



Chapter 9 Alcohol



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"Alcohol" by the Barenaked Ladies

Alcohol, my permanent accessory
Alcohol, a party-time necessity
Alcohol, alternative to feeling like yourself
O Alcohol, I still drink to your health

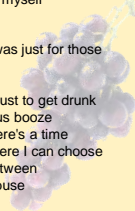
I love you more than I did the week before
I discovered alcohol

I love you more than I did the week before
I discovered alcohol

O Alcohol, would you please forgive me?
For while I cannot love myself
I'll use something else

Forget the cafe latte,
screw the raspberry iced tea
A Malibu and Coke for you, a G&T for me
Alcohol, your songs resolve like
My life never will
When someone else is picking up the bill

I thought that Alcohol was just for those
with
Nothing else to do
I thought that drinking just to get drunk
Was a waste of precious booze
But now I know that there's a time
And there's a place where I can choose
To walk the fine line between
Self-control and self-abuse



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Fermentation Products

- **Fermentation = the production of alcohol from sugars through the action of yeasts**
 - Forms the basis of all alcoholic beverages
- **Fruits + yeast = fermentation will begin**
 - Fruits naturally contain sugar
- **Cereal grains contain starch, which must be converted to sugar by malt before fermentation can begin**
- **Yeast has a limited tolerance for alcohol**
 - When the concentration reaches a certain percentage (15% is possible, but standard for wine is about 12%) the yeast dies and fermentation ceases.

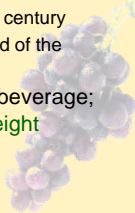


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Distilled Products

- **Distillation** = evaporation and condensing of alcohol vapors to produce beverages with alcohol content higher than 15 percent
 - Perhaps first used in Arabia around AD 800
 - Introduced into Europe in about the 10th century
 - In U.S., began on a large scale at the end of the 18th century
- **Proof** = alcohol content of a distilled beverage; twice the percentage of alcohol by weight
 - 90-proof whiskey is 45 percent alcohol



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Beer

- **Made by adding barley malt to other cereal grains**
- **Hops** are added with **yeast** to give beer its distinctive flavor



Malted barley



Hops

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Beer: Types

- **Lager**—uses a type of yeast that settles to the bottom of the mash to ferment (from German, *lagern*, "to store")
 - Most common type in United States
- **Ale**—uses a top-fermentation yeast, warmer fermentation temperature, more malt and hops
- **Light beer**—fermented longer at a cooler temperature
 - More sugar is converted to alcohol, then water added
 - Result is a beverage with similar alcohol content but less sugar (and fewer calories) than regular beer



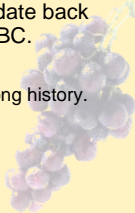
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Alcohol-- History

- Alcoholic beverages have been consumed for thousands of years, **at least as far back as 6400 BC** (beer and berry wine)
- Grape wine has existed for over 2,000 years
- Mead (sugar source is *honey*) may date back to the Paleolithic Age, around 8000 BC.

Alcohol is a CNS depressant with a long history.



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Beer: Manufacturers

- Most beer sold in the **United States** is mass-produced by the **two largest brewers, Anheuser-Busch and MillerCoors**
- Brewpubs and microbreweries** are growing in popularity, but still only account for **5% of the U.S. market.**



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Wine

- Made from **fermented grapes**
- Produced by both **small and large wineries**
- Most wines contain about **12% alcohol**
- Factors in quality include selection and cultivation of grapevines, good weather, timing of harvest, and careful monitoring of fermentation and aging




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Wine: Varieties

- **Generics (region) vs. varietals (grape)**
 - Determined by type of grapes and flavor
- - Red vs. white
 - Sweet vs. dry
 - Sparkling wines (champagne)
 - Fortified wines (port, sherry)
 - Alcohol content near 20 percent



- **Wine has increased in popularity in the U.S.** since the 1970s, when California and other states entered the market (challenging the traditional monopoly the French had on fine wines). Cf. movie: [Bottle Shock](#) (2008)

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Distilled Spirits

- **Whiskey** = distillate of fermented malted barley (strong beer)
 - Scottish highlands origin from before 1500 ("uisgebaugh")
 - Early U.S. distiller (Elijah Craig) from Bourbon County, KY, gave beverage its name
 - Distilled at a lower proof (160) and so contains more congeners and some flavor from the grain used
 - Rye whiskey, corn whiskey (bourbon), blended whiskey

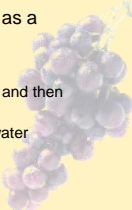


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Distilled Spirits

- **Grain neutral spirits** — clear, tasteless, nearly pure alcohol (190 proof) produced by distillation (goes back to 17th century)
 - May be sold as *Everclear* or used in research
 - Ethanol is used in commercial products as a gasoline additive, cleaner, solvent
 - Used to make various beverages:
 - **Gin**: distillate filtered through juniper berries and then diluted with water
 - **Vodka**: mixture of grain neutral spirits and water
 - Contains relatively few congeners



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Distilled Spirits

Liqueurs or cordials

- Alcohol content 20 to 25 percent
- Originally made from brandy mixed with flavorings from herbs, berries, or nuts
- Now typically made from flavored, diluted grain neutral spirits



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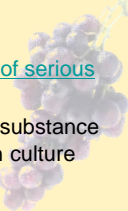
Alcohol Use: Early Views

Before American Revolution

- People drank **more alcohol than water**
- Drunkenness was viewed as misuse of a *positive* product

After American Revolution

- Alcohol itself viewed as the cause of serious problems, an active agent of evil
- Alcohol was the first psychoactive substance to become demonized in American culture



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Temperance Movement

Benjamin Rush (1745-1813)

- Heavy drinking = health problems
- Alcohol use damages morality
- Alcohol addiction = a disease

Temperance societies

- Initially promoted abstinence from distilled spirits and dependent consumption of beer and wine
- Later promoted total abstinence

Became fashionable to "take the pledge" (see right)

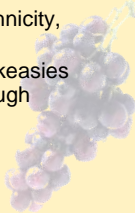


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Prohibition

- **States began passing prohibition laws in 1851**
 - By 1917, 64 percent of Americans lived in "dry" territory
 - Laws reflected issues of class, ethnicity, religion, immigration, and politics
 - People still drank illegally in speakeasies and private clubs and legally through purchase of patent medicines

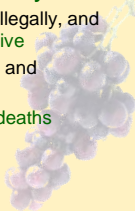


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Prohibition

- **Federal prohibition, 1920**
 - **18th Amendment** to the U.S. Constitution, banning the sale of alcohol, was ratified in January 1919
 - National prohibition went into effect in **January 1920**
 - People continued to buy and sell alcohol illegally, and enforcement was challenging and expensive
 - **Organized crime** became more organized and profitable
 - **Alcohol dependence and alcohol-related deaths declined**



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Enforcement activities during Prohibition



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Prohibition Repealed

- Concerns that **widespread disrespect for Prohibition laws** encouraged a general sense of lawlessness
- **Taxation:** Alcohol taxes had been a major source of revenue
- Repealed by the **21st Amendment**
 - **Ratified in 1933**
- Alcohol per capita sales and consumption increased slowly until **after World War II**, when they returned to pre-Prohibition levels

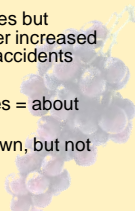


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Regulation and Taxation

- **Regulation after 1933**
 - Some states remained dry after national prohibition ended, but most allowed at least beer sales
 - Laws were slowly relaxed until the **last dry state, Mississippi, became wet in 1966**
 - Drinking ages were lowered in some states but raised again to 21 following concerns over increased drinking rates and alcohol-related traffic accidents
- **Taxation**
 - Federal and state taxes and licensing fees = about **half the price of an alcoholic beverage**
 - When taxes go up, consumption goes down, but not dramatically



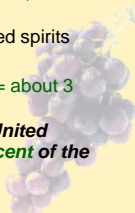
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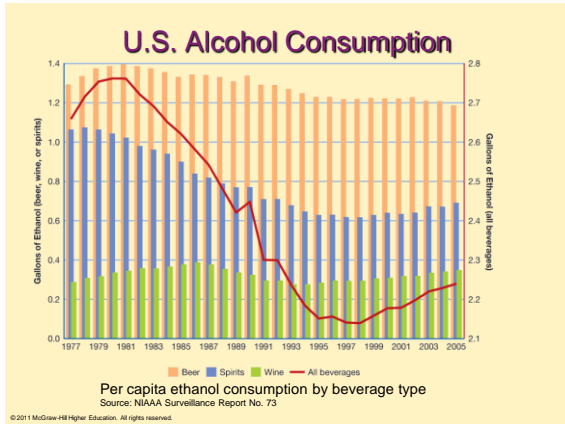
Who Drinks and Why?

Cultural influences on drinking—ethnic and social factors:

- **Trends in U.S. alcohol consumption**
 - Use peaked in 1981, followed by a decline, mirroring patterns of illicit drug use
 - Decline particularly significant for distilled spirits
 - About one-third of Americans abstain
 - Average consumption among drinkers = about 3 drinks per day—*but most drink far less*
 - **Half of all alcohol consumed in the United States is consumed by about 10 percent of the drinkers**



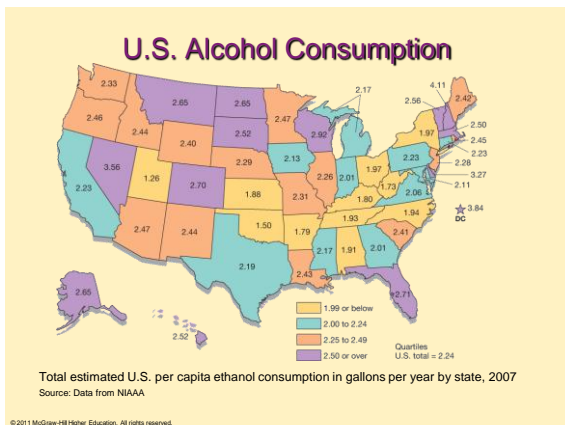
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U.S. Alcohol Consumption

- **Regional differences in the United States**
 - **Stress index:** Drinking rates higher in states where people experience a great deal of social stress and tension
 - **Drinking norms:** Drinking rates higher in states where people tend to approve of the use of alcohol to relieve stress

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U.S. Alcohol Consumption

- **Gender differences:** Males more likely to drink than females, and more likely to drink more
- **Drinking among college students**
 - College students drink more than their nonstudent peers
 - Many campuses have banned sale and advertising of alcohol, and many fraternities have banned keg parties
 - Alcohol use and drinking behavior hasn't changed significantly in response
 - Today's college students are less likely to drink and drive compared to students in the early 1980s



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Alcohol Pharmacology

- **Absorption**
 - Some absorbed in the stomach, most in the small intestine
 - Absorption is slower if there is food or water in the stomach
 - Absorption is faster in the presence of carbonated beverages

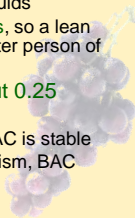


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Alcohol Pharmacology

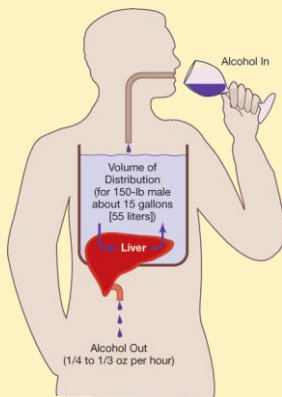
- **Distribution**
 - Blood alcohol concentration (BAC) is a measure of the concentration of alcohol in blood, expressed as a percentage in terms of grams per 100 ml
 - Alcohol is distributed throughout body fluids
 - Alcohol is less distributed in fatty tissues, so a lean person will have a lower BAC than a fatter person of the same weight
- **Metabolism:** Liver metabolizes about 0.25 ounces of alcohol per hour
 - If rate of intake = rate of metabolism, BAC is stable
 - If rate of intake exceeds rate of metabolism, BAC climbs



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Blood Alcohol Concentration

The relationship between blood alcohol concentration and alcohol intake



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What Is One Drink?

- **Standard drink** has about 0.5 ounces of pure alcohol
 - 12 ounces of beer
 - 4 ounces of wine
 - 1 ounce of 100-proof spirits



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Gender Differences

- **Women tend to be more susceptible** than men to the effects of alcohol after consuming the same amount
 - Alcohol dehydrogenase (a stomach enzyme) is more active in men
 - Women absorb a greater proportion of the alcohol they drink
 - Women tend to weigh less and have a higher proportion of body fat
 - "Tank" into which alcohol is added is smaller

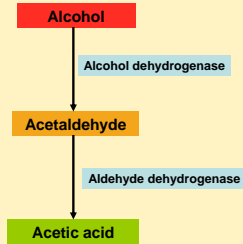


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Alcohol Metabolism

- About 2 percent of alcohol is excreted unchanged
- About 90 percent is metabolized in the liver



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Alcohol Metabolism

- Exercise, coffee, and other strategies **do not** speed up the rate of metabolism
- Liver responds to chronic intake of alcohol by increasing enzyme activity
 - Contributes to tolerance among heavy users
 - Can result in cross-tolerance to other depressants

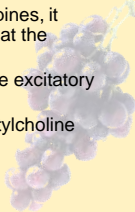


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Mechanism of Action

- Central nervous system depressant
- Used as anesthetic until the late 19th century
- Alcohol has many effects on the brain and the mechanisms are difficult to pin down
 - Similar to barbiturates and benzodiazepines, it enhances the inhibitory effect of GABA at the GABA-A receptor
 - At high doses, it blocks the effects of the excitatory transmitter glutamate
 - It affects dopamine, serotonin, and acetylcholine neurons




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Behavioral Effects

- **Blood alcohol concentration determines effects**
 - *At low effective blood levels:* complex and abstract behaviors disrupted
 - *At higher blood levels:* simpler behaviors also affected




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Behavioral Effects

- **Mood changes** can include euphoria, reduced anxieties, and reduced inhibitions
- Effects are greater when BAC is rising
- A higher BAC is needed to impair a chronic heavy drinker
- Expectations (placebo effects) explain many of the effects on social behavior



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BAC and Behavioral Effects

BAC (%)	Behavioral Effects
0.05	Lowered alertness, release of inhibitions, impaired judgment
0.10	Slower reaction times, impaired motor function, less caution
0.15	Large, consistent increases in reaction time
0.20	Marked depression in sensory and motor capability, intoxication
0.25	Severe motor disturbance, staggering, great impairment
0.30	Stuporous but conscious—no comprehension of what's going on
0.35	Surgical anesthesia; about LD ₁ , minimal level causing death
0.40	About LD ₅₀

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Behavioral Effects

- Alcohol use serves as a social signal for a time-out from responsibilities, work, and seriousness
- Intoxicated individuals focus on the here and now, with little care for future consequences (*alcohol myopia*)

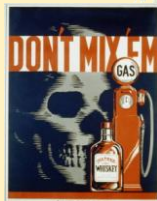


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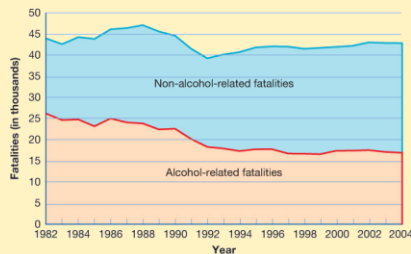
Driving Under the Influence

- About 40 percent of all traffic crash fatalities are linked to alcohol use
- Risk of a fatal crash is dose-related
- Single-vehicle fatalities are more likely to involve alcohol than are multiple-vehicle fatalities
- Alcohol-related fatalities are more likely to occur during dark hours and on weekends



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Driving Under the Influence



Alcohol-related and non-alcohol-related traffic crash fatalities for the United States

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Behavioral Effects

- **Sexual behavior**
 - Alcohol use enhances interest in sex but impairs physiological arousal
 - Linked to unsafe sex
- **Blackouts**
 - A danger sign of excessive alcohol use
- **Crime and violence**—alcohol use is statistically related to violence
 - Homicide
 - Assault, including family violence, sexual assault, and date rape
 - Suicide



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Driving Under the Influence

- Men are more likely than women to be involved in an alcohol-related fatal crash
- **Anyone who drinks and drives (not just problem drinkers) is a potential threat**
- Current efforts
 - Keep repeat offenders off the road
 - Publicize the dangers of drinking and driving
 - Target younger drinkers for special prevention efforts



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Physiological Effects

- **Peripheral circulation:** Dilation of peripheral blood vessels means that drinkers lose body heat but feel warm
- **Fluid balance:** Alcohol has a diuretic effect that can lower blood pressure in some people
- **Hormonal effects:** Chronic abusers of alcohol can develop a variety of hormone-related disorders



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Acute Physiological Toxicity

- **Alcohol overdose** (poisoning) is common and dangerous
- **If someone drinks enough to pass out**
 - Place her or him on side and monitor breathing or take to ER immediately
 - Do not leave the person alone
- **If someone drinks enough to vomit**
 - He or she should stop drinking
 - Vomiting reflex indicates a rapidly rising BAC but is suppressed at BACs above 0.20 percent



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Hangover

- **Symptoms:** upset stomach, fatigue, headache, thirst, depression, anxiety, and general malaise
- **Possible causes:** alcohol withdrawal, exposure to congeners, cellular dehydration, gastric irritation, reduced blood sugar, and/or the accumulation of acetaldehyde
- **Moderate drinking is the only way to avoid a hangover**



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Alcohol Toxicity: Long-Term Risks and Effects

- Brain tissue loss and intellectual impairment
- Liver disease: hepatitis, fatty liver, cirrhosis *(see right)*
- Heart disease: cardiomyopathy, heart attack, hypertension, stroke
 - Alcohol's effects on HDL may reduce heart attack risk among moderate drinkers
- Cancer
- Impaired immunity



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Fetal Alcohol Syndrome (FAS)

- FAS = a collection of physical and behavioral abnormalities caused by the presence of alcohol during fetal development
- Diagnostic criteria
 - Growth retardation before and/or after birth
 - Pattern of abnormal features of the face and head
 - Evidence of central nervous system abnormality



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Fetal Alcohol Syndrome and Fetal Alcohol Effects

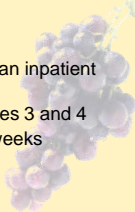
- Fetal alcohol syndrome**
 - Related to peak BAC and to duration of alcohol exposure
 - Prevalence: 0.2 to 1.5 per 1,000 births
- Fetal alcohol effects**
 - All alcohol-related developmental abnormalities associated with prenatal alcohol exposure
 - Prevalence: 80 to 200 per 1,000 births
- Drinking during pregnancy increases risk of spontaneous abortion
- Data do **not prove** that low levels of alcohol use during pregnancy are **safe** or that they are **unsafe**



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Alcohol Dependence: Withdrawal Syndrome

- Abstinence syndrome is **medically more severe and more deadly than opioid withdrawal**
- Abstinence syndrome occurs in stages
 - Stage 1: tremors, rapid heartbeat, hypertension, heavy sweating, loss of appetite, insomnia
 - Stage 2: hallucinations (auditory, visual, and/or tactile)
 - Stage 3: delusions, disorientation, delirium
 - Stage 4: seizures
- Initial detoxification should be carried out in an inpatient medical setting
- Sedatives given in stage 1 or 2 prevent stages 3 and 4
- Some symptoms can last for up to several weeks



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Dependent Behaviors

- Alcoholics Anonymous view—alcohol dependence as a disease—became popular beginning in the 1940s and 1950s
 - A progressive disease characterized by loss of control over drinking
 - Only treatment is abstinence from alcohol
 - Disease model: alcohol dependence is the primary disease and not the result of another underlying cause
- Criticisms of disease model
 - What is the cause of the disease?
 - Why don't all dependent drinkers exhibit the same symptoms?

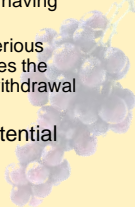


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Dependent Behaviors

- APA defines **substance abuse and dependence** and includes alcohol as a psychoactive substances
 - **Alcohol abuse** is a maladaptive pattern indicated by continued use despite knowledge of having persistent problems caused by alcohol
 - **Alcohol dependence** involves more serious psychosocial characteristics and includes the physiological factors of tolerance and withdrawal among the possible symptoms
- Cognitive and genetic factors are potential underlying causes of dependence



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