

Tobacco and Alcohol: Understanding Co-Use to Reduce Cancer Incidence and Mortality



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24

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Tobacco and Alcohol: Understanding Co-Use to Reduce Cancer Incidence and Mortality

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About the National Cancer Institute Tobacco Control Monograph Series

The National Cancer Institute established the Tobacco Control Monograph series (formerly the Smoking and Tobacco Control Monograph series) in 1991. The series provides comprehensive scientific reviews of tobacco use, treatment, and prevention topics to inform the work of researchers, clinicians, and public health practitioners working to reduce cancer morbidity and mortality. All 24 Tobacco Control Monographs and their supplemental materials can be downloaded from cancercontrol.cancer.gov/monographs.

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Foreword

Tobacco and alcohol are two of the most commonly used addictive substances in the United States. Whether consumed individually or together, their negative toll on health is substantial. Tobacco use is the leading risk factor for cancer, accounting for nearly 20% of cancer incidence, while alcohol is the third leading cause. In addition to cancer, tobacco and alcohol cause many other chronic diseases; adverse reproductive outcomes; and, especially for alcohol, increased risk of accidents and injury. As this monograph describes, use of both tobacco and alcohol products—known as “co-use”—is common, and there is strong correlation between dependence on tobacco and alcohol. In the United States, an estimated 11.8% of adults (approximately 30 million people) report both smoking cigarettes and drinking alcohol in the past month. Initiation of tobacco and alcohol use often begins in adolescence, and early onset of use is a strong predictor of dependence, cancers caused by tobacco, and many other chronic and acute health conditions.

There are strong biological relationships between tobacco and alcohol. Nicotine (the primary addictive constituent of tobacco) and ethanol (the primary addictive constituent of alcohol-containing beverages) each affect the three major neurobiological circuits implicated in dependence and addiction (i.e., the basal ganglia, the extended amygdala, and the prefrontal cortex). Tobacco use increases the risk of cancer through numerous carcinogens, including those formed from combustion. Alcohol use causes cancer via the effects of ethanol and its metabolic product, acetaldehyde (which is also found in tobacco smoke) and via effects on metabolism, oxidative stress, inflammation, and hormonal pathways. Alcohol may also influence tobacco-related carcinogenesis through its effects on membrane permeability, epigenetic changes, and promotion of tumor growth. In addition to each causing cancer individually, co-use of tobacco and alcohol is associated with synergistically higher risk of head and neck and esophageal cancers, and potentially with cancer at other sites.

With this background in mind, the publication of a National Cancer Institute (NCI) Tobacco Control Monograph is a critical step to increase attention on the importance of addressing co-use of tobacco and alcohol for cancer prevention and health promotion. A key goal of the monograph is to examine how tobacco control, including prevention and cessation of tobacco use, can be improved by addressing alcohol use. As the monograph explains, the co-use of tobacco and alcohol is driven by complex biological and genetic factors, including the neurobiology of addiction, the physiological effects of tobacco and alcohol exposures, behavioral genetics, carcinogenesis, and psychological processes. Tobacco and alcohol co-use is also influenced by an intricate and interconnected landscape of social, economic, and policy factors. The monograph emphasizes each of these important factors by summarizing the literature, highlighting research needs, and drawing conclusions relevant to diverse audiences.

Research focused on tobacco and alcohol has long been funded and conducted by the National Institute on Drug Abuse (NIDA), the National Institute on Alcohol Abuse and Alcoholism (NIAAA), and NCI. The work of these three institutes spans neuroscience and behavior, epidemiology, public health interventions, clinical treatment, and medication development, to name just a few scientific domains. In 2013, the National Institutes of Health (NIH) formed the Collaborative Research on Addiction at NIH (CRAN) initiative, an NIH-wide initiative to enhance integration of the work of these three NIH Institutes in better understanding and

addressing morbidity and mortality from alcohol, tobacco, and other addictive substances. The signature project of CRAN is the Adolescent Brain Cognitive Development (ABCD) Study, launched in 2015. This long-term study of brain development and child health enrolled nearly 12,000 children ages 9–10 who are being followed for at least a decade using structural and functional brain imaging together with genetic, neuropsychological, behavioral, and other health assessments to understand brain development in adolescents. Among the questions to be addressed by ABCD is how the use of tobacco and alcohol affects the structure and function of the adolescent brain. This volume clearly highlights the importance of this question because both tobacco and alcohol use typically begins during adolescence, and early onset of substance use is linked to greater dependence and higher risk of disease. By disseminating the latest evidence and effective practices related to addressing tobacco and alcohol co-use, this monograph makes an important contribution to the enhanced integration that was envisioned when CRAN was formed.

This monograph describes numerous research needs that may inform scientists in these fields. A few are highlighted here:

1. Improved measurement and epidemiological surveillance of tobacco and alcohol use is frequently identified as an important area for improvement. Many studies would benefit from assessing both tobacco and alcohol use and co-use in greater depth, including considering the evolving marketplace of both tobacco and alcohol products.
2. A better understanding of the cancer risks of tobacco and alcohol co-use, especially for cancers in addition to those of the head and neck and esophagus (for which synergistic risk is already known). Attention is needed to the potential for synergistic risks, along with a better understanding of the biological mechanisms underlying these risks.
3. Although there are effective treatments for tobacco use and alcohol use and/or use disorder individually, few interventions have been developed to treat co-use. Given the large number of people who use both substances, this is an important area of continued study.
4. Better evidence concerning integrated interventions (e.g., program, policy, public education, clinical) to prevent tobacco and alcohol use and co-use among adolescents and young adults is urgently needed to advance cancer prevention and public health.

The monograph's key findings and conclusions will also inform public health practitioners, clinicians, and the public. For example, because alcohol use, especially heavy alcohol use, is a barrier to successful smoking cessation, people trying to quit smoking should be advised and assisted to reduce or stop their alcohol use. Additionally, providing smoking cessation treatment during treatment for alcohol use disorder does not threaten sobriety outcomes; this is important because a high percentage of people entering treatment for alcohol use disorder or substance abuse disorder also smoke cigarettes. However, many substance use treatment facilities have yet to incorporate tobacco cessation services into their program offerings, and there are many opportunities, including smokefree policies and integrated treatment systems, to implement these systems of care.

NIDA, NIAAA, and NCI have supported research to reduce the morbidity and mortality caused by tobacco and alcohol products for many decades, and success in tobacco control has dramatically reduced the burden of cancer caused by tobacco. However, more work is needed to achieve comprehensive tobacco control and relatively little progress has been made in addressing

tobacco and alcohol co-use or addressing alcohol alone as a target for cancer prevention and control. Notably, more effort is needed to address barriers between the fields—both with regards to individual substances and to research domains—to better understand the complex patterns and determinants of substance use among both youth and adults. This monograph is an important step to better integrate work to address tobacco and alcohol use, which are among the nation’s most commonly used hazardous and addictive substances. Advancing research on the co-use of tobacco and alcohol will help shape effective interventions to mitigate the combined impact of these addictive products on cancer incidence and mortality.

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Table of Abbreviations and Acronyms

Abbreviation/Acronym	Definition
ABV	Alcohol by volume
ADH	Alcohol dehydrogenase
aHR	Adjusted hazard ratio
AI/AN	American Indian and Alaska Native
AICR	American Institute for Cancer Research
ALDH	Aldehyde dehydrogenase
aOR	Adjusted odds ratio
AUD	Alcohol use disorder
BAC	Blood alcohol content
BRFSS	Behavioral Risk Factor Surveillance System
CBT	Cognitive behavioral therapy
CDC	U.S. Centers for Disease Control and Prevention
CI	Confidence interval
COVID-19	Coronavirus disease 2019
CYP2A6	Cytochrome P450 2A6
CYP2E1	Cytochrome P450 2E1
DNA	Deoxyribonucleic acid
DSM	Diagnostic and Statistical Manual of Mental Disorders
EMA	Ecological momentary assessment
FDA	U.S. Food and Drug Administration
FSPTCA	Family Smoking Prevention and Tobacco Control Act
FTC	U.S. Federal Trade Commission
ENDS	Electronic nicotine delivery system
GWAS	Genome-wide association study
HED	Heavy episodic drinking
HID	High-intensity drinking
HINTS	Health Information National Trends Survey
HNSCC	Head and neck squamous cell carcinoma
HIV	Human immunodeficiency virus
HR	Hazard ratio
HTP	Heated tobacco product
HPV	Human papillomavirus
IARC	International Agency for Research on Cancer
MLDA	Minimum legal drinking age

Table of Abbreviations and Acronyms

Abbreviation/Acronym	Definition
MSA	Master Settlement Agreement
MTF Study	Monitoring the Future Study
nAChR	Nicotinic acetylcholine receptors
NAS	National Alcohol Survey(s)
NCI	National Cancer Institute
NESARC	National Epidemiologic Survey on Alcohol and Related Conditions
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIDA	National Institute on Drug Abuse
NIH	National Institutes of Health
NNK	Nicotine-derived nitrosamine ketone
NNN	N'-nitrosonornicotine
NMR	Nicotine metabolite ratio
NSDUH	National Survey on Drug Use and Health
NRT	Nicotine replacement therapy
NYTS	National Youth Tobacco Survey
OR	Odds ratio
PATH	Population Assessment of Tobacco and Health
PHS	Public Health Service
RCT	Randomized controlled trial
RR	Relative risk or risk ratio
RTD	Ready-to-drink
SAMHSA	Substance Abuse and Mental Health Services Administration
SEER	Surveillance, Epidemiology, and End Results (program)
SES	Socioeconomic status
SNP	Single nucleotide polymorphism
SUD	Substance use disorder
T21	Tobacco 21 (law)
TUD	Tobacco use disorder
TUS-CPS	Tobacco Use Supplement to the Current Population Survey
U.S.	United States of America
USDA	U.S. Department of Agriculture
USDHHS	U.S. Department of Health and Human Services (HHS)
USPSTF	United States Preventive Services Task Force
WCRF	World Cancer Research Fund

Abbreviation/Acronym	Definition
WHO	World Health Organization
YRBS	Youth Risk Behavior Survey

Glossary

Term	Definition
Alcohol	A chemical substance found in drinks such as beer, wine, and liquor. It is also found in some medicines, mouthwashes, household products, and essential oils (scented liquid taken from certain plants). It is made by a chemical process called fermentation that uses sugars and yeast. There are different types of alcohol. The type used to make alcoholic drinks is called ethyl alcohol (ethanol).
Alcohol by volume (ABV)	A standard measure of how much alcohol (ethanol) is contained in a given volume of a drink. The amount of alcohol in a container is shown as a percentage of the overall volume of the drink.
Alcohol use disorder	A medical condition characterized by an impaired ability to stop or control alcohol use despite adverse social, occupational, or health consequences. It encompasses the conditions that some people refer to as alcohol abuse, alcohol dependence, alcohol addiction, and the colloquial term alcoholism. Considered a brain disorder, alcohol use disorder can be mild, moderate, or severe.
Beer	Fermented beverage using cereal grains, commonly malted barley. The alcohol by volume for beers typically ranges between 3% to 6%. Some beers have 15% or more alcohol by volume.
Cider	Fermented beverage using fruits. The alcohol by volume for ciders ranges from 4% to 8%.
Electronic nicotine delivery systems (ENDS)	A rapidly changing class of tobacco products known by many different names, including e-cigarettes, e-cigs, vapes, mods, and tank systems. ENDS deliver an aerosol to the user that typically contains nicotine, propylene glycol, vegetable glycerin, and flavoring chemicals.
Liquor	Fermented beverages that include two broad categories—liqueurs and distilled spirits. Liqueurs are flavored and sweetened beverages with a typical alcohol by volume range of 15% to 30%. Distilled spirits have a typical alcohol by volume range of 35% to 55%.
Nicotine	An addictive, poisonous chemical found in tobacco. It can also be made in the laboratory. When it enters the body, nicotine causes an increased heart rate, an increased use of oxygen by the heart, and a sense of well-being and relaxation.
Nicotine replacement therapy	A type of treatment that uses special products to give small, steady doses of nicotine to help stop cravings and relieve symptoms that occur when a person is trying to quit smoking. These products include nicotine gums, nicotine inhalers, nicotine nasal sprays, nicotine lozenges, and nicotine patches, and some are available without a prescription. They do not contain any of the other chemicals found in tobacco products.
Pack year	A standard measure of the amount a person has smoked over a period. It is calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the person has smoked.
Ready-to-drink beverages (RTDs)	Alcoholic beverages often mixed with soft drinks. RTDs are sometimes referred to as “alcopops” or “flavored alcoholic beverages,” with their alcohol by volume ranging from 3% to 7%.
Smoking	Cigarette use.
Smoking cessation treatment	Treatment aimed at smoking reduction, smoking cessation, and relapse prevention after treatment.
Tobacco use	The use of tobacco products including cigarettes, cigars, hookah, ENDS, and smokeless tobacco. In this monograph, tobacco use refers to the use of commercial tobacco and not the sacred and traditional use of tobacco by some American Indian communities.
Wine	Fermented beverage using grapes. Includes red wines, white wines, rose wines, sparkling wines, and fortified wines. The ABV for wines varies widely, with most ranging from 8% to 14%.