and tobacco⁹ and the use of tobacco together with alcohol and/or other substances, compared to the use of any one substance alone, increases the risk of smoking-related diseases¹⁰⁻¹⁴. For example, the concurrent use of tobacco and alcohol is associated with greater risk of head cancer, neck cancer, cirrhosis, and pancreatitis than use of alcohol alone^{15,16}. Persons using both tobacco and alcohol/illicit substances have greater mortality mainly due to smoking-related health consequences than those using just alcohol/illicit substances^{10,11}.

AUDs/SUDs affect millions of Americans and persons with AUDs and SUDs are greatly impacted by tobacco through higher smoking rates, lower quit rates, and health consequences^{10-14,17-19}. In order to begin to address and counteract the specific consequences of smoking in this population, a clearer understanding of the current state of knowledge about the smoking behavior of adults with AUDs/SUDs is needed. The examination of epidemiologic research provides the opportunity to obtain detailed information on smoking behaviors of large community samples that have greater generalizability at the population level. Recent reviews of smoking and AUDs/SUDs have focused on specific smoking behaviors (e.g., smoking prevalence¹⁷, smoking cessation¹⁸), clinical samples (e.g., persons in treatment for AUDs/SUDs¹⁷, adolescents²⁰), and specific substances (e.g., marijuana²⁰). The purpose of this paper is to conduct the first systematic

review of epidemiologic studies of smoking behavior and AUDs/SUDs. In addition, this review presents more comprehensive information on the relationship between smoking and AUDs/SUDs by including data on a range of smoking behaviors, age groups (e.g., adults, adolescents), and AUDs/SUDs. The specific aims of this paper are to review and synthesize the epidemiologic evidence on smoking behavior among persons with AUDs/ SUDs and to identify areas needing additional work.

Materials and Methods

Papers for this review were identified through literature searches of Medline and PubMed using search terms related to epidemiologic research (e.g., “epidemiology”, “nationally representative”), smoking (“smoking”, “cigarettes”, “tobacco”, “nicotine”), and alcohol/substance use disorder (e.g., “alcohol use disorders”, “substance use disorders”, “drug use disorders”). Abstracts from these literature searches were individually examined to determine whether they met the inclusion criteria. To be included in the review, the paper had to: (1) be published in English, (2) have a full text available, (3) analyze epidemiologic data (defined by the use of sampling procedures aimed at generating a representative sample from the geographic area of the study), and (4) examine smoking behavior in persons with AUDs/ SUDs (defined as abuse and/or dependence). No limits were set related to publication date. Studies that examined alcohol or substance use or problematic use rather than an AUD or SUD (e.g., heavy use, binge drinking) and studies that examined alcohol or substance outcomes rather than smoking behavior outcomes (e.g., rates of AUDs or SUDs among persons who smoke) were excluded from the review. Information gathered from publications included the country, the area of sampling if the study did not recruit respondents from the entire country, sample size, and smoking behavior. Smoking behaviors included prevalences of current or lifetime smoking, nicotine dependence, quitting smoking outcomes, smoking initiation, quit attempts, and withdrawal symptoms. Data on the use of non-cigarette tobacco products was also gathered.

Medline and PubMed searches of the terms above yielded 2,312 results (617 abstracts from Medline and 1,695 abstracts from PubMed). These abstracts were individually reviewed by the authors. The major reasons for excluding studies were that they did not include samples of persons with AUDs and SUDs and they did not examine smoking behavior as an outcome. Additional publications were elicited from the reference lists of papers included in the review and supplementary searches conducted with terms for specific drugs of abuse (e.g., “alcohol”, “cocaine”, “stimulants”, “heroin”, “opiates”). In the end, 29 publications met all of the criteria to be included in the review. See Tables 1 and 2 for a summary of the study characteristics (Table 1) and assessed outcomes (Table 2). More than one study that used the same dataset could be included and datasets are listed in the tables along with the sample size for the analyses from each unique article. While most analyses of SUDs combined multiple substances, results from analyses conducted for a specific substance (e.g., cannabis use disorders) are also included when reported in the publications.

Results

Current and lifetime smoking among persons with AUDs/SUDs (Table 3)

Current and lifetime smoking—Thirteen studies were identified that examined current or lifetime smoking by AUD and/or SUD diagnosis (see Table 3): ten studies of adults^{19,21–30} and two studies of adolescents^{31,32}. The majority of studies (n =8) were conducted in the U.S. with five of those studies using the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) dataset. For adults, current and lifetime smoking was consistently reported to be higher among adults with lifetime, past-year, and past-month AUDs, SUDs, and cannabis use disorders compared with other adults. While few studies examined smoking among adolescents with AUDs/SUDs, the results were similar to adult studies: SUDs were significantly associated with increased nicotine use among adolescents in Germany³² and alcohol abuse was significantly associated with higher levels daily cigarette smoking among adolescents, compared with those without alcohol abuse, in New Zealand³¹.

Gender and age differences—Few studies examined the relationship between smoking and AUDs/SUDs by demographics. Smith et al²⁸ and Higgins et al³⁰ were the only two studies that were identified as reporting analyses of smoking and AUDs/SUDs by demographics. Higgins et al³⁰ found no significant two-way interactions of AUD or SUD and smoking by gender, age, or race/ethnicity. Conversely, Smith et al²⁸'s analyses revealed a number of significant gender and age differences in the relationship between AUDs/SUDs and smoking. Overall, lifetime smoking was 2 to 3 times more common for women and men with current and lifetime AUDs/ SUDs (63.1%–77.0%) compared to women and men with no AUD/SUD diagnosis (28.3%–37.5%). Men with past-year and lifetime AUDs were more likely to report lifetime smoking (65.1% and 65.3%) than women with past-year and lifetime AUDs (63.1% and 63.9%; $p < 0.001$); these differences were statistically significant but not substantial in terms of percentages. Conversely, women with past-year and lifetime SUDs were more likely to report lifetime smoking (77.0% and 76.7%) than men with lifetime SUDs (74.9% and 74.6%, $p < 0.001$), though the differences were again fairly small. Prevalences of current smoking were 2 to 4 times higher for women and men with current and lifetime AUDs/SUDs (38.1%–55.1%) compared to women and men with no diagnosis (13.8%–17.8%). With regard to current smoking, women with past-year AUDs (53.9%), lifetime AUDs (41.3%), and lifetime SUDs (55.1%) were more likely to report current smoking compared to men with past-year AUDs, lifetime AUDs, and lifetime SUDs (49.87%, 38.1%, and 52.8%; $p < 0.001$). Conversely, no difference in current smoking was found among men and women with past-year SUDs (66.3% and 67.0%). Smoking was more common among women than men among those with current AUD/SUDs but there were no gender differences in lifetime smoking rates.

In Smith and colleagues²⁸'s analyses of age-related differences, adults with past-year and lifetime AUDs and SUDs of all ages (18–29 years old, 30–44 years old, 45 years and older) were 2 to 3 times more likely to report lifetime and current smoking than adults without past-year and lifetime AUDs and SUDs. Significant differences in lifetime smoking were found among age groups ($p < 0.001$); lifetime smoking was significantly more common

among adults in the oldest age group (45 years and older; 74.6%–79.2%), followed by the youngest age group (60.2%–76.4%), followed by the middle age group (56.9%–72.3%). Significant differences in current smoking among age groups were reported as well ($p < 0.001$); adults in the youngest age group were most likely to report current smoking (52.0%–71.3%), followed by the middle age group (39.0%–65.2%), with the lowest prevalences of current smoking in the oldest age group (32.5%–52.9%).

Quitting smoking and smoking relapse among persons with AUDs/SUDs (Table 4)

Quitting smoking—Eight studies that included adults examined the relationship of AUDs and SUDs to quitting smoking^{19,23,24,28,33–36}. Seven out of eight studies examined U.S. data and five of those studies used the NESARC dataset. Adults with lifetime or past-year AUDs/SUDs were less likely to quit smoking as assessed both by cross-sectional data (respondents who reported lifetime smoking but not current smoking) and longitudinal data (respondents who reported current smoking at one assessment and no current smoking at a later assessment; see Table 4).

Smoking relapse—Two studies of U.S. adult former smokers, both analyzing data from the NESARC, found that past-year AUDs, SUDs, and cannabis use disorders (when examined separately from other SUDs) were associated with increased likelihood of smoking relapse three years later^{35,37}. In the one study that included covariates³⁵, the comparisons remained significant after controlling for psychiatric disorders and other substance use disorders.

Gender and age differences—Three studies^{28,33,35} examined the relationship between quitting smoking or smoking relapse by gender or age. Smith and colleagues²⁸ found no gender differences in quitting smoking using either cross-sectional or longitudinal data among those with lifetime and past-year AUDs or past-year SUDs. Yet, women with lifetime SUDs were more likely than men with lifetime SUDs to quit smoking (cross-sectional data, 27.8% versus 24.7%, $p < 0.001$; longitudinal data, 17.6% and 14.0%, $p < 0.001$). Weinberger and colleagues³⁵ found no significant gender differences in the relationship between AUDs/SUDs and quitting smoking or smoking relapse over a three-year period.

Two studies examined differences by age^{28,33} with mixed results. In contrast to a study of U.S. adults³³ that reported that AUDs were significantly related to a decreased likelihood of quitting smoking for adults in the oldest age group (61 to 99 years) but not other age groups, Smith et al²⁸ found that fewer adults with past-year and lifetime AUDs/SUDs in nearly every age category reported quitting smoking compared to adults without the respective diagnosis. Younger adults (18–29 years) with past-year and lifetime AUDs/SUDs were most likely to quit smoking (15–9%–22.0%) relative to other age groups when analyzing longitudinal data. When quitting smoking was assessed using cross-sectional data, adults with past-year and lifetime AUDs/SUDs who were oldest (45 years and older) had the highest prevalence of quitting smoking (27.7%–50.4%). In summary, age differences in the association of AUDs/SUDs to quitting smoking have differed by study methodology with different findings emerging for longitudinal versus cross-sectional data.

Nicotine dependence among persons AUDs/SUDs

Nicotine dependence—Four studies examined the association of AUDs and SUDs to nicotine dependence. Three of the studies reported data from U.S. adults^{38–40} and one study reported data from German adults⁴¹. Similar to smoking, current and lifetime nicotine dependence prevalences were higher among adults with past-year AUDs/ SUDs and lifetime AUDs than those without (Table 3). While this was generally consistent across studies, a study using data from adults who reported lifetime smoking and completed Wave 2 of the NESARC found that respondents with a past-year AUD were more likely to report past-year nicotine dependence while adults with lifetime AUD were less likely to report past-year nicotine dependence compared to those without AUDs⁴⁰ perhaps due to those with remitted AUDs being more likely to quit smoking (see Table 4). In that study, there were no significant gender differences in the relationships between AUDs/SUDs and past-year nicotine dependence⁴⁰. Average level of nicotine dependence, as measured by the Fagerström Test for Nicotine Dependence⁴², was higher for German adults with current or remitted alcohol dependence compared to adults without alcohol use problems.⁴¹

Nicotine dependence transitions—Six studies analyzing data from adults in the U.S.^{25,26,39,43–45} examined transitions in nicotine dependence. Overall, both cross-sectional and longitudinal studies found that AUDs and SUDs were associated with increased likelihood of the onset of nicotine dependence and appeared to be a barrier to remission from nicotine dependence. For example, U.S. adults with lifetime alcohol, cocaine, and cannabis dependence were 3–4 times more likely (alcohol OR=3.05, 95% CI=2.9, 3.2; cocaine OR=3.08, 95% CI=2.7, 3.5; cannabis OR=4.31, 95% CI=3.8, 4.8) to transition from nicotine use to nicotine dependence than adults without the respective disorders after controlling for education, marital status, mood disorders, anxiety disorders, and other substance use disorders²⁵. A second study found that, after adjusting for demographics and other substance use disorders, both alcohol dependence (adjusted OR (AOR)=1.29, 95% CI=1.01, 1.66) and substance abuse or dependence (AOR=1.47, 95% CI=1.11, 1.95) were associated with the persistence of nicotine dependence (i.e., no remission from nicotine dependence)⁴⁵. Similarly, U.S. adults with lifetime alcohol dependence (AOR=0.49, 95% CI=0.37, 0.63), cannabis dependence (AOR=0.038, 95% CI=0.15, 0.93), and cocaine dependence (AOR=0.08, 95% CI=0.02, 0.33) were less likely to report remission from nicotine dependence than adults without the respective diagnosis after adjusting for mood disorders, anxiety disorders, other substance use disorders, level of education, and marital status³⁹.

Longitudinal studies have produced similar results. For example, AUDs have been shown to be associated with an increased risk of nicotine dependence onset three years later after controlling for demographics and psychiatric disorders (alcohol abuse AOR=1.49, 95% CI=1.14, 1.95; alcohol dependence OR=1.53, 95% CI=1.11, 2.10)²⁶. Similarly, after controlling for age, sex, race, education, marital status, number of children, region, urbanicity and employment status, alcohol abuse (OR=1.7, 95% CI=1.2, 2.3), alcohol dependence (OR=1.8, 95% CI=1.3, 2.6), substance abuse (OR=1.9, 95% CI=1.4, 2.5), substance dependence (OR=1.7, 95% CI=1.2, 2.4), and a combined category of any alcohol/substance use disorder (OR=1.8, 95% CI=1.3, 2.4)⁴³ were associated with significantly

increased risk of nicotine dependence ten years later. Conversely, a NESARC⁴⁴ analysis found that SUDs (OR=1.37, 95% CI=1.18, 1.58), but not AUDs (OR=1.00, 95% CI=0.87, 1.16), were associated with persistence of nicotine dependence, compared to remission, over a three year period, after adjusting for sex, age, education, marital status and household income (SUD OR=1.27, 95% CI=1.09, 1.49; AUD AOR=1.02, 95% CI=0.88, 1.18).

Gender differences—Two studies found mixed results regarding gender differences in the link between AUDs/SUDs and nicotine dependence^{38,40}. One study³⁸ found AUDs/SUDs were associated with nicotine dependence for both men and women (e.g., AUD: men OR=3.9, 95% CI=3.4, 4.5, women OR=5.1, 95% CI=4.3, 6.1; SUD: men OR=7.1, 95% CI=5.7, 8.8, women OR=9.5, 95% CI=6.7, 13.7). Garcia-Rodriguez et al⁴⁰ found no gender differences in the relationships between lifetime or past-year AUD, lifetime or past-year cannabis use disorder, or lifetime SUDs and past-year nicotine dependence. Additional research on differences in nicotine dependence among persons with AUDs/SUDs by gender and other demographics would be useful to help clarify the relationships.

Other smoking-related variables

Smoking initiation—Five studies examined the role of AUDs/SUDs in smoking initiation^{26,27,40,41,43} and have found links in both cross-sectional and longitudinal studies. Lifetime AUDs⁴⁰ were associated with a more than threefold increased likelihood of smoking initiation (OR=3.61, 95% CI=3.36, 3.89) while adults with a lifetime cannabis use disorder or SUD were nearly 5 times more likely to report lifetime smoking initiation (OR=4.93, 95% CI=4.37, 5.57 and OR=4.81, 95% CI=1.43, 1.54, respectively) in cross-sectional data. After controlling for other demographics, childhood factors, and other SUDs, past year AUD was shown to be more strongly associated with smoking initiation among women than men (OR=1.40, CI=1.06, 1.84)⁴⁰. Similarly, a prospective study²⁶ reported that symptoms of alcohol dependence (OR=1.49, 95% CI=1.14, 1.97), alcohol abuse (OR=1.90, 95% CI=1.23, 2.86), and alcohol dependence (OR=1.78, 95% CI=1.17, 2.72) were significantly associated with incident smoking three years later relative to no symptoms of alcohol dependence at Wave 1, controlling for demographics and psychiatric disorders. In a longitudinal study using NCS data⁴³ found that having an AUD/SUD was associated with significantly increased likelihood of the onset of tobacco use ten years later, controlling for age, gender, race, education, marital status, number of children, region, urbanicity and employment status (alcohol abuse OR=2.6, 95% CI=1.6, 4.4; alcohol dependence OR=3.0, 95% CI=1.7, 5.5; substance abuse OR=4.2, 95% CI=1.8, 9.4; substance dependence OR=4.0, 95% CI=1.5, 10.8). With regard to age of smoking onset, current (OR=4.15, 95% CI=2.12, 8.13) and past alcohol dependence (OR=1.82, 95% CI=1.16, 2.85)⁴¹ were associated with a younger age of smoking onset (17 years or younger) compared to an older age of smoking onset (age 18 or older) among adults in Germany. In contrast, having a concurrent cannabis use disorder did not appear to be associated with age of smoking initiation among adults with nicotine dependence compared with those without cannabis use disorder.²⁷

Quit attempts—It appears that no studies to date have examined SUDs and cigarette quit attempts; the two studies that examined the relationship between smoking quit attempts and

AUDs suggested that current AUDs were associated with lower and past AUDs were associated with higher quit attempts^{34,41}. Given the high prevalence of smoking among those with AUDs/SUDs, and the lack of information about quitting in this group, it seems that more research is needed to understand the relationship of AUDs and SUDs to attempts to quit smoking.

Withdrawal Symptoms—A central element of nicotine dependence is the experience of withdrawal symptoms⁴⁶ and many smokers relapse to nicotine during the first week of abstinence when withdrawal symptoms are the strongest⁴⁷. Three studies^{41,48,49} were identified that examined withdrawal symptoms among those with AUDs/SUDs with mixed results. One study of U.S. adults⁴⁸ found no significant differences in the number of withdrawal symptoms (range 0–12) reported by adults with a lifetime history of alcohol abuse or dependence ($M=4.86$, $SD=2.11$) or adults with a history of substance abuse or dependence ($M=4.47$, $SD=2.48$) compared to adults with no AUD/SUD history ($M=3.60$, $SD=2.02$). Conversely, a study using data from Wave 1 of the NESARC⁴⁹ found a significant, albeit small, difference in the number of withdrawal symptoms (range=0–8) reported by adults with past-year AUDs ($M=3.5$, $SD=2.0$) compared to adults without past-year AUDs ($M=3.3$, $SD=1.9$, $p<0.01$) and for adults with past-year SUDs ($M=3.9$, $SD=2.1$) compared to adults without past-year SUDs ($M=3.2$, $SD=1.9$, $p<0.001$). In a study of smokers in Germany⁴¹, adults with alcohol dependence reported a greater number of withdrawal symptoms but not a greater number of days of withdrawal. With regard to other aspects of withdrawal, more U.S. adults with past-year AUDs and SUDs, compared to U.S. adults with no diagnosis, reported experiencing at least one withdrawal symptoms during a quit attempt (AUDs 49.1% versus 37.9%, $p<0.001$; SUDs 60.6% versus 38.5%, $p<0.001$), discomfort or distress related to withdrawal symptoms (47.1% versus 28.7%, $p<0.05$), and relapsing to smoking to relieve withdrawal symptoms (60.6% versus 46.5%, $p<0.05$)⁴⁹. While results are mixed, there is evidence that persons with AUDs and SUDs are more likely to experience some aspects of withdrawal during quit attempts and maybe more likely to go back to smoking because of withdrawal symptoms. More research is needed to understand the role of withdrawal in the smoking behavior of persons with AUDs and SUDs including best way to treat withdrawal in order to achieve the best quit outcomes.

Non-cigarette tobacco products—The most common form of tobacco around the world is smoked tobacco, such as cigarettes^{50,51}, and most studies of adults with AUDs/SUDs have focused on cigarette use with fewer published studies of other tobacco products. Three studies of U.S. adults reported greater use of non-cigarette tobacco products for persons with AUDs/SUDs^{27,52,53}. One cross-sectional epidemiologic study of U.S. adults that examined lifetime diagnoses of ten AUDs/SUDs (alcohol, cannabis, amphetamine, opiates, sedative, tranquilizer, inhalant/solvent, cocaine, hallucinogen, heroin)⁵² found that seven out of ten AUDs/SUDs (all except tranquilizer, inhalant, and heroin) were related to increased likelihood of lifetime snuff use, nine out of ten AUDs/SUDs (all except heroin) were related to lifetime use of chewing tobacco, and eight out of ten AUDs/SUDs (all except inhalant and heroin) were related to lifetime use of both snuff and chewing tobacco. After controlling for demographics, quantity of cigarette smoked, and psychiatric disorders, the association between snuff and AUDs and cannabis use disorders; between chewing tobacco

and AUDs and inhalant use disorders; and between use of both snuff and chewing tobacco and AUDs and amphetamine use disorders remained significant. A second study²⁷ reported that U.S. adults with both nicotine dependence and cannabis use disorders were more likely to report use of pipes (OR=9.73, 95% CI=1.69, 55.90) and less likely to report use of snuff (OR=0.08, 95% CI=0.01, 0.59) compared to adults with just nicotine dependence. A third study⁵³ found greater odds of past-month smokeless tobacco use for respondents with alcohol dependence (OR=2.46, 95% CI=1.71, 3.53), heroin dependence (OR=7.98, 95% CI=3.07, 20.72), and cannabis dependence (OR=2.33, 95% CI=1.45, 3.76), but not cocaine dependence (OR=1.61, 95% CI=0.53, 4.89). The ORs for alcohol and heroin dependence remained significant in multiple logistic regressions that adjusted for demographics.

Discussion

Together, epidemiologic data suggest greater lifetime and current smoking, nicotine dependence, and non-cigarette tobacco use; and lower quit rates for persons with AUDs/SUDs compared to those without AUDs/SUDs or other comparison groups. These results were found across a range of respondents including persons with AUDs, SUDs, a combined AUD/SUD category, cannabis use disorders, and cocaine use disorders. While few studies examined outcomes by demographics (e.g., gender, age, race/ethnicity), the results of several of these studies suggested that specific patterns differ by demographic subgroups. Only a few studies examined other smoking-related behaviors such as quit attempts and withdrawal symptoms and results of these studies were mixed. All but three studies^{31,41,48} collected data from nationally representative samples and most studies were conducted in the U.S. (using NESARC data) and Australia.

Public health and clinical efforts are needed to lower the smoking and nicotine dependence rates and increase successful quitting for persons with AUDs/SUDs. Similar to other smokers, persons with AUDs/SUDs want to stop smoking⁵⁴⁻⁵⁶ and can successfully quit smoking⁵⁷. Data from this review suggest that lower quit rates are not found for persons with remitted AUDs/SUDs (as opposed to lifetime or current disorders). There are also promising outcomes for smoking cessation treatments for persons with AUDs/SUDs⁵⁸⁻⁶¹. Studies conducted in clinical treatment settings have found that smoking treatment or successful abstinence does not lead to worse treatment outcomes and may even improve abstinence from alcohol and other drugs⁶¹⁻⁶⁶. Further, smoking by adults with past AUDs and SUDs has been associated with a greater likelihood of AUD or SUD relapse^{67,68}.

The results of this review highlight a number of areas in need of additional research. First, few studies examined the relationship of AUDs/SUDs and smoking by gender and age and only one study examined the relationship by race/ethnicity. With regard to gender, women are less likely than men to be current smokers^{1,69} and there is evidence that women are also less likely to report successful smoking cessation compared to men⁷⁰. It is therefore notable that Smith et al²⁸ found higher prevalences of current smoking for women with AUDs/SUDs and either no difference or greater percentages of quitting for women with AUDs/SUDs compared to men with AUDs/SUDs. There is a need for more research on the smoking behavior of adults with AUDs/SUDs by gender as well as by age, race/ethnicity, and other demographic subgroups (e.g., sexual orientation minorities^{71,72}).

More research is also needed on persons from countries other than the U.S. and Australia and on adolescents including longitudinal data on how interventions with adolescents could impact the relationship between AUDs/SUDs and smoking behavior in adults. The field would also benefit from more research on several aspects of smoking (e.g., smoking relapse, quit attempts for persons with SUDs), smoking-related behaviors that may impact cessation outcomes (e.g., withdrawal symptoms), and non-cigarette tobacco products as there has been a notable increase in alternative tobacco product use (e.g., hookah, e-cigarettes) since 2010^{73,74}. No study was identified that examined AUDs/SUDs and e-cigarette use, but one study of 15-year-old adolescents in Greece⁷⁵ reported that frequent alcohol use (OR=1.6, 95% CI=1.0, 2.5) and lifetime cannabis use (OR=4.0, 95% CI=2.6, 6.1) were significantly related to lifetime e-cigarette use. More research is needed to understand the relationship between AUDs/SUDs and these tobacco products and how increased access to these products will affect both tobacco consumption and AUDs/SUDs. Further, most studies of SUDs combined illicit drugs into one category. While there were some data on cannabis use, cocaine, and heroin use disorders, it would be useful to examine whether smoking behaviors differ among users of different illicit substances in order to best target treatment efforts. Finally, continued research is needed to understand the mechanisms of AUDs/SUDs and smoking behavior which may include behavioral and neurochemical links among substances^{13,60,76–79} and comorbid psychiatric and personality disorders^{27,80} in order to work toward the best treatment outcomes for smoking as well as AUDs and SUDs.

While there are strengths to epidemiologic studies (e.g., generalizability, large samples), there are also limitations including the retrospective recall of smoking behaviors which may be subject to recall bias^{81,82}, the inability to examine certain subgroups of interest such as users of individual substances mentioned above, and limits to generalizability based on inclusion and exclusion criteria (e.g., adult data may not generalize to adolescents; data from one country may not generalize to another country). Importantly, epidemiologic studies may exclude some individuals with the most severe and/or complicated AUDs/SUDs (e.g., those who are homeless, incarcerated, or in residential treatment programs). Further, many of the studies analyzed data from the same (NESARC) dataset on U.S. adults. In addition, the data from some studies did not allow direct comparisons either based on timeframe or diagnosis (e.g., comparing respondents with both past-month and lifetime AUDs to respondents with no lifetime or current diagnosis). Finally, it must also be noted that the significant variability among studies (e.g., types of comparison group) that precluded our ability to calculate summary statistics through meta-analytic analyses.

Conclusions

Persons with AUDs/SUDs are more likely to smoke, smoke more heavily and are less likely to stop smoking than those without AUDs/SUDs. The prevalence and intractability of smoking in this population should be a priority for targeted cessation. Development of smoking interventions that evaluate and treat the specific needs of persons with AUDs/SUDs and increased consideration of the provision of smoking treatments in programs for treating AUDs/SUDs seems warranted. More research is needed on demographic subgroups and aspects of smoking behavior in order to develop the most effective public health and clinical

interventions to reduce smoking behaviors, improve cessation outcomes, and reduce the harmful consequences of smoking for those with AUDs/SUDs.

Acknowledgments

Funding

This work was supported in part by NIH grant R01-DA20892 (Dr. Goodwin). The NIH played no role in the study design; in the analysis and interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

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Highlights

- We reviewed epidemiologic research on smoking and alcohol/substance use disorders.
- AUDs/SUDs were associated with greater lifetime and current smoking.
- AUDs/SUDs were associated with lower quitting smoking.
- Some differences in smoking behavior were found by gender, age, and race.
- More research is needed on demographic groups and some smoking behaviors.

Table 1

Characteristics of the 29 studies included in the review.

Reference	Country	Dataset	Sample size	Type of sample	Instrument used to assess AUD and SUD diagnoses	Criteria used for AUD and SUD diagnoses	Alcohol diagnoses <i>a,b</i>	Substance diagnoses ^{a,b}	Current smoking variables ^c	Lifetime smoking variables ^d	Nicotine dependence variables <i>b,e</i>	Quit or relapse to smoking variables ^f
Breslau et al., 1992 ⁴⁸	U.S.	---	1,007	persons ages 21 to 30 in Detroit, Michigan (U.S.)	DIS	DSM-III-R	A1	D1	--	--	--	--
Fergusson et al., 1994 ³¹	New Zealand	CHDS	965	adolescents born in Christchurch (New Zealand)	---	DSM-III-R	B2	--	AA	--	--	--
Lasser et al., 2000 ¹⁹	U.S.	NCS	4,411	persons ages 15 to 54	CIDI	DSM-III-R	A1, A3	D1, D2	BB	AAA	--	AAAAA
Degenhardt et al., 2001 ²¹	Australia	NSMHWB	10,641	adults	CIDI	DSM-IV, ICD-10	--	I2, J2	AA	--	--	--
Degenhardt et al., 2003 ²²	Australia	NSMHWB	10,641	adults	CIDI	DSM-IV	B2, C2	--	AA	--	--	--
John et al., 2003 ⁴¹	Germany	TACOS	4,075	adults in the city of Lübeck and its surrounding communities (Germany)	CIDI	DSM-IV	B2, C2	--	--	AAAAA5	--	--
Grant et al., 2004 ³⁸	U.S.	NESARC Wave 1	43,093	adults	AUDADIS-IV	DSM-IV	A2, B2, C2	D2, E2, F2	--	--	BBBBB2	--
Agrawal et al., 2008 ³³	U.S.	NESARC Wave 1	17,919	adults	AUDADIS-IV	DSM-IV	A1	--	--	--	--	BBBBB
Agosti et al., 2009 ²³	U.S.	NESARC Wave 1	976	persons ages 18 to 30	AUDADIS-IV	DSM-IV	A1, G2	D1, G2	CC	--	--	BBBBB
Lawrence et al., 2009 ²⁹	Australia; U.S.	SMHWB, NCS, NHIS	8,841, 9,282, 23,393 ^g	adults	CIDI	ICD-10	C2, G2	D2, G2	AA	--	--	--
Ayo-Yusuf et al., 2010 ³⁴	South Africa	SADHS	12,481	adults	CAGE ^h	CAGE 2	C1	--	--	--	--	CCCCC
Hickman et al., 2010 ²⁴	U.S.	NSAL	3,411	African-American adults	CIDI	DSM-IV	B1, B2, B3, C1, C2, C3	E1, E2, E3, F1, F2, F3	AA	BBB	--	AAAAA
Swendsen et al., 2010 ⁴³	U.S.	NCS	5,001	adults	CIDI	DSM-III-R, DSM-IV	A1, C1, G1	D1, F1, G1	--	--	BBBBB6	--

Reference	Country	Dataset	Sample size	Type of sample	Instrument used to assess AUD and SUD diagnoses	Criteria used for AUD and SUD diagnoses	Alcohol diagnoses ^{a,b}	Substance diagnoses ^{a,b}	Current smoking variables ^c	Lifetime smoking variables ^d	Nicotine dependence variables ^{b,e}	Quit or relapse to smoking variables ^f
Weinberger et al., 2010 ⁴⁹	U.S.	NESARC Wave 1	8,213	adults	AUDADIS-IV	DSM-IV	A2	D2	--	--	--	--
Goodwin et al., 2011 ⁴⁴	U.S.	NESARC Waves 1 & 2	34,653	adults	AUDADIS-IV	DSM-IV	A1, G1	D1, G1	--	--	BBBB1,2	--
Hasin et al., 2011 ⁴⁵	U.S.	NESARC Wave 1	1,172, 454, 4,017 ^j	adults with a lifetime diagnosis of alcohol dependence, cannabis use disorder, or nicotine dependence	AUDADIS-IV	DSM-IV	C2, C4	H2, H4, K2, K4	--	--	BBBBB2,4	--
Lopez-Quintero et al., 2011 ³⁹	U.S.	NESARC Wave 1	4,781, 530, 408 ^j	adults with a lifetime diagnosis of alcohol, cannabis, or cocaine dependence	AUDADIS-IV	DSM-IV	C1	J1, L1	--	--	BBBBB1,6	--
Lopez-Quintero et al., 2011 ²⁵	U.S.	NESARC Waves 1 & 2	28,907, 7,389, 2,259 ^k	adults with lifetime use of alcohol, cannabis, or cocaine	AUDADIS-IV	DSM-IV	C1	J1, L1	--	CCC	BBBBI	--
García-Rodríguez et al., 2013 ³⁷	U.S.	NESARC Waves 1 & 2	5,831	adults with a history of daily smoking who were not smoking at Wave 1	AUDADIS-IV	DSM-IV	A2	H2, K2	--	--	--	DDDDD
Goodwin et al., 2013 ²⁶	U.S.	NESARC Waves 1 & 2	22,245	adults	AUDADIS-IV	DSM-IV	B2, C2	--	DD	--	BBBB2	--
Goodwin et al., 2013 ³²	Germany	EDSPS	3,021	adolescents	CIDI	DSM-IV	G1	G1	EE	--	--	--
Weinberger et al., 2013 ³⁵	U.S.	NESARC Waves 1 & 2	11,973	adults	AUDADIS-IV	DSM-IV	A2, A4	D2, D4, H2, H4	--	--	--	BBBBB, EEEEE
Fu et al., 2014 ⁵²	U.S.	NESARC Wave 1	43,093	adults	AUDADIS-IV	DSM-IV	A1	M1	--	--	--	--
García-Rodríguez et al., 2014 ⁴⁰	U.S.	NESARC Wave 2	34,653	adults	AUDADIS-IV	DSM-IV	A1, A2	H1, H2, K1	--	--	BBBB2	--
Peters et al., 2014 ²⁷	U.S.	NESARC Wave 2	74, 100, 3,424 ^l	adults	AUDADIS-IV	DSM-IV	--	H1	--	--	BBBB2	--

Reference	Country	Dataset	Sample size	Type of sample	Instrument used to assess AUD and SUD diagnoses	Criteria used for AUD and SUD diagnoses	Alcohol diagnoses ^{a,b}	Substance diagnoses ^{a,b}	Current smoking variables ^c	Lifetime smoking variables ^d	Nicotine dependence variables ^{b,e}	Quit or relapse to smoking variables ^f
Redner et al., 2014 ⁵³	U.S.	NSDUH	39,133	adults	--	DSM-IV	C2	J2, L2, N2	FF	--	--	--
Smith et al., 2014 ²⁸	U.S.	NESARC Waves 1 & 2	34,653	adults	AUDADIS-IV	DSM-IV	A1, A2	D1, D2	GG	BBB	--	BBBBB
Smith et al., 2014 ³⁶	U.S.	NESARC Waves 1 & 2	34,653	adults	AUDADIS-IV	DSM-IV	A2	--	--	--	--	BBBBB
Higgins et al., 2016 ³⁰	U.S.	NSDUH	114,426	adults	--	DSM-IV	A2	D2	HH	--	--	--

Key for Abbreviations: ANRF, American Nonsmokers' Rights Foundation United States Tobacco Control Database; AUDADIS, Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV Version; CHDS, Christchurch Health and Development Study; CIDI, Composite International Diagnostic Interview (including modified versions); DIS, Diagnostic Interview Schedule; DSM, Diagnostic and Statistical Manual of Mental Disorders; EDSPS, Early Developmental Stages of Psychopathology Study; HBSC, Health Behaviour in School-aged Children study; ICD, International Classification of Disease; ITC, International Tobacco Control Four Country Survey; NCS, National Comorbidity Survey; NESARC, National Epidemiologic Survey on Alcohol and Related Conditions; NHIS, National Health Interview Survey; NSAL, National Survey of American Life; NSDUH, National Survey on Drug Use and Health; (N)SMHWB, (National) Survey of Mental Health and Well-Being; SADHS, South African Demographic and Health Survey; TACOS, Transitions in Alcohol Consumption and Smoking; U.K., United Kingdom; U.S., United States

^aKey for type of diagnosis: A, alcohol abuse or dependence (analyzed in the study as one combined category); B, alcohol abuse; C, alcohol dependence; D, substance abuse or dependence (analyzed in the study as one combined category); E, substance abuse; F, substance dependence; G, alcohol abuse/dependence and substance abuse/dependence; H, cannabis abuse or dependence; I, cannabis abuse; J, cannabis dependence; K, substance abuse or dependence, not including cannabis abuse or dependence; L, cocaine dependence; M, examination of 9 classes of substance use disorders: cannabis use disorder, amphetamine use disorder, opiate use disorder, sedative use disorder, tranquilizer use disorder, inhalant/solvent use disorder, cocaine use disorder, hallucinogen use disorder, heroin use disorder; N, heroin dependence

^bKey for time-frame of diagnosis: 1, lifetime or ever diagnosis; 2, past-year or past-12 months; 3, past-month or past-30 days; 4, prior to the past 12 months; 5, at the time of the assessment; 6, since the time of the last assessment

^cKey for current smoking variables: AA, current use at the time of the assessment; BB, smoking "fairly regularly" in the past month; CC, smoking in past 12 months; DD, any smoking between Wave 1 and Wave 2; EE, daily smoking for at least 4 weeks; FF, smoking in the past 30 days; GG, smoked 100 cigarettes in lifetime and smoking during the past 12 months; HH, smoked 100 cigarettes in lifetime and smoking during the past 30 days

^dKey for lifetime smoking variables: AAA, ever smoked daily for a month or more; BBB, smoked 100 cigarettes in lifetime, CCC, ever use

^eKey for nicotine dependence variables: AAAA, Fagerström Test for Nicotine Dependence⁴²; BBBB, DSM criteria

^fKey for quit smoking or relapse to smoking variables: AAAAA, proportion of lifetime smokers who were not current smokers (see definition of current smoking); BBBBB, no smoking in past 12 months; CCCCC, reported lifetime smoking of 100 cigarettes and no smoking for at least 6 months; DDDD, no smoking for at least one week prior to the Wave 1 interview and smoking 100 cigarettes between the Wave 1 and Wave 2 interviews; EEEE, no smoking for at least one year prior to the Wave 1 interview and report of any smoking in the year prior to the Wave 2 interview

^gSample sizes reflect respondents for the SMHWB, NCS, and NHIS respectively

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^qCAGE questionnaire (4 items - Have you ever felt you needed to Cut down on your drinking?, Have people Annoyed you by criticizing your drinking? Have you ever felt Guilty about drinking? Have you ever felt you needed a drink first thing in the morning (Eye-opener) to steady your nerves or to get rid of a hangover?)

^jSample sizes reflect respondents with a lifetime diagnosis of alcohol dependence, cannabis use disorder, or nicotine dependence, respectively

^kSample sizes reflect respondents with a lifetime diagnosis of alcohol, cannabis, and cocaine dependence, respectively

^lSample sizes reflect respondents with lifetime use of alcohol, cannabis, and cocaine, respectively

^mSample sizes reflect respondents with past-year cannabis use disorder and nicotine dependence, cannabis use disorder, and nicotine dependence, respectively

Table 2

Assessed outcomes for the 29 studies included in the review.

References	Lifetime and/or Current Smoking	Lifetime and/or Current Nicotine Dependence	Nicotine Dependence Transitions	Quitting Smoking	Smoking Relapse	Smoking Initiation	Quit Attempts	Withdrawal Symptoms	Non-Cigarette Tobacco Products	Examined outcomes by gender ^d	Examined outcomes by age ^d	Examined outcomes by race/ethnicity ^d
Breslau et al., 1992 ⁴⁸								X				
Fergusson et al., 1994 ³¹	X											
Lasser et al., 2000 ¹⁹	X			X								
Degenhardt et al., 2001 ²¹	X ^b											
Degenhardt et al., 2003 ²²	X											
John et al., 2003 ⁴¹		X				X	X	X				
Grant et al., 2004 ³⁸		X							X			
Agrawal et al., 2008 ³³				X							X	
Agosti et al., 2009 ²³	X			X								
Lawrence et al., 2009 ²⁹	X											
Ayo-Yusuf et al., 2010 ³⁴				X			X					
Hickman et al., 2010 ²⁴	X			X								
Swendsen et al., 2010 ⁴³						X						
Weinberger et al., 2010 ⁴⁹								X				
Goodwin et al., 2011 ⁴⁴												
Hasin et al., 2011 ⁴⁵				X								
Lopez-Quintero et al., 2011 ³⁹		X		X								
Lopez-Quintero et al., 2011 ²⁵	X			X								
García-Rodríguez et al., 2013 ³⁷					X							
Goodwin et al., 2013 ²⁶	X					X						

References	Lifetime and/or Current Smoking	Lifetime and/or Current Nicotine Dependence	Nicotine Dependence Transitions	Quitting Smoking	Smoking Relapse	Smoking Initiation	Quit Attempts	Withdrawal Symptoms	Non-Cigarette Tobacco Products	Examined outcomes by gender ^a	Examined outcomes by age ^a	Examined outcomes by race/ethnicity ^a
Goodwin et al., 2013 ³²	X									X		
Weinberger et al., 2013 ³⁵				X	X							
Fu et al., 2014 ⁵²									X			
García-Rodríguez et al., 2014 ⁴⁰		X				X				X		
Peters et al., 2014 ²⁷	X					X			X			
Redner et al., 2014 ⁵³	X								X			
Smith et al., 2014 ²⁸	X			X						X	X	
Smith et al., 2014 ³⁶				X						X		
Higgins et al., 2016 ³⁰	X									X	X	X

^aExamined differences in the relationship between AUD/SUD and smoking variables by gender, age, or race/ethnicity

^bCurrent tobacco use including cigarettes

Smoking and nicotine dependence for adults with and without alcohol and substance use disorders.

Table 3

Reference	Substance	Current Smoking (% or OR/95% CI)	Lifetime Smoking (% or OR/95% CI)	Current Nicotine Dependence (% or OR/95% CI)
Fergusson et al., 1994 ³¹	Alcohol abuse (versus no alcohol abuse)	OR=18.4* 95% CI=9.8, 34.6		
Lasser et al., 2000 ¹⁹	<i>No diagnosis</i>	22.5	39.1	
	Lifetime alcohol abuse or dependence	43.5*	65.9*	
	Lifetime substance abuse or dependence	49.0*	72.2*	
	Past-month alcohol abuse or dependence	56.1*	67.5*	
	Past-month substance abuse or dependence	67.9*	87.5*	
Degenhardt et al., 2001 ²¹	<i>No past-year cannabis use</i>	20.7		
	Past-year cannabis use	51.1* ^a		
	Past-year cannabis abuse	60.1* ^a		
	Past-year cannabis dependence	70.4* ^a		
Degenhardt et al., 2003 ²²	<i>No past-year alcohol use</i>	15.3		
	Past-year alcohol use	23.9* ^b		
	Past-year alcohol abuse	48.7* ^b		
	Past-year alcohol dependence	51.0* ^b		
Grant et al., 2004 ³⁸	<i>Full sample</i>			12.8
	Past-year alcohol abuse or dependence			34.5*
	Past-year alcohol abuse			25.5*
	Past-year alcohol dependence			45.4*
	Past-year substance abuse or dependence			52.4*
	Past-year substance abuse			44.7*
	Past-year substance dependence			69.3*
Agosti et al., 2009 ²³	Past-year remitted alcohol or substance use disorder	26.0		
	Past-year non-remitted alcohol or substance use disorder	74.0*		

Reference	Substance	Current Smoking (% or OR/95% CI)	Lifetime Smoking (% or OR/95% CI)	Current Nicotine Dependence (% or OR/95% CI)	
Lawrence et al., 2009 ²⁹	<i>No psychiatric disorder -Australia</i>	36.2			
	Past-year alcohol dependence -Australia	61.3*			
	Past-year substance use disorder -Australia	72.6*			
	Past-year alcohol or substance use disorder -Australia	53.6*			
	<i>No psychiatric disorder - U.S.</i>	21.3			
	Past-year alcohol dependence - U.S.	70.9*			
	Past-year substance use disorder - U.S.	67.1*			
	Past-year alcohol or substance use disorder - U.S.	63.6*			
	Hickman et al., 2010 ²⁴	<i>No lifetime psychiatric diagnosis</i>	23.1	37.2	
		Lifetime alcohol abuse	58.1*	81.0*	
Lifetime alcohol dependence		55.5*	84.2*		
Lifetime substance abuse		25.4*	85.3*		
Lifetime substance dependence		61.3*	89.4*		
<i>No past-year psychiatric diagnosis</i>		25.9	41.2		
Past-year alcohol abuse		61.5*	71.9*		
Past-year alcohol dependence		71.8*	81.3*		
Past-year substance abuse		50.6*	62.6*		
Past-year substance dependence		76.8*	81.3*		
Lopez-Quintero et al., 2011 ³⁹	Lifetime alcohol dependence			48.8 ^f	
	Lifetime cannabis dependence			69.6 ^f	
	Lifetime cocaine dependence			71.6 ^f	
Lopez-Quintero et al., 2011 ²⁵	<i>No lifetime alcohol dependence</i>		42.5		
	Lifetime alcohol dependence		71.8 ^{*g}		
	<i>No lifetime cannabis dependence</i>		46.1		
	Lifetime cannabis dependence		81.8 ^{*g}		
	<i>No lifetime cocaine dependence</i>		46.2		

Reference	Substance	Current Smoking (% or OR/95% CI)	Lifetime Smoking (% or OR/95% CI)	Current Nicotine Dependence (% or OR/95% CI)
Goodwin et al., 2013 ²⁶	Lifetime cocaine dependence		87.2 ^{*g}	
	No alcohol dependence symptoms	22.8		
	Alcohol abuse	44.2 ^{*h}		
Goodwin et al., 2013 ³²	Alcohol dependence	56.9 ^{*b}		
	Lifetime alcohol or substance use disorder (versus no alcohol or substance use disorder)	OR=2.8 ^{*i}		
García-Rodríguez et al., 2014 ⁴⁰	Past-year alcohol use disorder	95% CI=2.2, 3.6		
	(versus no alcohol use disorder)			OR=1.45 ^{*j} 95% CI=1.23,1.70
Peters et al., 2014 ²⁷	Lifetime alcohol use disorder			OR=0.79 ^{*j}
	(versus no alcohol use disorder)			95% CI=0.70,0.90
Redner et al., 2014 ⁵³	Past-year cannabis use disorder	84.3 ^f		
	Past-year alcohol dependence	OR=4.42 ^{*k}		
Smith et al., 2014 ²⁸	(versus no alcohol dependence)	95% CI=3.49, 5.60		
	Past-year cocaine dependence	OR=13.20 ^{*k}		
	(versus no cocaine dependence)	95% CI=5.71, 30.52		
	Past-year heroin dependence	OR=24.33 ^{*k}		
	(versus no heroin dependence)	95% CI=6.95, 85.13		
	Past-year cannabis dependence	OR=7.71 ^{*k}		
	(versus no cannabis dependence)	95% CI=5.50, 10.80		
	No diagnosis	15.5	32.3	
	Lifetime alcohol abuse or dependence	39.2 ^{*l}	64.9 ^{*l}	
	Lifetime substance abuse or dependence	53.6 ^{*l}	75.4 ^{*l}	
Higgins et al., 2016 ³⁰	Past-year alcohol abuse or dependence	51.0 ^{*l}	64.5 ^{*l}	
	Past-year substance abuse or dependence	66.7 ^{*l}	77.6 ^{*l}	
	Full sample	21.6		
	Past-year alcohol abuse or dependence	44.3 ^{*m}		
	Past-year substance abuse or dependence	63.7 ^{*m}		

Notes: Data in italics represent the comparison group (e.g., the full respondent sample, adults with no alcohol or substance use disorder diagnosis). Percentages are presented when possible with an asterisk to denote significant comparisons. Odds ratios (OR) and 95% confident intervals (CIs) are presented when percentages were not reported in the article and include an asterisk when significant (i.e., CI does not overlap with 1). Unadjusted ORs are presented unless otherwise noted.

- a* Comparison remained significant after adjusting for demographics and after adjusting for demographics and neuroticism
- b* Comparison remained significant after adjusting for age, gender, education, relationship status, employment status, and neuroticism
- c* Sample sizes reflect respondents for the SMHWB, NCS, and NHIS respectively
- d* Sample sizes reflect respondents with a lifetime diagnosis of alcohol, cannabis, and cocaine dependence, respectively
- e* Sample sizes reflect respondents with lifetime use of alcohol, cannabis, and cocaine, respectively
- f* No comparison group without the respective alcohol, cannabis, or substance use disorder
- g* Analyses adjusted for education, marital status, mood disorders, anxiety disorders, and other substance use disorders
- h* Analyses remained significant after adjusting for age, gender, race, ethnicity, family, income, education level, mood disorders, and anxiety disorders
- i* Outcome variable was nicotine use
- j* Analyses adjusted for age, ethnicity, gender, education, history of divorce, family history of substance use disorders, childhood sexual abuse, childhood vulnerable family environment, impulsivity, low self-esteem, early-onset anxiety, social deviance, history of trauma, psychiatric disorders, personality disorders, physical exercise, social support, religious service attendance, marital problems, stressful life events, past and current substance use disorders, and history of nicotine dependence.
- k* Comparison remained significant after adjusting for demographics
- l* Analyses adjusted for age, gender, and education
- m* Comparison remained significant in multivariate analysis that included gender, age, race/ethnicity, education, poverty status, any mental illness, and AUD (for the analysis of SUD) or SUD (for the analysis of AUD).

Quitting smoking for adults with and without alcohol and substance use disorders.

Table 4

Reference	Substance	Quitting Smoking (cross-sectional data) ^a (% or OR/95% CI)	Quitting Smoking (longitudinal data) ^b (% or OR/95% CI)
Lasser et al., 2000 ¹⁹	<i>No diagnosis</i>	42.5	
	Lifetime alcohol abuse or dependence	34.0*	
	Lifetime substance abuse or dependence	32.1*	
	Past-month alcohol abuse or dependence	16.9*	
	Past-month substance abuse or dependence	22.4*	
Agosti et al., 2009 ²³	<i>Full sample</i>	10.0	
	<i>No lifetime substance use disorder</i>	4.6	
	Past-year remitted substance use disorder	12.0*	
	Past-year non-remitted substance use disorder	7.0	
Ayo-Yusuf et al., 2010 ³⁴	<i>Full sample</i>	14.1	
	<i>Never drank alcohol</i>	16.4	
	<i>No alcohol dependence</i>	16.2	
	Past alcohol dependence	25.0*	
	Current alcohol dependence	6.5*	
	<i>No lifetime psychiatric diagnosis</i>	37.9	
	Lifetime alcohol abuse	28.3*	
Hickman et al., 2010 ²⁴	Lifetime alcohol dependence	34.1*	
	Lifetime substance abuse	25.9*	
	Lifetime substance dependence	31.4*	
	<i>No past-year psychiatric diagnosis</i>	37.2	
	Past-year alcohol abuse	14.4*	
	Past-year alcohol dependence	11.6*	
	Past-year substance abuse	19.0*	
Past-year substance dependence	5.5*		

Reference	Substance	Quitting Smoking (cross-sectional data) ^a (% or OR/95% CI)	Quitting Smoking (longitudinal data) ^b (% or OR/95% CI)
Weinberger et al., 2013 ³⁵	<i>No history of alcohol use disorder</i>		16.9
	Past-year alcohol use disorder		12.4 [*]
	Past alcohol use disorder		12.9 [*]
	<i>No history of substance use disorder</i>		16.3
	Past-year substance use disorder		8.6 [*]
	Past substance use disorder		10.8 [*]
	<i>No history of cannabis use disorder</i>		15.8
	Past-year cannabis use disorder		8.7 [*]
	Past cannabis use disorder		11.5 [*]
	Smith et al., 2014 ²⁸	<i>No diagnosis</i>	48.3
Lifetime alcohol abuse or dependence		34.6 ^{*c}	17.6 ^{*c}
Lifetime substance abuse or dependence		25.7 ^{*c}	15.4 ^{*c}
Past-year alcohol abuse or dependence		17.0 ^{*c}	17.7 ^{*c}
Past-year substance abuse or dependence		9.8 ^{*c}	13.8 ^{*c}
Men with a past-year AUD			OR=0.88 [*]
(versus men with no past-year AUD)			CI=0.77, 0.99
Women with a past-year AUD			OR=0.78 [*]
(versus women with no past-year AUD)			CI=0.68, 0.90

Notes: Data in italics represent the comparison group (e.g., the full respondent sample, adults with no alcohol or substance use disorder diagnosis). Percentages are presented when possible with an asterisk to denote significant comparisons. Odds ratios (OR) and 95% confident intervals (CIs) are presented when percentages were not reported in the article and include an asterisk when significant (i.e., CI does not overlap with 1). Unadjusted ORs are presented unless otherwise noted.

^aCross-sectional data collection; participants who reported they were lifetime smokers who were not current smokers

^bLongitudinal data collection; participants who were smoking at one assessment and were not smoking at a later assessment

^cAnalyses adjusted for age, gender, and education