



# Stimulants

Psychology 470

Introduction to Chemical Addictions

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Psyc 470 – Introduction to Chemical Addictions

## Overview

- Are substances that increase neuronal and behavioral activity when given
- Have many effects
  - Increase mood and motor activity
  - Increase alertness
  - Decrease appetite
  - Decrease need for sleep
  - At high levels can cause seizures and hallucinations
  - Some types cause paranoia

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## Many substances contain stimulants

- Analgesics
- Stay alert products
- Some decongestants
- Herbal stimulants
  - Ephedrine

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## Pharmacokinetics

- Can be taken orally, through inhalation, injection
- Distributed through the bloodstream
- Target organs are usually neurons
- Can also influence other structures and cause immediate or delayed problems
  - Heart tissue (cardiac arrest)
  - Deviated Septum
  - Teeth problems

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## Pharmacodynamics

- Generally, most stimulants
  - Increase neurotransmitter release
  - Block reuptake
  - Can also shut down inhibitory neurotransmitters via other processes

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## Some Stimulants

- Amphetamines and Methamphetamine
- Cocaine
- Xanthenes
  - Coffee
  - Tea
  - Chocolate
- Nicotine
- Ephedrine
- Ritalin

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## Amphetamines

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## Overview

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- Used therapeutically for many disorders
- Used to reduce fatigue and enhance performance
- Widespread abuse began in 1940's
  - Students and truck drivers
- Were used as appetite suppressants
- Problem
  - Rapid tolerance
  - Strong physical and psychological dependence (CC and neg. reinforcement)

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## Pharmacokinetics

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- Usually taken orally or via injection (medical usage)
- Travels to sites via the bloodstream
- Metabolized by the Liver
- Byproducts are secreted through urine
- Urine tests good for about 48 hours
- Hair samples good until cut

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## Pharmacodynamics

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- Impacts the NS, cardiac tissue, and other structures.
- Causes the release dopamine and norepinephrine from presynaptic elements
- Blocks the reabsorption of NT
  - Remains on the binding sites longer
    - Get stimulation

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## Result

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- Motor stimulation
  - Move faster, talk faster, etc
  - Get too much, performance decreases
- Increased BP but decreased HR
- Increased alertness and concentration
- Increases memory
  - Good for studying
- Loss of appetite
- May also get arousal and increased mood
- Often develop a feeling of power
  - Can be reinforcing when performance increases

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## High Doses

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- Can get repetitive acts
- Often develops paranoia
  - Important for trust in counseling settings
- May develop aggression/violence
- Can get delusions and other types of psychotic behavior
  - Often is difficult to detect the difference between amphetamine psychotic behavior and other psychotic behavior
- Physical problems
  - Cardiac, NS, liver, and oral.

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### Other problems

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- Infections from neglected health care
  - Poor eating habits
- Deterioration in life
  - Social, personal, job areas
- Cognitive problems (often irreversible)
  - Academic performance decreases
  - Mental functioning decreases
  - Other problems result
- Withdrawal
  - Lethargy, depression, feeling down

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### Methamphetamine

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### Overview

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- Is very powerful
- Is highly addictive
- Is a synthetic amphetamine
- Lots of different names
- Terms referring to meth:
  - Crank, Crystal, Speed, Ice, Glass, Lines

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### Some slang

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- Eight ball: Eight ounce package of crank
- Rig or works: Material used to inject meth.
- Crankster: Someone who uses or manufactures meth.
- Mule: A person who obtains ephedrine, pseudoephedrine and moves drugs.
- Spun: Person overdosed on meth. And experiencing psychotic confusion.

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### Users

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- Past White males, blue collar workers, urban areas
- Today Everyone and it is everywhere
- 4.7 million Americans have tried meth.
- 4.8% of high school seniors have tried meth.
  - 1.9 percent within the past year.

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### Pharmacokinetics

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- Oral Euphoria within 15 to 20 minutes
- Injection
  - Intense rush 15-45 seconds
  - Also get arousal before taking
- Inhalation (smoking)
  - Intense rush 7-15 seconds
- Inhalation (snorted)
  - Euphoria within 3 to 5 minutes

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### Some Effects

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- Euphoria
- Increased heart rate and blood pressure
- Increased alertness
- Convulsions
- Decreased appetite
- Hallucinations, paranoia
- Aggression
- Insomnia
- Hallucinations
- Depression
- Lung and kidney disorders
- Brain damage
- Irritability and confusion
- Malnutrition
- Hyperthermia
- Strokes

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### Brain Damaged By Meth

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- Damages post synaptic elements of dopamine neurons
- Kills other brain cells

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### When you are on Methamphetamine

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- It changes your impression of "Normal"
  - Being on meth. Feels normal
  - Not on meth. Feels weird.
- Increases your risk for BBPs
  - You do not care what happens
  - Now Viagra and Meth.
- Stop using, get depression, fatigue, intense craving
- Hard to kick.

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### ICE

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- Is a freebase form of methamphetamine
- Is very potent
- Smoking allows for immediate absorption
- High is intense and lasts a long time
  - 11 hour half-life
- Chronic use causes lots of problems
  - Psychiatric
  - Cardiovascular
  - Endocrine changes
  - Neuromuscular changes

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### Cocaine

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### Background

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- Comes from the leaves of Erythroxylin coca
- Used in South America for religious, social, euphoriant, and medicinal purposes
- Alkaloid purified from the leaves in 1860 – What we commonly know as Cocaine.
- One of the first local anesthetics used for surgery
  - Still used today

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### Usages

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- Incorporated into numerous medicines and beverages
  - Coca-Cola
- Harrison Narcotic Act banned use in 1914
- Recreational use increased in late 1960's
  - Jet setters
- Crack use spread in the late 1980's

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### Forms of Cocaine

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- Leaves contain about 0.5-1.0% cocaine
- Leaves are soaked in kerosene and gasoline and mashed
- Cocaine extracted – paste (50-60% pure)
- Cocaine Hydrochloride
  - Paste is treated to oxidize and purify the paste
  - Forms water soluble cocaine hydrochloride powder.
  - Close to 100% pure
  - Can be injected, snorted, ingested
- Cannot be smoked

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### Crack (Freebase)

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- Similar to the coca paste.
- Is made by reversing the oxidation process
- Cannot be inhaled or injected
- Forms a vapor when heated and smoked
- Is much cheaper

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### Pharmacokinetics

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- Can be absorbed from all areas
- Oral, lungs, stomach
- Half-life 30-90 min.
- Metabolized by enzymes in both plasma and liver
- Slowly removed from brain
- Positive urine tests for 12 hours
- Hair samples until cut

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### Injection and smoking

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- IV injection
  - Rapid increase
- Smoking (crack)
  - Onset in seconds
  - Peaks in 5 minutes
  - Lasts about 30 minutes

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### Pharmacodynamics

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- Distribution by the circulatory system
- Penetrates brain rapidly
- Works on Dopamine neurons
  - Blocks reabsorption of dopamine
  - Dopamine stays in the synapse longer
  - Get more action potentials
  - Feel good

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### Some Effects

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- Immediate euphoria (60-90 min.)
- Enhanced self-consciousness
- Forceful boastfulness
- Increased alertness
- Motor hyperactivity
- Shifts of blood flow from internal organs to muscles
- Thoughts race,
- Rapid speech
- Sleep delayed
- Appetite suppressed
- A depressive state follows use
- Anxiety and sleep deprivation
- Hypervigilance
- Paranoia

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### Medical Complications

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- Many cardiovascular effects
  - Heart attacks
  - Irregular heart rhythm
- Respiratory failure
- Seizures

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### Xanthenes

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### Many Types

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- Xanthenes
  - Theophylline (Tea)
  - Theobromine (Chocolate)
  - Caffeine (Coffee and colas)

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### Theophylline

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- Found in Tea
  - Has very little in it when made so it has minimal effects
- Primarily used for breathing problems in asthmatics
  - Relaxes and open bronchial trees

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### Theobromine

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- Found in Chocolate
- Has far less potency than caffeine

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### CAFFEINE

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- Most commonly consumed psychoactive drug in the world
- Average intake per person per day is between 80 to 400 milligrams
- Consumption of caffeine is not considered drug abuse
- No regulation on sale or use

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### Found in Lots of Products

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Item	
Coffee (5 oz)	100mg
Tea (5oz)	50mg
Cocoa (5oz)	5mg
Chocolate (1oz)	25mg
Chocolate milk (1oz)	5mg
Cola drink (12oz)	>100mg
OTC stimulants	>100mg
OTC analgesics (aspirin)	< 65mg
OTC cold remedies	30mg

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### EFFECTS

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- Enhanced mental alertness
  - Good for sustained intellectual effort
- Increased energy
- A sense of well-being
- Reduced fatigue
- Sleep onset is delayed

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### Chronic use

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- Habituation and tolerance
- Withdrawal
  - Headaches
  - Drowsiness
  - Fatigue
  - Depression

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### Pharmacokinetics

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- Blood levels are reached in 30-45 minutes
- Peak levels - about 2 hours
- 3.5 to 5 hours half life
- Distributed through body water

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### Pharmacokinetics

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- Metabolized in the liver into three metabolites
  - Theophylline
    - Used in bronchial relaxation
  - Paraxanthine
  - Theobromine
  - Theophylline and Paraxanthine act similar to caffeine
- About 10% is excreted unchanged

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### Mechanism of Action

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- Major site of action
  - Adenosine receptors
  - Most potent at adenosine A<sub>1</sub> and A<sub>2A</sub>
- Blocks the adenosine receptor (shuts down excitatory neurons)
- Block the receptor, more firing by other neurons

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### NICOTINE

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### NICOTINE

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- Primary active ingredient in tobacco
- One of the three most widely used psychoactive drugs
  - Caffeine
  - Alcohol
- Has few or no therapeutic applications
- Important because of widespread use and toxicity
- Tobacco is good as a plant herbicide

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### Background Information

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- Responsible for the deaths of 1100 Americans every day
- Each day
  - 6000 American teenagers try their first cigarette
  - 3000 children become regular smokers
  - 1000 of these will die from smoking related disease
  - 9 in 10 smokers become addicted before age 21
- Girls become addicted faster than boys
  - Have a harder time quitting as well

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### Smoking Diseases

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- Each Year
  - 4,000 Americans die from lung cancer caused by second-hand smoke
  - 37,000 die per year from heart disease caused by second-hand smoke

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### Effects

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- Nicotine exerts powerful effects on
  - Brain
  - Spinal cord
  - Peripheral nervous system
  - Heart
  - Various other body structures

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### Effects

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- Stimulates the vomit center in the brain stem and sensory receptors in the stomach
  - Develops nausea in early stages of smoking
  - Tolerance develops rapidly
- Reduces weight gain
  - Suppresses appetite

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### Effects

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- In the CNS nicotine increases
  - Psychomotor activity
  - Cognitive functioning
  - Sensorimotor performance
  - Attention
  - Memory consolidation

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### Withdrawal Symptoms

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- Intense nicotine craving
- Irritability
- Anxiety
- Anger
- Difficulty concentrating
- Restlessness
- Impatience
- Increased appetite
- Weight gain
- Insomnia

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### Pharmacokinetics

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- Easily absorbed by
  - Lungs
  - Buccal and nasal mucosa
  - Skin
  - Gastrointestinal tract
- Is distributed throughout the body
  - No barriers to nicotine distribution
  - Rapid brain penetration
  - Crosses placental barrier
  - Appears in all bodily fluids
- The liver metabolizes 80% to 90% of Nicotine
- Metabolites are removed by the kidney

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### Methylphenidate (Ritalin)

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- Is a non-amphetamine stimulant
- Half life = 2 – 4 hours
- Time release half-life = 3 – 8 hours
  - Doesn't work well for ADHD
- Is erratically absorbed
  - Blood levels are unpredictable

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### Medical Uses

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- Attention Deficit Disorder
- Narcolepsy

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### Effects

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- Increased Alertness
- Excitation
- Euphoria
- Increased HR & BP
- Insomnia
- Loss of appetite

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### Pharmacokinetics

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- Oral
  - Used for kids and adults (ADHD)
  - Not much euphoria
- Injection
  - Rapid euphoria
  - Get a surge of Dopamine
  - High potential for abuse
  - Used within youth groups

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### Distribution and Elimination

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- Distributed to the brain and other structures via the blood stream
- Metabolized by the liver

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### Brain Effects

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- Shuts down the frontal lobe
  - Gives greater focus
  - Why used for ADHD
- Stimulates other brain areas
  - LC
  - NA
  - Others

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### Side Effects

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- Apathy
- Depression
- Disorientation
- Irritability

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### Neuron Effects

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- Blocks reuptake of Dopamine
  - Similar to Cocaine
- Slightly increases the release of Dopamine
  - Like other amphetamines

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### Dose levels

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- Low
  - Minimal effects
- High
  - Get a rush

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### Conclusions

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- Lots of stimulants
- Impact lots of societal areas
  - Are now causing lots of problems
- Believe you are doing great
  - You do until you develop tolerance
  - Then causes problems.

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