Disclosure

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Objectives

- Review current patterns of illicit and licit substance use and abuse among adolescents and young adults.
- Discuss common substances adolescents and college students are ingesting and using to become intoxicated.
- Review symptoms of and treatment for overdose or toxicity of common ingestions.
National Surveys

- High School Youth Risk Behavior Survey - 2013
  - Grades 9 to 12
  - 42 states, 5 territories, 2 tribal surveys
  - http://www.cdc.gov/healthyyouth/yrbs/overall.htm

- Monitoring the Future
  - 8th, 10th, 12th graders
  - College students and young adults
  - www.monitoringthefuture.org

Adolescent Substance Abuse

- Decrease in alcohol and tobacco use
  - Current alcohol use (used in past 30 days) among adolescents has decreased over the past 20+ years
    - YRBS 50% in the 1991 to 1999 report to 34.9% in 2013
    - MTF survey
      - 12th grade: decrease from 54% in 1991 to 39.2% in 2013
      - College students: 74.7% in 1991 to 63.1% in 2013
  - Tobacco use also decreasing
    - YRBS reported frequent use prevalence decrease from 12.7%-16.8% in 1991-1999 to 5.6% in 2013
    - MTF reported daily tobacco use
      - 12th grade decreased from 28.3% in 1991 to 16.3% in 2013
      - College students: 23.2% in 1991 to 14% in 2013

- Increase in illicit drug use
  - The use of illicit (unlawful) and licit (legal) drugs among adolescents has seen an upswing over the past 20 years
    - 50% have tried illicit drugs
    - 25.5% of 12th graders & 22.5% of college students used in last 30 days
  - Marijuana use:
    - YRBS 40.7% have ever used (2013)
    - MTF last 30 days: 12th grade 22.7% vs college 20.6%
  - Synthetic marijuana (K2, Spice)
    - 7.9% of 12th graders vs 2.3% of college students used in past year (MTF, 2013)
  - Ecstasy (MDMA)
    - YRBS survey: 5.8% in 2007, increase to 6.6% in 2013
    - MTF survey (2013):
      - Ever tried: 12th 7.7% vs college 8.8%
      - Last 30 days: 12th 1.5% vs college 0.8%
Increase in licit drug use

- Easily accessible over-the-counter and prescription drugs
- Dextromethorphan: 2013 MTF 5.0% of 12th graders abused cough syrup in the past year
- Nonmedical use of prescription drugs:
  - MTF survey: 21.5%,
  - YRBS report: 17.8% (oxycontin, Percocet, Vocodin, codeine, Adderall, Ritalin, or Xanax)
- Hand sanitizers
- Caffeine
Spice/K2

- Synthetic cannabinoid
  - mixture of dry, shredded plant material that is sprayed with synthetic cannabinoid receptor agonists
  - bind to one of the cannabinoid receptors (i.e. CB$_1$, CB$_2$)
  - CB$_1$ is found in the CNS; responsible for the physiological and psychotropic effects of cannabis or tetrahydrocannabinol (THC)
  - Four currently identified synthetic cannabinoid groups
    - JWH, CP, HU, benzoylindoles
    - DEA has made JWH-018, JWH-073, HU-210 and CP 47, 497 Schedule 1

Spice/K2

- Spice is usually smoked via joint or water pipe
  - Onset of action occurring within minutes
  - Causes elevated mood, relaxation, altered perception
  - Other symptoms: scleral injection, tachycardia, xerostomia, increased appetite, nausea and vomiting may occur
  - Symptoms last up to six hours
  - Synthetic cannabinoids may not be detected on a routine urine drug test

Spice/K2: Adverse Effects

- Poison Center reports: severe agitation and anxiety, muscle spasms, seizures and tremors, intense hallucinations and psychotic episodes, suicidal thoughts and actions
  - 10/13/14 NIDA alert: "Cloud" and "Mojo" causing hallucinations, aggressive behavior, vomiting, suicidal thoughts
  - 8/14/14 New Hampshire governor declares State of Emergency due to 41 overdoses from use of "Smacked"
  - Severe tachycardia and hypertension have been reported
  - Also fever, hyperglycemia, hypokalemia, chest pain and acidosis
  - Kidney failure
Spice/K2: Treatment

- Psychosis
  - Treatment – Emergency Department
    - Seizure medications
    - Antipsychotics
    - Monitoring of heart and liver function

Salvia

- Salvia (Salvia divinorum) is an herb and member of the mint family
- MTF survey: 2013 3.4% of 12th graders reporting use in the past 12 months (1% of college students)
- Salvia is abused for its hallucinogenic effects
- Salvia divinorum's active ingredient, Salvinorin A, selectively activates the kappa opioid receptors in the brain leading to hallucinations and dysphoria

Salvia: Adverse Effects & Treatment

- Short-term hallucinations or “psychomimetic” experiences similar to psychosis
- Dysphoria or mood swings
- Incoordination, dizziness and slurred speech

- Treatment
  - Quiet environment if they are hallucinating
  - ED care: Monitor VS and neurological status
Ecstasy, Molly (MDMA)
- Synthetic drug 3,4-Methylenedioxymethamphetamine (MDMA)
- Structurally similar to the stimulant methamphetamine and the hallucinogen mescaline
- MDMA causes release of neurotransmitters from storage
  - Serotonin
  - Tolerance occurs

Ecstasy (MDMA)
- Onset 30 to 60 minutes; peak at 90 minutes
- The effects of MDMA last 3 to 6 hours
- Metabolized by CYP 2D6
  - Poor metabolism may increased risk of fatality
  - MDMA inhibits its own metabolism

Ecstasy (MDMA)
- Acute effects of MDMA begin 30 minutes after oral intake
  - adverse effects include anxiety, tachycardia and elevated blood pressure
- An hour after intake user experiences relaxation and euphoria
  - increased sensitivity to touch, increased energy, increased sensual arousal, emotional warmth, and need to be touched
- Post-use period of lethargy, anorexia and dysphoria for 24 to 48 hours
Ecstasy: Adverse Effects

- Serotonin syndrome
  - hyperthermia, changes in level of consciousness, autonomic instability and altered muscle tone
- Sympathetic effects
  - tachycardia, hypertension and hyperthermia
- Dehydration, hyperthermia and hyponatremia
- Liver toxicity
- Stroke
- Long-term adverse effects on the brain
  - May damage serotonin receptors
  - Poor performance on cognitive and memory tasks
  - Depression for weeks and months after use

Ecstasy (MDMA): Treatment

- Emergency Department care
  - If stable, treatment is symptomatic
  - Moderate-to-severe toxicity requires prompt treatment to decrease mortality
    - O2, IV fluids, serial neurologic checks
  - Hyperthermia may be life-threatening
  - Monitor urine output
  - Seizures or muscle spasms
  - Long term care: depression

Bath Salts

- Synthetic stimulants that contain mephedrone and/or MDPV
- Synthetic cathinones are structurally similar to amphetamine
- Mephedrone increases dopamine, norepinephrine and serotonin levels in the synapse
  - Stimulant effect and euphoria
- MDVP acts as a dopamine and norepinephrine inhibitor
  - stimulation and euphoria
**Bath Salts**

- Synthetic stimulants or bath salts are usually snorted, but may be injected or used rectally
- Mephedrone: onset of action 10 to 20 minutes after snorting or ingestion, peak in 45 minutes to one hour
  - duration of action of 60 to 120 minutes
- MDPV onset of action one hour after ingestion, peak at 90 minutes
  - duration of stimulant action lasting 2.5 to 3.5 hours
- Standard urine drugs screens do not detect synthetic cathinones

**Bath Salts: Adverse effects**

- Agitation, insomnia, irritability, anxiety, paranoia, memory impairment, tremors and seizures
- Poison Center reports
  - hallucinations and paranoia
  - tachycardia and hypertension
- Mephedrone associated with:
  - altered kidney function, muscle breakdown
  - May be fatal

**Bath Salts: Treatment**

- ED care required:
  - Treatment of synthetic stimulant toxicity is based on the presenting symptoms
  - Agitation and seizures are treated with benzodiazepines
  - Heart and kidney function need to be monitored
Dextromethorphan

- 2013 MTF survey: 5% of 12 graders used in the past 12 months
- Dextromethorphan (d-3-methoxy-N-methylmorphine) the D-isomer of the codeine analogue levorphanol
  - acts centrally in the cough center in the medulla to elevate the threshold for coughing
  - gives a dissociative experience similar to PCP and ketamine
  - inhibits the reuptake of serotonin

Abusers of DXM describe four dose-dependent “plateau”

<table>
<thead>
<tr>
<th>Plateau</th>
<th>Dose (mg)</th>
<th>Behavioral Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>100-200</td>
<td>Mild stimulation</td>
</tr>
<tr>
<td>2nd</td>
<td>200-400</td>
<td>Euphoria and hallucinations</td>
</tr>
<tr>
<td>3rd</td>
<td>300-600</td>
<td>Distorted visual perceptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of motor coordination</td>
</tr>
<tr>
<td>4th</td>
<td>500-1500</td>
<td>Dissociative sedation</td>
</tr>
</tbody>
</table>

Dextromethorphan

- OTC dextromethorphan is often found in a combination cough and cold medication
  - analgesic (acetaminophen)
  - decongestant (phenylephrine or pseudoephedrine)
  - antihistamine (chlorpheniramine or diphenhydramine)
  - Alcohol
- Toxic effects of other ingredients
  - Acetaminophen level
  - Anticholinergic toxicity
Dextromethorphan

- Onset of CNS effects within 20 minutes
- Extensively metabolized in the liver by CYP 2D6
  - Poor metabolizers unable to convert dextromethorphan to dextrophan, leading to toxicity
  - Extensive 2D6 metabolizers may experience more euphoria

Dextromethorphan: ADRs

- Symptoms of intoxication are dependent on dose
- Adverse effects include:
  - Nystagmus, dilated pupils, body itching, rash, ataxia, sweating, hot/cold flashes, fever, hypertension, shallow respiration, urinary retention, diarrhea, opisthotonos, tachycardia, hyperthermia, toxic psychosis and coma
- Chronic ingestion may cause a withdrawal syndrome
- Interactions with other drugs
  - SSRIs inhibit CYP2D6, so may cause serotonin syndrome
  - MDMA may cause serotonin syndrome

Dextromethorphan: Treatment

- American Association of Poison Control Centers guidelines for treatment
  - If more than 5 to 7.5 mg/kg DMX ingested refer to ED for evaluation
  - If > 7.5 mg per kg has been ingested emergency department care is mandated to evaluate and treat adverse effects
  - Naloxone (Narcan) used if sedated or in coma
2C-E
- 2C-E or (4-ethyl-2,5-dimethoxyphenethylamine)
- “Europa”
- Hallucinogen
- Binds to the 5-HT2A serotonin receptor
- Onset is 20 to 90 minutes after ingestion and the duration of a single dose is 8 to 12 hours
- Little is known about toxic effects
  - fatal toxic leukoencephalopathy
  - methemoglobinemia

“Krokodil”
- Synthetic heroin-like drug
  - Combination of codeine, lighter fluid and industrial cleaners
  - A scaly, gray-green dead skin forms at the site of injection
  - Highly addictive
  - Deadly

Caffeine/energy drinks
- The Drug Abuse Warning Network (DAWN) has reported a large increase in ED visits associated with ingesting energy drinks
- July 2014: NIDA Alert regarding caffeine powder
- Energy drinks have 80mg to 500 mg caffeine per serving
  - Also contain supplements: B vitamins, taurine, ginseng, ginko biloba, guarana
- Caffeine is a methylxanthine
- CNS stimulant
Caffeine
- Rapidly absorbed, with peak in 30 to 60 minutes
- Intoxication: seizures, fast/irregular heart rate and death
- Combining alcohol and energy drinks masks intoxicating effects of alcohol
- Treatment
  - Supportive care
  - Charcoal if within 1 hr of ingestion
  - Benzodiazepines for seizures or CNS excitation
  - Hemodialysis

Hand Sanitizer
- ER reports of adolescents presenting with alcohol poisoning from ingesting hand sanitizers
- 60% ethyl alcohol "Purell Shots"
- Alcohol poisoning may be fatal due to high concentration of alcohol
  - Whiskey 80 proof = 40% alcohol

Take Aways
- Kids are creative!
- Think outside the box when evaluating an adolescent or young adult with cognitive or behavior changes
- Urine drug screens may not give you an accurate picture of what is happening
Questions?

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References


