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Etiology of Alcohol, Tobacco, and Substance Use Disorders

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Overview

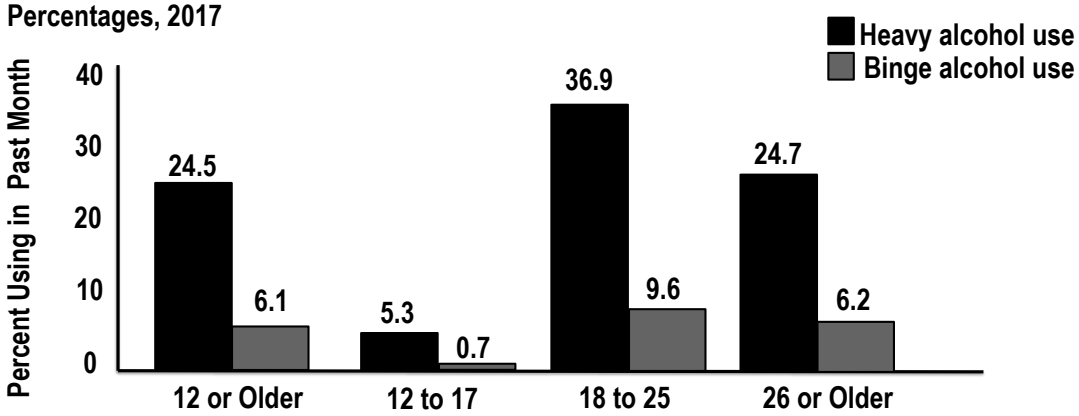
- Prevalence of substance use and substance use disorders
- Defining substance use disorders
- Comorbidity among substance use disorders
- Relevant etiological factors
- Implications for respiratory therapists

Prevalence of Substance Use and Substance Use Disorders

- Substance use is not uncommon in the U.S.

National Survey on Drug Use and Health: Alcohol

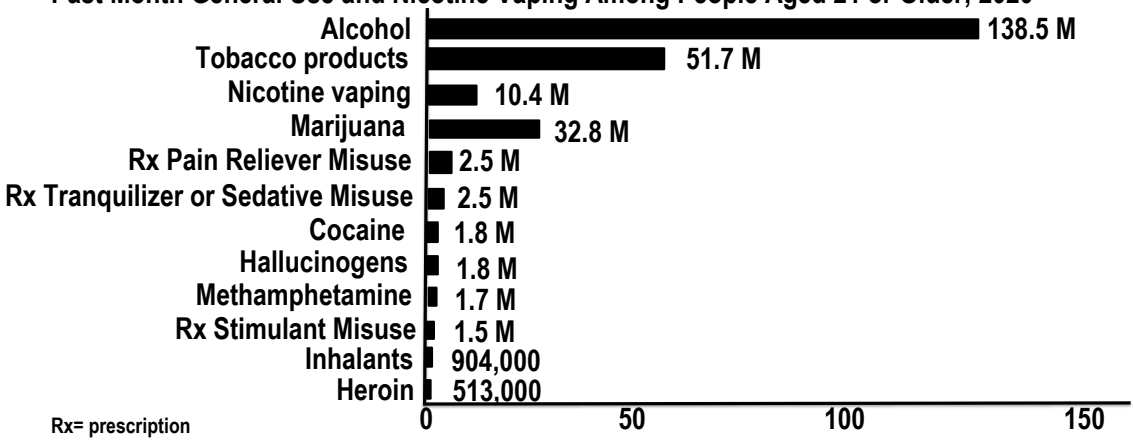
Past month binge and heavy alcohol use among people aged 12 or older, by age group: Percentages, 2017



Note: Since 2015, the threshold for determining binge alcohol used for males is consuming five or more drinks on an occasion and for females is consuming four or more drinks on an occasion

National Survey on Drug Use and Health: 2020 Data

Past Month General Use and Nicotine Vaping Among People Aged 21 or Older; 2020

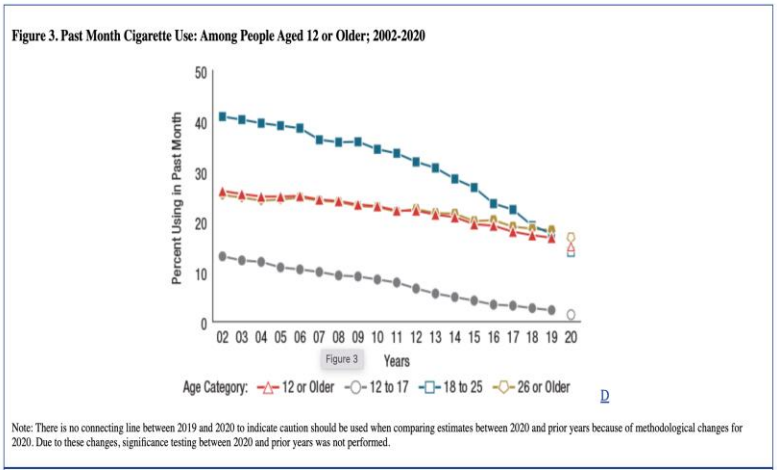


Rx= prescription

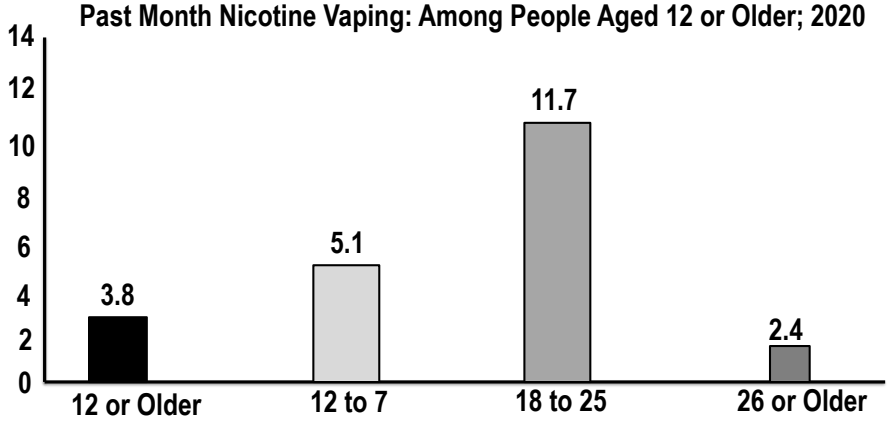
Note: General Substance Use includes any illicit drugs, alcohol, and tobacco product use. Tobacco products are defined as cigarettes, smokeless tobacco, cigars and pipe tobacco.

The estimated numbers of current users of different substances are not mutually exclusive because people could have used more than one type of substance in the past month.

National Survey on Drug Use and Health: Tobacco 2020



National Survey on Drug Use and Health: Vaping 2020

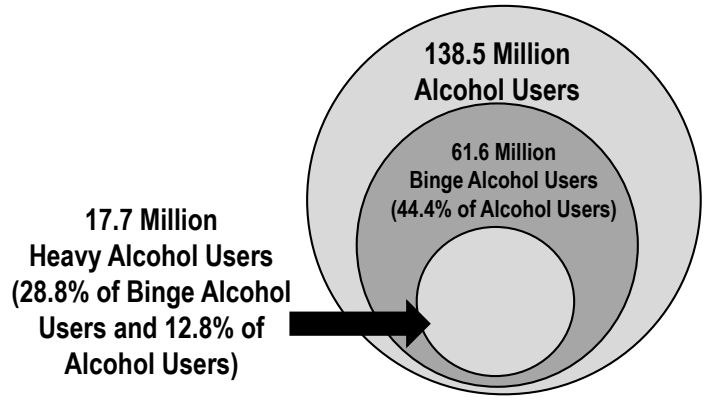


E-cigarettes have been the most commonly used nicotine product among youths since 2014

National Survey on Drug Use and Health: 2020 Data

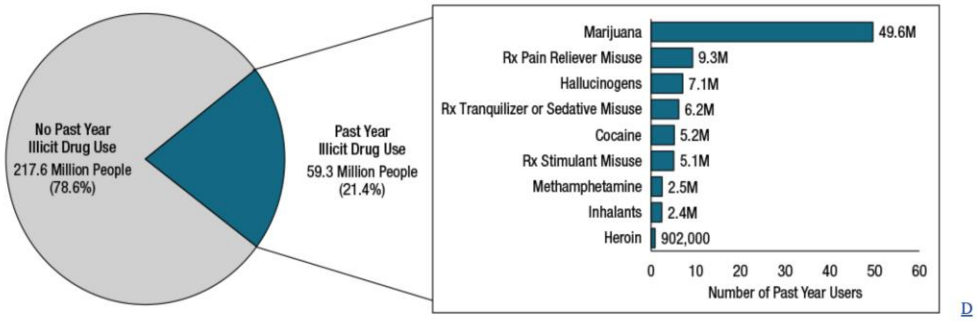
Current, Binge, and Heavy Alcohol Use: Among People Aged 12 or Older; 2020

Note: Binge Alcohol Use is defined as drinking five or more (for males) or four or more drinks (for females) on the same occasion on at least 1 day in the past 30 days. Heavy Alcohol Use is defined as binge drinking on the same occasion on 5 or more days in the past 30 days; all heavy alcohol users are also binge alcohol users.



National Survey on Drug Use and Health: 2020 Data

Figure 9. Past Year Illicit Drug Use: Among People Aged 12 or Older; 2020



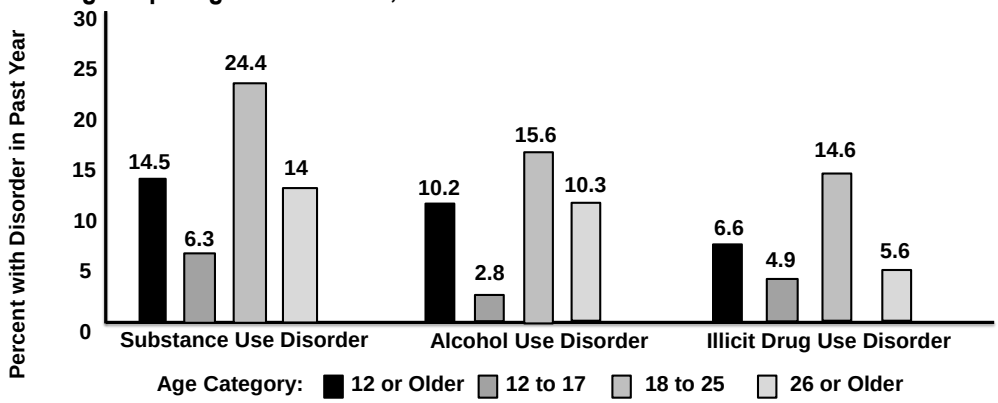
Rx = prescription.
Note: The estimated numbers of past year users of different illicit drugs are not mutually exclusive because people could have used more than one type of illicit drug in the past year.

Prevalence of Substance Use and Substance Use Disorders

- Substance use is not uncommon in the U.S.
- Substance use disorders (SUDs) are also prevalent

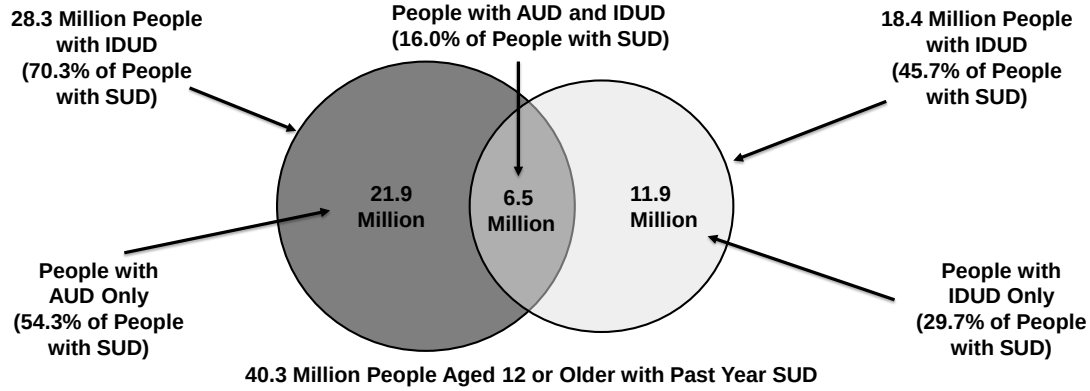
National Survey on Drug Use and Health: 2020 Data

Substance Use Disorder, Alcohol Use Disorder, and Illicit Drug Use Disorder in the Past Year Among People Aged 12 or Older; 2020



National Survey on Drug Use and Health: Illicit Drugs 2020

Alcohol Use Disorder (AUD) and Illicit Drug Use Disorder (IDUD) in the Past Year: Among People Aged 12 or Older with a Past Year Substance Use Disorder (SUD); 2020



What is Substance Use Disorder?

- Diagnostic and Statistical Manual (DSM) of Mental Disorders
- DSM-IV
  - 7 substance "dependence" symptoms (3 or more to meet criteria)
  - 4 "abuse" symptoms (1 or more to meet criteria)

What is Substance Use Disorder?

- Dependence and abuse does not apply to all substances
  - A patient could have alcohol abuse but not tobacco abuse

Recent Changes to Substance Use Disorder Symptoms

- DSM-5 completely eliminates word "dependence", changes to "substance use disorder"
  - Including tobacco, which in DSM-IV only included dependence

DSM-5: 2 of 11 to meet Dx

- Taking the substance in larger amounts or for longer than you meant to
- Wanting to cut down or stop using the substance but not managing to
- Spending a lot of time getting, using, or recovering from use of the substance
- Cravings and urges to use the substance

DSM-5: 2 of 11 to meet Dx

- Not managing to do what you should at work, home, or school, because of substance use
- Continuing to use, even when it causes problems in relationships
- Giving up important social, occupational, or recreational activities because of substance use
- Using substances again and again, even when it puts you in danger

DSM-5: 2 of 11 to meet Dx

- Continuing to use, even when you know you have a physical or psychological problem that could have been caused or made worse by the substance
- Needing more of the substance to get the effect you want (tolerance)
- Development of withdrawal symptoms, which can be relieved by taking more of the substance

Consequences of Substance Use and Substance Use Disorders

- Leading causes of preventable deaths in the U.S.

Substance Use: Leading Causes of Preventable Death

- **Tobacco use is the leading preventable cause of death in U.S. (CDC, 2020)**
  - **Tobacco use causes about 7 million deaths a year worldwide**
  - **About 480,000 deaths a year (20% of all deaths) caused by cigarette smoking in U.S.**
  - **On average, smokers die 10 years earlier than nonsmokers**

Substance Use: Leading Causes of Preventable Death

- **Excessive alcohol use is a leading preventable cause of death in U.S. (CDC, 2022)**
  - **About 140,000 people die each year in the U.S.**
  - **On average, an individual's life is cut short by 26 years**

Substance Use: Leading Causes of Preventable Death

- Drug overdose leading cause of injury death in U.S. (CDC, 2020)
  - In 2020 - 91,799 drug overdose deaths occurred in the U.S.
  - The age-adjusted rate of overdose deaths increased by 31% from 2019 (21.6 per 100,000) to 2020 (28.3 per 100,000)

Consequences of Substance Use and Substance Use Disorders

- Leading causes of preventable deaths in the U.S.
- Economic costs

Substance Use: Economic Costs

- Smoking costs the U.S. approximate $300 billion a year (CDC, 2021)
  - At least $225 billion for direct medical care of adults and more than $156 billion in lost productivity
  - $5.6 billion for lost productivity due to exposure to secondhand smoke

Substance Use: Economic Costs

- Alcohol misuse problems cost the U.S. about $249 billion a year (CDC, 2019)
- Workplace productivity (179 billion) and healthcare expenses (28 billion) two leading costs
- Illicit drug use alone accounts for $193 billion in healthcare, productivity loss, crime, incarceration, and drug enforcement (HHS, 2022)

Consequences of Substance Use and Substance Use Disorders

- Leading causes of preventable deaths in the U.S.
- Economic costs
- Linked to multiple risks

Risks Associated with Problematic Substance Use

Short-Term Risks	Long-Term Risks
Injuries	Hypertension, liver disease, heart disease, and stroke
Violence	Cancer
Overdose	Learning/memory problems
Risky behaviors	Mental health problems
Risk for pregnant women	Social problems

Consequences of Substance Use and Substance Use Disorders

- Consequences specific to respiratory health - tobacco use and tobacco use disorders
- Risks include: shortness of breath, aggravation of asthma, impotence, infertility, increased carbon monoxide concentration, bronchitis, emphysema, and lung cancer
- Children living in households with smokers have a higher risk of respiratory infection, asthma, and middle ear infection

Consequences of Substance Use and Substance Use Disorders

- Consequences specific to respiratory health - AUD
- Pneumonia (Morojele et al., 2021)
- Patients with AUDs have increased risk for infection/spread of bacteria in the blood and shock from typical pathogens (Jong et al., 1995; Perlino & Rimland, 1985)
- Community-acquired pneumonia is more fatal for individuals with AUDs (64%) vs. other patients (20%) (Jong et al., 1995)

Consequences of Substance Use and Substance Use Disorders

- Acute Respiratory Distress Syndrome (ARDS) (Morojele et al., 2021)
- ARDS - deficiency of oxygen in bloodstream as a result of accumulation of fluid in airspaces that is not explained by heart failure
- Incidence of ARDS is 43% for those with AUD vs. 22% without

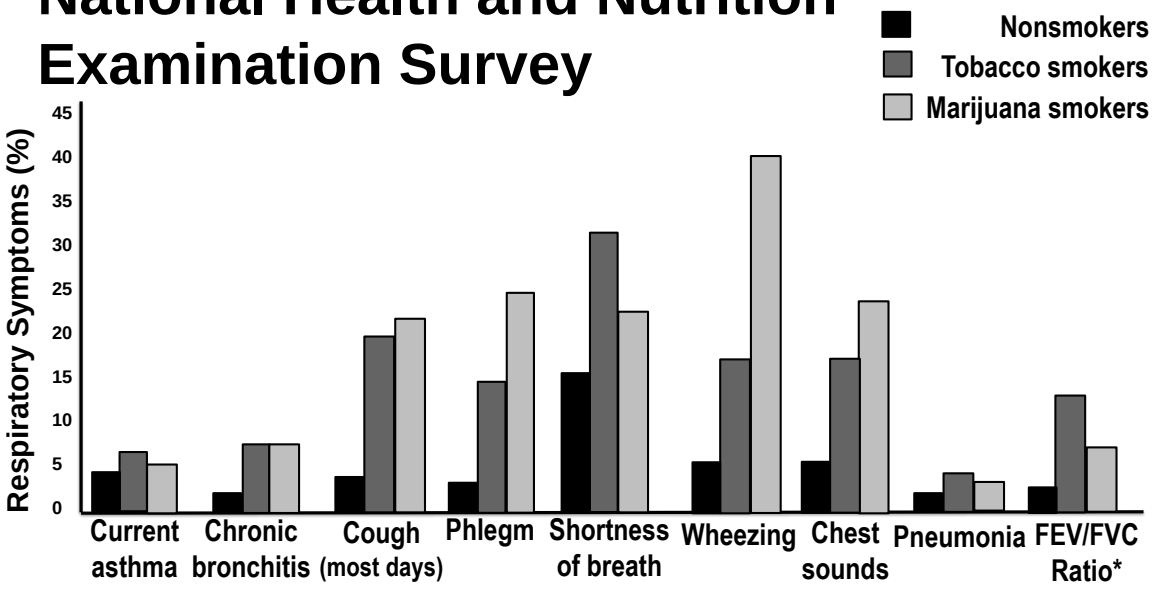
Consequences of Substance Use and Substance Use Disorders

- Mortality rate is 65% for those with AUD vs. 26% without (Moss et al., 1996)
- Prospective data indicate patient with AUD is 3.7 times more likely to develop ARDS, with 50% of patients who develop ARDS to have AUD (Moss et al., 2003)

Consequences of Substance Use and Substance Use Disorders

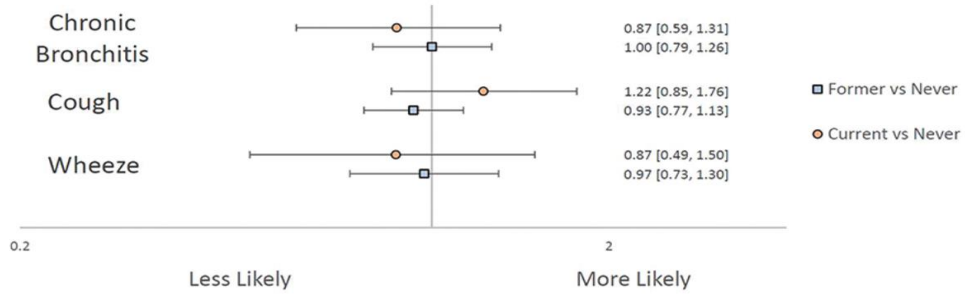
- Consequences specific to respiratory health: DUD
- Illicit drugs that can affect the respiratory system (NIDA, 2020)
  - Cocaine
  - GHB and Ketamine
  - Heroin
  - Inhalants
  - Marijuana
  - PCP
  - Prescription opiates

National Health and Nutrition Examination Survey



More Recent Data (Morris et al., 2018)

Figure 1. Respiratory Symptoms Among Current and Former Cannabis Users

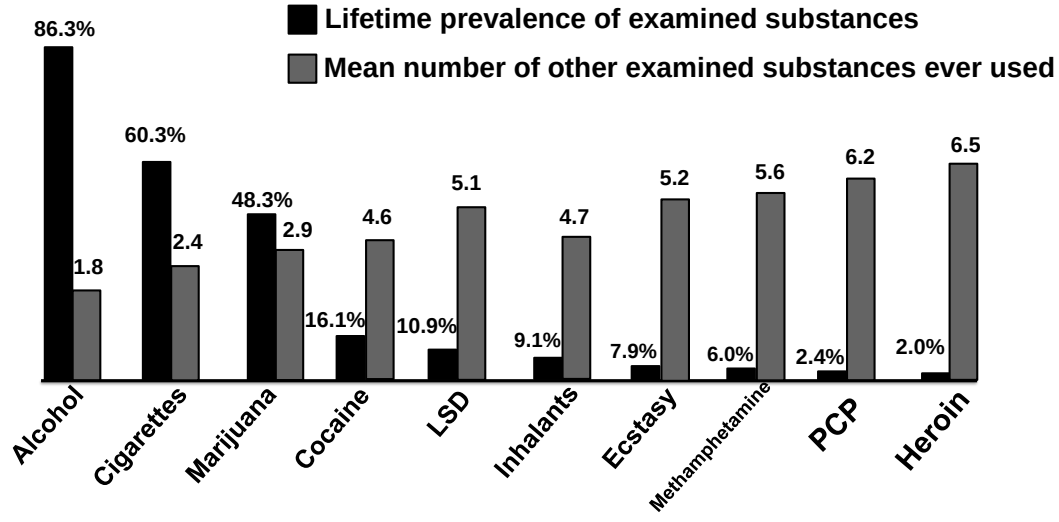


Multivariate analysis: odds ratios comparing former and current cannabis users to never cannabis users. Adjusted for age, race, gender, FEV_1%, current tobacco smoking status, pack years, and joint years.

Comorbidity of Substance Use and Substance Use Disorders

- Substance use and substance use disorders across various substances are highly comorbid
- Individuals who use a given substance are more likely to use other substances, experience various substance use disorders

National Epidemiological Study on Alcohol and Related Conditions

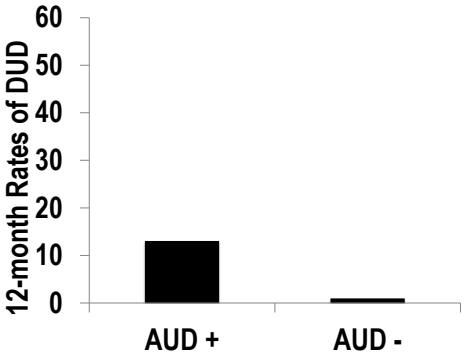


Excessive Alcohol Use and Smoking

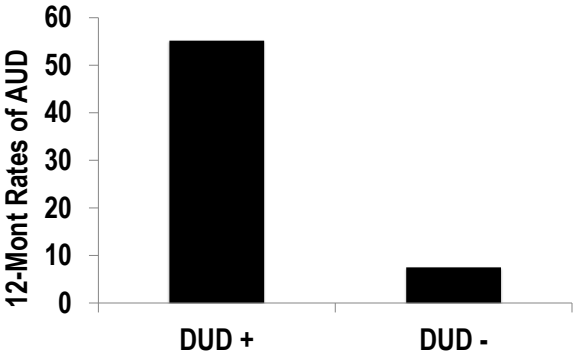
- Comorbidity with smoking/tobacco dependence
  - The heaviest alcohol consumers are also the heaviest consumers of tobacco
    - Heavy drinkers are four times more likely to smoke than the general population (Garnett et al., 2022)
- Individuals that engage in heavy and even moderate drinking are less likely to quit smoking (Lynch et al., 2018)

National Epidemiological Study on Alcohol and Related Conditions

Rates of Drug Use Disorders (DUD) as Function of Alcohol Use Disorder (AUD)



Rates of Alcohol Use Disorder (AUD) as Function of Drug Use Disorder (DUD)



Summary: Substance Use and Substance Use Disorders

- Substance use and misuse is relatively common in the U.S.
  - Problematic substance use is related to various negative consequences
    - Including issues directly relevant for respiratory health
- Strong evidence of comorbidity between substance use, SUDs
  - e.g., an individual who smokes is very likely to also drink alcohol, and many use at problematic levels

Etiological Models of Substance Use Disorders

- Given issue related to problematic substance use, determining the various factors that contribute to SUDs is important
- Etiology - the cause, set of causes, or manner of causation of a disease or condition

Considerations of Etiology of SUDs

- Etiology of SUDs is complex
  - Multiple factors (e.g., genetic, environmental) at various levels of analysis (e.g., societal, family, individual) that may interact in complex ways to influence SUDs
  - Similar factors contribute to development of multiple SUDs
- Etiology of SUDs is difficult to study
  - Ethical/practical considerations limit inference
    - Need for other lines of evidence, e.g., animal models
- Etiology for a particular individual or substance may be unique
  - Factors that lead "Bob" to an AUD may be different compared to "Sue", and different factors may have contributed to "Bob's" smoking

Etiological Models of SUDs (Sher et al., 2005)

- Affect regulation (Weiss et al., 2022; Votow & Witkiewitz, 2021)
  - Positive and negative
- Pharmacological vulnerability (Nehring et al., 2021)
- Deviance Proneness (Stewart et al., 2021; Waddell et al., 2022)
- Genetics (Deak & Johnson, 2021)
- Environmental Influences (Meyers & Salvatore, 2021)
  - Interfamilial influences
  - Peer influences
- Personality (Tackett & Mullins-Sweatt, 2021)

Affect Regulation

- Positive affect regulation (e.g., most drinkers expect alcohol use to be a positive, pleasurable experience)
- Using substances for positive reinforcement/"enhancement" a common motive/reason to use
  - Using "to get high", "because it makes you feel good", "buzz"
- Associated with positive expectancies and personality traits related to reward seeking (e.g., sensation seeking)
- Based on neuropharmacological effects on brain centers involved in basic reward mechanisms (e.g., alcohol, other drugs of abuse stimulate mesolimbic dopamine activity, opioids systems)

Affect Regulation

- Enduring etiological model - SUDs develop because substances alleviate negative affect
  - "Self-medication" or tension-reduction hypothesis
- Individuals have strong expectations that substances reduce anxiety/stress
- Negative reinforcement motives/reasons related to both consumption and problems of SUDs
- Despite beliefs, laboratory studies suggest relation between substance and negative affect complex
  - Depends on expectancies, genetics, stress-inducing environments, etc.

Pharmacological Vulnerability

- Pharmacological Vulnerability model (Sher, 1991)
  - Proposes that individuals differ in their responses to acute and/or chronic effects from substances
- Especially low or high sensitivity may be problematic
  - Low sensitivity - relatively insensitive to reinforcement (either positive or negative) and thus must consume more substance to get desired effect, thus increasing risk of physiological dependence
  - High sensitivity - are more sensitive to reinforcement (either positive or negative) from substance and are more likely to use substances because get comparatively greater effect

Deviance Proneness

- Deviance Proneness model (Sher, 1991)
  - Problematic substance use is part of a general deviant pattern rooted in childhood and is attributable to deficient socialization
- Common correlates of SUDs:
  - History of childhood antisocial behavior problems
  - Childhood achievement problems
  - Poorer childhood interpersonal relations
  - Less parent-child contact, inadequate parenting
- Problem Behavior Theory
  - Personality, family, peer, and other environmental variables relate to involvement in range of deviant behaviors including substance use

Genetics

- Well understood that substance use disorders run in families
  - Originally thought to be a result of modeling
- Now established much of the familial effect due to genetics
  - Pedigree studies
  - Twin studies
  - Adoption studies
  - Measured gene studies

Genetic Studies

- **Pedigree studies**
  - **Increase in risk for developing SUD (e.g., AUD) about 4-7 times higher among first-degree relatives of individuals with SUDs compared to general population**
  - **However, most offspring of individuals with SUDs do not go on to develop an SUD in their lifetime**
- **Twin studies**
  - **Compare phenotypic similarity between MZ and DZ twins**
    - **MZ share 100% genes; DZ share 50%**
    - **High concordance between MZ vs. DZ suggests heritable influence**
  - **Suggests heritability in SUDs about 50%**

Genetic Studies

- **Adoption studies**
  - **Studies of adopted infants placed in nonalcoholic homes find adopted children of an alcoholic parent develop SUDs as adults at a higher rate than do adopted children with neither biological parent affected with SUDs**
  - **Demonstrates familial risk is more than "modeling"**
- **Measured genotypic studies**
  - **Molecular genetics studies measure specific genotypes**
    - **e.g., ADH2 and ADH3 variants relate to risk in Asian populations**
  - **Many Genome Wide Association Studies (GWAS) have attempted to identify specific genetic markers of SUDs**
    - **Difficulty identifying single markers of risk**
    - **Genetics of SUDS increasingly viewed as complex-multiple genes in various locations**

Environmental Influences: Interfamilial

- Prenatal Substance Exposure
  - Prenatal exposure to substances has been implicated as a specific risk factor for development of psychiatric disorders that are often comorbid with SUDs
    - e.g., fetal alcohol syndrome causes cognitive, behavioral problems and increases rates of subsequent antisocial behavior and SUDs
- Prenatal exposure to drugs may lead to specific drug sensitivities and preferences
  - Pharmacological Vulnerability
- Parenting practices
  - Parents who abuse substances often demonstrate poor family management practices such as lax/inconsistent supervision/monitoring
  - Harsh/inconsistent discipline associated with earlier initiation of substance use

Environmental Influences: Peer Influences

- Adolescents' and young adults' substance use is similar to their peers or friends
- Two main processes - socialization and selection
  - Socialization - individual's alcohol use is influenced by peer group
    - Increases substance use through social learning, peer group influence, modeling, and social facilitation
  - Selection - individuals select peers with similar patterns of substance use
    - Adolescents from disadvantaged, dysfunctional environments, and predisposed towards antisocial behaviors are more likely to select into deviant peer groups
  - Regardless of socialization or selection process, proportion of peers who use substances a strong predictor of developing SUDs

Personality

- Problematic substance use and substance use disorders also associated with personality characteristics
- Impulsivity - broad construct reflecting various differences in decision making
  - Numerous studies suggest robust relation between traits associated with impulsivity, development and course of SUDS
- Neuroticism/negative emotionality - tendency to experience negative mood states
  - Cross-sectional evidence of association with SUDs, more mixed findings with prospective data
- Extraversion - tendency to enjoy and engage in social interactions
  - Tenuous relation with SUDs

Etiology of SUDs: Takeaways

- Various models regarding etiology of SUDs
  - NOT mutually exclusive
  - Most likely suggest additive/super additive influences
- No "definitive" etiological model of SUDs
  - Each model has various degrees of empirical support
- Individuals with SUDs suffer from a complex, biologically-influenced condition
  - Strong heritable base
  - Influenced by multiple environmental factors that interact with genetic diathesis

Summary

- Problematic substance use and SUDs have negative consequences for individuals, families, and societies
- These conditions largely represent preventable death/injury, and make up a large proportion of respiratory illnesses that are preventable
- As respiratory therapist, it is important to understand that SUDs are complex disorders involving biological and environmental factors
  - Heritability, certain environmental influences out of a given individual's "control"
  - Implications for stigma, respect when working with patients with SUDs

Resources for Respiratory Therapist

- Locating treatment services
  - National Drug and Alcohol Treatment Referral Routing Service (1-800-662-HELP)
  - http://findtreatment.samhsa.gov

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