Substance Use Disorders

Main Questions

- Why study addiction?
- What is addiction?
- Why do people become addicted?
- What do alcohol and drugs do?
- How do we treat substance use disorders?

Why study addiction?

It's a BIG PROBLEM!
### Prevalence

<table>
<thead>
<tr>
<th></th>
<th>Ever Used</th>
<th>Prevalence of Dependence</th>
<th>Dependence Among Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td>75.6</td>
<td>24.1</td>
<td>31.9</td>
</tr>
<tr>
<td>Alcohol</td>
<td>91.5</td>
<td>14.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Illicit Drugs</td>
<td>51.0</td>
<td>7.5</td>
<td>14.7</td>
</tr>
<tr>
<td>Cannabis</td>
<td>46.3</td>
<td>4.2</td>
<td>9.1</td>
</tr>
<tr>
<td>Cocaine</td>
<td>16.2</td>
<td>2.7</td>
<td>16.7</td>
</tr>
<tr>
<td>Other Stimulants</td>
<td>15.3</td>
<td>1.7</td>
<td>11.2</td>
</tr>
<tr>
<td>Anxiolytics</td>
<td>12.7</td>
<td>1.2</td>
<td>9.2</td>
</tr>
<tr>
<td>Heroin</td>
<td>1.5</td>
<td>0.4</td>
<td>23.1</td>
</tr>
<tr>
<td>Other Opiates</td>
<td>9.7</td>
<td>0.7</td>
<td>7.5</td>
</tr>
<tr>
<td>Psychedelics</td>
<td>10.6</td>
<td>0.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Inhalants</td>
<td>6.8</td>
<td>0.3</td>
<td>3.7</td>
</tr>
</tbody>
</table>


### Consequences of Substance Use

- Child and spousal abuse
- STDs including HIV
- Teen pregnancy and fetal health problems
- Problems at school and work – low productivity
- Family and social problems
- Health problems – cardiovascular, liver, brain, immune system, gastrointestinal, pancreas, kidneys, lungs…
- Motor vehicle crashes, homicides, suicides, accidental death

### Health Consequences

- Causes of 1,060,000 preventable deaths in 1990:
  - Tobacco: 29%
  - Alcohol: 7%
  - Diet Activity: 26%
  - Illicit Drugs: 4%
  - Motor Vehicles: 4%
  - Sexual Behavior: 2%
  - Filler Med: 2%
  - Toxic Agents: 6%
  - Dialysis: 9%

- 620,000 deaths from alcohol, tobacco, and illicit drug use
- 50% of preventable deaths; 25% of all deaths in the US
### What is Addiction?

- DSM-IV-TR Substance Use Disorders (SUD)
  - Substance Abuse = “hazardous use”
  - Substance Dependence = “addiction”

### Substance Abuse

*Repeated problems in one year in one or more of these areas:*

1. Don’t meet obligations
2. Use in hazardous situations
3. Legal problems
4. Use despite social or interpersonal problems

### Substance Dependence

*Repeated problems in one year in three or more of these areas:*

1. Tolerance
2. Withdrawal
3. Use larger amounts or for more time than intended
4. Can’t cut down or control use
5. Much time spent getting, using, or recovering
6. Important activities given up or reduced
7. Use despite physical or psychological problems
### Prevalence

<table>
<thead>
<tr>
<th>Past year abuse or dependence</th>
<th>Age 12 – 17</th>
<th>Age 18 – 25</th>
<th>Age 26 and up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>6.0%</td>
<td>17.4%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Drugs</td>
<td>5.3%</td>
<td>8.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Alcohol and/or drugs</td>
<td>11.3%</td>
<td>25.7%</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

Source: National Survey on Drug Use & Health

### Why do people become addicted?

- Biology
- Learning
- Cognitive factors
- Social factors
- Comorbid disorders
- Personality features

### Biological Mechanisms

**Dopamine cells in the nucleus accumbens**

*Normal Brain Cells:*

- Dopamine
- Pleasure signal
Substance Use Disorders, Part 1
Alecia Schweinsburg, MA
Abnormal Psychology, Fall 2005

Biological Mechanisms

**Dopamine cells in the nucleus accumbens**

*With Alcohol or Drugs:*

- Dopamine
- Pleasure signal

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**Dopamine cells in the nucleus accumbens**

*After Alcohol or Drugs:*

- Dopamine
- Pleasure signal

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Biological Mechanisms

- Level of response
  - Low response → vulnerable
  - Runs in families
  - Developmental stage
- Genetic factors
  - Vulnerability
  - Protective

*Alcohol metabolism:*

- Alcohol → Acetaldehyde → Acetic Acid
Classical Conditioning Model

Drug cues (neutral) → Drug (US) → Brain Changes (UR)

Drug cues (CS) → Brain Changes (CR)

Cue Reactivity

Alcohol Pictures

Non-Alcohol Pictures

Cue Reactivity

Alcohol Use Disordered teens showed more brain response to alcohol pictures than nondrinkers.

Visual Cortex

Nucleus Accumbens

Source: Tapert et al., (2003). Arch Gen Psychiatry
Operant Conditioning

• Positive reinforcement
  – pleasure of intoxication

• Negative reinforcement
  – avoiding withdrawal
  – stress relief
  – self-medication

Cognitive and Social Factors

• Cognitive factors
  – Expectancies

• Social & cultural factors
  – Perceived norms
  – Ethnicity
  – Stress
  – Cultural expectations
Comorbid Disorders

- High rates of comorbidity between SUD and other psychiatric disorders
  - Mood
  - Anxiety
  - Psychotic disorders
  - Antisocial personality disorder
  - Chicken or egg?
- High rates of polysubstance use among those with SUD

Comorbid Disorders

- Higher prevalence of mood and anxiety disorders among individuals with alcohol or drug dependence

<table>
<thead>
<tr>
<th></th>
<th>Alcohol Dependence</th>
<th>Drug Dependence</th>
<th>Alc or Drug Dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mood d/o</td>
<td>28%</td>
<td>55%</td>
<td>29%</td>
</tr>
<tr>
<td>Depression</td>
<td>21%</td>
<td>40%</td>
<td>22%</td>
</tr>
<tr>
<td>Mania</td>
<td>8%</td>
<td>18%</td>
<td>8%</td>
</tr>
<tr>
<td>Anxiety d/o</td>
<td>23%</td>
<td>43%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Source: Grant et al., (2004). Arch Gen Psychiatry

Personality Features

- Behavioral disinhibition
  - Impulsivity
  - Sensation-seeking
- Extraversion
- Neuroticism
What do drugs do?

- Five main categories:
  - Depressants – Result in relaxation and sleepiness (alcohol, Valium, GHB)
  - Stimulants – Increase alertness and elevate mood (cocaine, meth, nicotine, caffeine)
  - Opiates – Produce pain relief and euphoria (heroin, morphine, codeine)
  - Hallucinogens – Alter sensory perception (marijuana, LSD, MDMA)
  - Other drugs of abuse – Inhalants, anabolic steroids, medications, etc.

Depressants: Alcohol

- Mechanism of action
  - GABA agonist
    - Relaxation & sleepiness
    - Frontal lobe → disinhibition
    - Cerebellum → motor impairment
  - Glutamate antagonist
    - Hippocampus → impairs memory
Depressants: Alcohol

- Tolerance - Yes!
  - Brain adaptation
  - Metabolic change
- Withdrawal - Yeppers!
  - Starts after 8 – 12 hours
  - Agitation, insomnia, tremors, ↑ heart rate, seizures
  - “Delirium tremens”: confusion, delusions, hallucinations
  - 37% mortality without treatment
    - Detox with benzodiazepines (GABA drugs)

Alcohol & Brain Damage

- Wernicke-Korsakoff syndrome
  - 12% of patients
  - Thiamine deficiency
  - Early: reversible – confusion, visual problems, stupor, coma, hyperthermia, hypotension
  - Late: irreversible – anterograde amnesia
  - 10 – 20% mortality

Healthy Control  Alcoholism

Alcohol & Brain Damage

- The images in the Alcohol & Brain Damage section show brain scans comparing healthy control to alcoholism.
### Alcohol & Brain Damage

![Healthy Control and Alcoholism](image)

### Stimulants

- **Acute effects**
  - Euphoria
  - Psychostimulant effects
    - Increased activity
    - Improved performance
  - Sympathetic arousal
    - ↓ appetite
    - ↑ heart rate, etc.
  - Psychotic symptoms
    - Hallucinations & delusions
    - Paranoia

- **Tolerance**
  - Euphoria, appetite suppression
  - No tolerance to physical stimulation

- **Sensitization—↑ effect with ↑ use**
  - Stimulant effects
  - Psychosis and paranoia

- **Withdrawal**
  - Depression
  - Irritability
  - Fatigue
### Opiates

- Morphine, heroin, codein, Oxycontin, Vicodin
- Endogenous opioid agonists
  - 3 receptor systems
  - Many endogenous chemicals

- Tolerance
  - Euphoria > analgesia > respiratory depression > constipation
  - Situational tolerance

- Withdrawal
  - Starts in 6 – 12 hours, lasts 5 – 10 days
  - Flu-like state
  - Methadone – slow acting opiate used for detox
  - Naltrexone – antagonist – used for detox
  - Naloxone – antagonist → immediate withdrawal
  - used for overdose

### Hallucinogens

- LSD, mushrooms, peyote
- Ecstasy
- Marijuana
- Alter sensory perceptions
Marijuana

- Tolerance
  - Moderate, in heavy users
- Withdrawal
  - Starts in ~12 hours, lasts 3 – 4 days
  - Relatively mild
  - Tired, weak, anxious, irritable, trouble concentrating

Ecstasy

- Tolerance
  - Mechanism unclear
- Withdrawal
  - Depression
  - Anxiety and panic
  - Insomnia
  - Paranoia

Treatment

- 75 – 80% relapse in first year
- Average 5 – 7 quit attempts before success
- Treatment
  - Biological
  - Psychosocial
Biological Treatment

- **Agonist substitution**
  - Methadone maintenance for opiates
  - Nicotine patch/gum
- **Antagonist treatments**
  - Naltrexone for opiates & alcohol
  - Acamprosate for alcohol
- **Aversive treatment**
  - Antabuse for alcohol – blocks ALDH2 enzyme

Psychosocial Treatment

- Inpatient or outpatient
- Alcoholics Anonymous
- CBT
  - Contingency management
  - Community reinforcement
  - Skills training
    - Particularly important for comorbidity with other psych problems

Summary

- Disorders include abuse and dependence
- Causes include biological, behavioral, cognitive, social, and personality factors
- Comorbid disorders are common and may require treatment
- Drugs act in different ways to produce euphoria & impair thinking