This project was supported by grant No. 2016-MU-BX-K021 awarded by the Bureau of Justice Assistance. The Bureau of Justice Assistance is a component of the Office of Justice Programs, which also includes the Bureau of Justice Statistics, the National Institute of Justice, the Office of Juvenile Justice and Delinquency Prevention, the SMART Office, and the Office for Victims of Crime. Point of view or opinions in this document are those of the author and do not represent the official position or policies of the United States Department of Justice.
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<table>
<thead>
<tr>
<th>Materials To Download</th>
<th>Size</th>
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<tr>
<td>Excel SPC HMIS Self Assessm.</td>
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<tr>
<td>PATH Data Collection Workflow</td>
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<tr>
<td>Presentation Slides</td>
<td>6 MB</td>
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<tr>
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<td>31 KB</td>
</tr>
<tr>
<td>PATH Participation Policy</td>
<td>122 KB</td>
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</table>
Housekeeping: Communication

**Q&A and Technical Issues**
If you have questions for either the presenters or our Technical Support Staff, enter them in the Q&A box.

Our support staff will assist you with your technical issues, and our moderator will present as many questions as possible to the presenter.

**Chat with us!**
If you have general comments, please post them in the participant chat box.
Synthetic Drugs

Philip Barbour

TASC-II
http://www2.tasc-il.org/
Phillip Barbour / Master Trainer TASC
December 19, 2018
Training Collaborators

- South Southwest Addiction Technology Transfer Center
  - University of Texas at Austin, School of Social Work
- Pacific Southwest Addiction Technology Transfer Center
  - UCLA Integrated Substance Abuse Programs
- Centre for Addiction and Mental Health, Research Imaging Centre
Educational Objectives

At the end of this presentation, participants will be able to:

1. Identify the key characteristics and effects of synthetic drugs, most notably synthetic cannabinoids and synthetic cathinones.

2. Describe the current information available on the availability and patterns of synthetic drug use in the United States.

3. List at least three strategies for communicating the dangers involved with synthetic drug use.

4. Review some recent legislation intended to stem the manufacturing of these synthetic drugs.
Bath Salts made headlines in summer 2012 when a story of possible cannibalism was reported in Miami, FL.

The Miami-Dade Medical Examiner found no traces of bath salts, LSD, or synthetic marijuana in the perpetrator's system.

The sole psychoactive substance detected was cannabis (marijuana).
Have your heard these other media reports about “Bath Salts”?

• The man who slashed himself to remove the “wires” in his body
• The mother who left her demon-ridden 2-year-old in the middle of the highway
• The 21-year-old son of a family physician who, after snorting bath salts once, shot himself following 3 days of acute paranoia and psychosis, including hallucinations of police squad cars and helicopters lined up outside his house to take him away

An introduction to KEY terms and definitions
• Because of their chemical structure, alcohol and drugs have **dramatic effects** on neurotransmitters in CNS

• Effects on:
  • Mental processes
  • Behavior
  • Perception
  • Alertness

# Commonly Used Psychoactive Substances

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol (liquor, beer, wine)</td>
<td>euphoria, stimulation, relaxation, lower inhibitions, drowsiness</td>
</tr>
<tr>
<td>Cannabinoids (marijuana, hashish)</td>
<td>euphoria, relaxations, slowed reaction time, distorted perception</td>
</tr>
<tr>
<td>Opioids (heroin, opium, many pain meds)</td>
<td>euphoria, drowsiness, sedation</td>
</tr>
<tr>
<td>Stimulants (cocaine, methamphetamine)</td>
<td>exhilaration, energy</td>
</tr>
<tr>
<td>Club Drugs (MDMA/Ecstasy, GHB)</td>
<td>hallucinations, tactile sensitivity, lowered inhibition</td>
</tr>
<tr>
<td>Dissociative Drugs (Ketamine, PCP, DXM)</td>
<td>feel separated from body, delirium, impaired motor function</td>
</tr>
<tr>
<td>Hallucinogens (LSD, mushrooms, Mescaline)</td>
<td>hallucinations, altered perception</td>
</tr>
</tbody>
</table>
The Top 8 Drug Types

There are eight different drug types, and each has its own set of effects and risks:

1. Stimulants
2. Depressants
3. Hallucinogens
4. Dissociatives
5. Opioids
6. Inhalants
7. Cannabis
8. Prescription drugs

https://easyread.drugabuse.gov/content/drugs-people-misuse
There are primality only 3 main drug classifications when it comes to prescription drugs.

• Central Nervous System drugs (CNS)
• Stimulants
• Opioids
Substance Use Disorder (SUD)

The language we use matters

Addict \ Alcoholic
Abuse \ Abuser
Addiction \ Risky user
Substance abuse \ Chemical Dependence
Dependence \ Drug Addict
Abuse \ Recreational user
Substance Misuse
A substance use disorder (SUD) is a continuum of problematic use of substances:

- On one end of the continuum are people who are using at risky levels. They may not be having problems yet, but are at risk of developing them if current level of use continues.
- On the other end, SUD is a complex, chronic, relapsing brain disease characterized by compulsive, and at times, uncontrollable drug craving, seeking, and use that persist even in the face of extremely negative consequences.
Some Additional Important Terminology

- Psychological craving
- Tolerance
- Withdrawal symptoms
Psychological craving is a strong desire or urge to use drugs. Cravings are most apparent during drug withdrawal.
Tolerance

Tolerance is a state in which a person no longer responds to a drug as they did before, and a higher dose is required to achieve the same effect.

Withdrawal

The following symptoms may occur when substance use is reduced or discontinued:

• Tremors, chills
• Cramps
• Emotional problems
• Cognitive and attention deficits
• Hallucinations
• Convulsions
• Death

A Review of synthetic DRUGS
Synthetic Drugs

• Not really “Spice,” “Bath Salts,” “Incense,” or “Plant Food”
• Chemically-based; not plant derived
• Complex chemistry
• Constantly changing to “stay legal”
• Need to prove “intended to use” to convict in some areas
Synthetic Cannabinoids

Spice vs. “Spice”
Synthetic Cathinones

**Bath Salts vs. “Bath Salts”**
Marijuana (Cannabis)

- Often called pot, grass, reefer, MJ, weed, herb
- A mixture of the dried, shredded leaves, stems, seeds, and flowers of *Cannabis* sativa—the hemp plant
- Most commonly used drug in the U.S.
- Delta-9-tetrahydrocannabinol (THC) is the main active ingredient in marijuana
- Common effects include: euphoria, relaxation, heightened sensory perception, laughter, altered perception of time, and increased appetite
- May also produce anxiety, fear, distrust, or panic, and can lead to severe mental health problems for some users.

Synthetic Cannabinoids

• Wide variety of herbal mixtures
• Marketed as “safe” alternatives to marijuana
• Labeled “not for human consumption”
• Contain dried, shredded plant material (inert) and chemical additives that are responsible for their psychoactive effects.

Synthetic Cannabinoids

- Mainly abused by smoking (alone or with marijuana); may also be prepared as an herbal infusion for drinking.
- Many of the active chemicals most frequently found in synthetic cannabis products have been classified by the DEA as Schedule I controlled substances, making them illegal to buy, sell, or possess.
- Multiple “generations” of drugs.

Poll Question

When was K2 (spice) banned in the U.S.?

A. 1965
B. 1999
C. 2010
D. 2013
Poll Question

When was K2 (spice) banned in the U.S.?

A. 1965
B. 1999
C. 2010
D. 2013
Timeline of Synthetic Cannabinoid Products

Factors Associated with Synthetic Cannabinoid Popularity

• They induce psychoactive effects
• They are readily available in retail stores and online
• The packaging is highly attractive
• They are perceived as safe drugs
• They are not easily detectable in urine and blood samples

In the News

- **July 2018 FDA**: Hundreds hospitalized due to contaminated synthetic cannabinoids
- **Anticoagulants** (thins the blood)
- **Brodifacoum**, which commonly is used in rat poison
- Believed to “extend the high”
- **August 2018 CCN**: 100 Cases in New Haven Connecticut, 56 Cases in Illinois
Khat

• Pronounced “cot”
• Stimulant drug derived from a shrub (*Catha edulis*) native to East Africa and southern Arabia
• Use is considered illegal, because one of its chemical constituents, cathinone, is a Schedule I drug
• Khat found in the U.S. often comes in by mail from Africa

Synthetic Cathinones

- Could be MDPV, 4-MMC, mephedrone, or methylone
- Sold on-line with little info on ingredients, dosage, etc.
- Advertised as legal highs, legal meth, cocaine, or ecstasy
- Taken orally or by inhaling
- Serious side effects include tachycardia, hypertension, confusion or psychosis, nausea, convulsions
- Labeled “not for human consumption” to get around laws prohibiting sales or possession

Synthetic Cathinones are β-keto (‘bk’) Analogs of Amphetamine
Sources and Continuing Availability

• A number of synthetic marijuana and bath salt products appear to originate overseas and are manufactured in the absence of quality controls and devoid of governmental regulatory oversight.

• The large profits from sales, plus the fact that these chemicals can be easily synthesized to stay one step ahead of control, indicate there is no incentive to discontinue retail distribution of synthetic cannabinoid products under the current statutory and regulatory scheme.

The Effects of Synthetic DRUGS
“People high on these drugs can get very agitated and violent, exhibit psychosis, and severe behavior changes...some have been admitted to psychiatric hospitals and have experienced continued neurological and psychological effects.”

(Dr. Rick Dart, AAPCC President)
Short-Term Effects of Synthetic Cannabinoids

- Loss of control
- Lack of pain response
- Increased agitation
- Pale skin
- Seizures
- Vomiting
- Profuse sweating
- Uncontrolled spastic body movements
- Elevated blood pressure
- Elevated heart rate
- Heart palpitations
- Bleeding from the eyes and ears

*In addition to physical signs of use, users may experience severe paranoia, delusions, and hallucinations.*

Most symptoms are similar to cannabis intoxication:

- Tachycardia
- Reddened eyes
- Anxiousness
- Mild sedation
- Hallucinations
- Acute psychosis
- Memory deficits

Symptoms not typically seen after cannabis intoxication:

- Seizures
- Hypokalemia
- Hypertension
- Nausea/vomiting
- Agitation
- Violent behavior
- Coma

Synthetic Cannabinoids: Other Considerations

- Unlike cannabis, synthetic cannabinoids have **no therapeutic effects**
  - *Example: no cannabidiol (anti-anxiety), so mood effects unpredictable*

- Packets can contain other psychoactive substances: opioids, oleamide, harmine/harmaline (MAO-Is) that can interact with the synthetic cannabinoid

- Cancer-causing potential of inhaling smoke from these compounds unknown
The Neurobiology of Synthetic Drug USE
Cannabinoids

• Neurobiological Concerns:
  • Shown to induce dopamine release (although less directly than stimulants) \(\rightarrow\) brain reward signal \(\rightarrow\) potential for compulsive use/addiction
  • Shown to impact regions of the brain responsible for coordination, problem-solving, sense of time, motivation, etc. \(\rightarrow\) impaired when high
  • Effects on regions underlying learning and memory \(\rightarrow\) possible long-term effects
  • Possible link to psychosis and schizophrenia

SOURCE: Doris Payer, #CHSF2013.
“Classic” Cannabinoids

• Endocannabinoid system ("endo" = within)
  Only recently discovered, unusual, not well understood
  • Receptors: CB1 (brain), CB2 (immune system)
  • Transmitters: Anandamide, 2-AG
• THC: binds to CB1 receptor
  • But not very well (low affinity) and not very good at inducing effects (partial agonist)
  • But unlike endocannabinoid transmitters, not degraded immediately, so CB1 activation is extended/exaggerated compared to anandamide

SOURCE: Doris Payer, #CHSF2013.
Synthetic Cannabinoids

• No structural similarity to THC, but same effects profile
  • Bind to CB1 and CB2 receptors
  • Same types of physical effects & impairments
  • In animals: signs of “high” similar, but at 2-14x lower dose
• The problem: Stronger & longer-lasting than THC
  – Better binding to receptors (high affinity/potency) AND each binding event has greater effect (full agonist)
    • 4x higher affinity for CB1, 10x for CB2
    • Longer half-life so effects longer lasting
  – Products of break-down (metabolites) also psychoactive
  – Together: More, more-likely, and longer-lasting adverse effects (especially if dosing is based on cannabis)

SOURCE: Doris Payer, #CHSF2013.
Synthetic Cannabinoids: “The Next Generation”

- New compound, URB-754: Does NOT bind to CB receptors itself, but inhibits enzyme that breaks down endocannabinoids
  - More endocannabinoid around → more binding to receptors
- AND, one “spice” sample was found to contain URB + a cathinone, which reacted with one another and together created a whole new psychoactive compound

**URB-754: A new class of designer drug and 12 synthetic cannabinoids detected in illegal products**

- Nahoko Uchiyama, Maiko Kawamura, Ruri Kikura-Hanajiri, Yukihiro Goda

SOURCE: Doris Payer, #CHSF2013.
Stimulants

- Neurobiological Concerns
  - Addiction
    - Compulsive chase and use
  - Physical health
    - Cardio-vascular (heart rate, blood pressure, etc.)
    - Body temperature
    - Long-term brain changes
  - Mental state
    - Risky decisions, impaired judgment, impulsive acts, etc.

SOURCE: Doris Payer, #CHSF2013.
“Classic” Stimulants

Direct action on synapse

- Amphetamine, cathinone: induce dopamine release
- Cocaine, methylphenidate (Ritalin): block dopamine removal
- MDMA: additional effects on serotonin
  - Dopamine effects less strong, so less “reward,” so animals do not self-administer as much
  - Synthetic stimulants are variations on this theme, BUT: “Very subtle structural modifications can yield profoundly different behavioural, neurochemical, and neurotoxicological effects.”

SOURCE: Doris Payer, #CHSF2013.
Synthetic Stimulants

• In general: dopamine ↑ and animals like/want/work for drug
  • Sign of high abuse potential
  • Recreational use can progress easily to compulsive use

SOURCE: Doris Payer, #CHSF2013.
Synthetic Cathinones

• Block transporters (removal)
  • Rank at **DAT**: MDPV/pyrovalerone >> cocaine, amphetamine/MA, methcathinone, naphyrone > mephedrone, butylone, methylone, etylone, flephedrone, MDEA > cathinone, MDMA, MBDB
  • Rank at **SERT**: MDEA, MDMA, naphyrone > MBDB, cocaine, ethylone, mephedrone, butylone >> rest
  • Rank at **NET** (fight/flight): MDPV, pyrovalerone > amph/MA, methcathinone > cathinone, mephedrone, flephedrone, naphyrone > MDMA, cocaine, methylone > MDEA, butylone, ethylone, MBDB

SOURCE: Doris Payer, #CHSF2013.
Synthetic Cathinones

- Also release
  - **Dopamine**: Amph/MA, cathinone, methcathinone, mephedrone*, flephedrone > MDMA (potency low)
  - **Serotonin**: MDMA, MDEA, MBDB, methylone, ethylone, butylone, mephedrone
    - Amph/MA, methcathinone, flephedrone only at very high concentrations
- Pyrovalerone, naphyrone, MDPV: **NO** dopamine or serotonin release, but still extremely good at blocking removal – 10x cocaine

SOURCE: Doris Payer, #CHSF2013.
Synthetic Cathinones vs. “Classic” Stimulants

- Mephedrone originally thought to be more like MDMA than amphetamine b/c of serotonin effects, but dopamine release more like amphetamine → greater abuse liability
- In and out of brain faster than MDMA → greater potential for repeated binge use
- Effects on body temperature regulation different from MDMA: “Adverse effects cannot be extrapolated from previous observations on MDMA” (Shortall)
- MDPV: greater self-administration than even MA

SOURCE: Doris Payer, #CHSF2013.
Synthetic Stimulants: Physical Concerns

- Norepinephrine (fight/flight) system: hyper-active movement, body temperature regulation, cardio-vascular effects
- Especially MDPV
  - Better than cocaine (x10) at producing hyper-active movement, increased heart rate & blood pressure
  - Itself does not disrupt body temperature regulation (like MA or MDMA do), but heart rate/blood pressure interact with room temperature (Fantegrossi)
- Neurotoxicity ("brain damage"): some evidence for serotonin and dopamine depletion in animals
  - Mephedrone NOT toxic to dopamine cells (several reports)
  - **BUT: Mephedrone enhances toxic effects of amph/MA and MDMA! (Angoa-Perez) → co-administration frequent, even if accidental

SOURCE: Doris Payer, CHSF2013.
THE EPIDEMIOLOGY OF SYNTHETIC DRUG USE
Compounds Encountered in the U.S.

233 New synthetic compounds from the 8 classes of drugs Law Enforcement has encountered:

- 95 synthetic cannabinoids
- 51 synthetic cathinones
- 87 Other compounds (2C compounds, trytpamine, piperzines, etc.)
Synthetic Cannabinoid Data

American Association of Poison Control Center

These numbers reflect the closed human exposures to synthetic cannabinoid (THC homologs) reported to poison centers as of November 30, 2018. The numbers may change as cases are closed and additional information is received.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cases</th>
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<tr>
<td>2011</td>
<td>6,968</td>
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<tr>
<td>2012</td>
<td>5,230</td>
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<td>2013</td>
<td>2,668</td>
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<tr>
<td>2014</td>
<td>3,682</td>
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<tr>
<td>2015</td>
<td>7,797</td>
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<tr>
<td>2016</td>
<td>2,706</td>
</tr>
<tr>
<td>2017</td>
<td>1,959</td>
</tr>
<tr>
<td>2018</td>
<td>1,843</td>
</tr>
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</table>
### Emergency Room Visits Related to Synthetic Cannabis and Cathinones: DAWN, 2011

<table>
<thead>
<tr>
<th></th>
<th>% Male</th>
<th>% Under Age 21</th>
<th>% Sent to ICU or Sub. Abuse Treatment</th>
<th>% Discharged Home</th>
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</thead>
<tbody>
<tr>
<td>Synthetic Cannabis</td>
<td>70%</td>
<td>55%</td>
<td>3%</td>
<td>78%</td>
</tr>
<tr>
<td>Synthetic Cathinones</td>
<td>76%</td>
<td>14%</td>
<td>12%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Research is needed to better understand the side effects and long-term consequences associated with the use of synthetic cannabinoids and synthetic cathinones.

More toxicological identification of these new drugs, more information on the sources of them, as well as their distribution and patterns of use is needed to curtail future increases in use.
Resources for Continued Learning

• American Association of Poison Control Centers, www.aapcc.org
• Drug Enforcement Administration, www.dea.usdoj.gov
• European Monitoring Centre for Drugs and Drug Addiction, www.emcdda.europa.eu
• Office of National Drug Control Policy, www.ondcp.org
• Pacific Southwest ATTC, www.psattc.org
• Refer to the Synthetic Drugs Reference List**
Thank you for your time!
Questions?

Type your questions in the Q&A box on your screen

Speaker Contact Info:

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