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NPS
DISCOVERY

Outbreak Investigations *(...and More!)* Involving Synthetic Cannabinoids in Combination With Fentanyl

Alex J. Krotulski, PhD

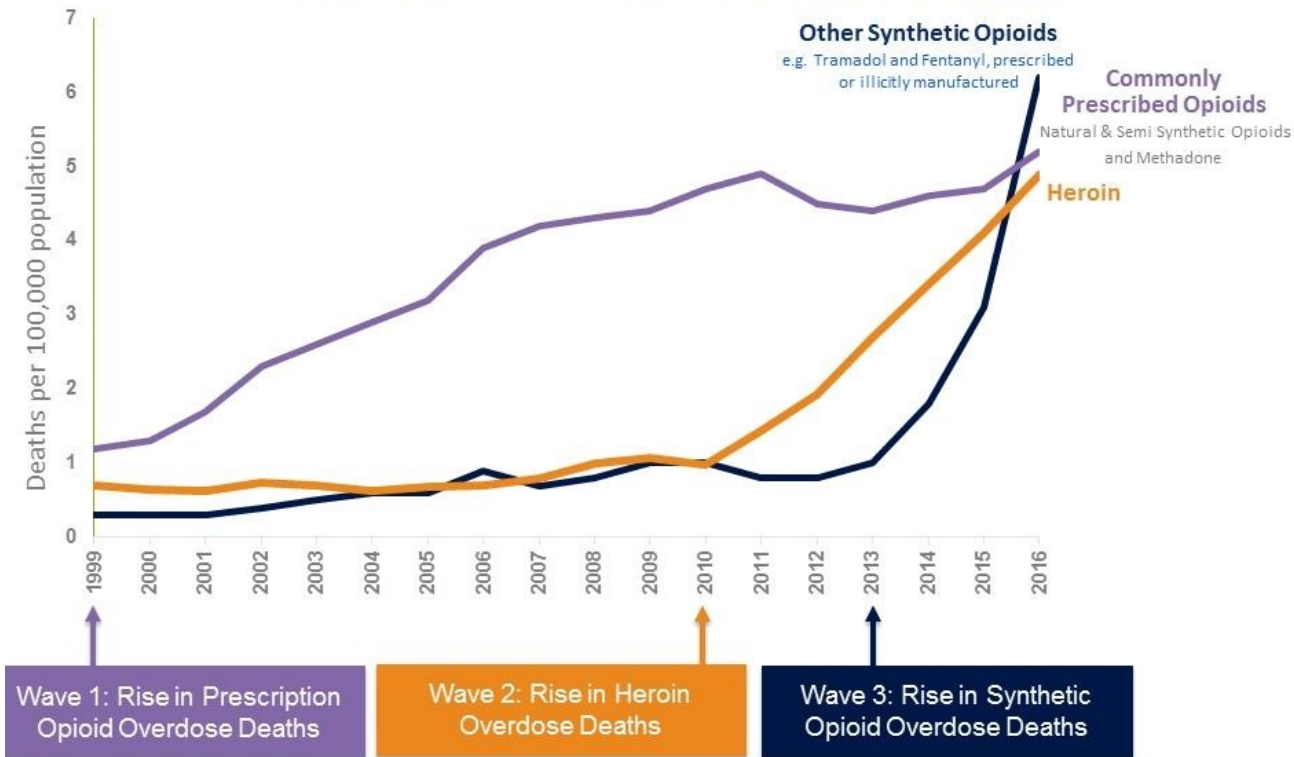
*Center for Forensic Science Research and Education (CFSRE)
at the Fredric Rieders Family Foundation, Willow Grove, PA*

Disclosure

- Nothing to disclose.

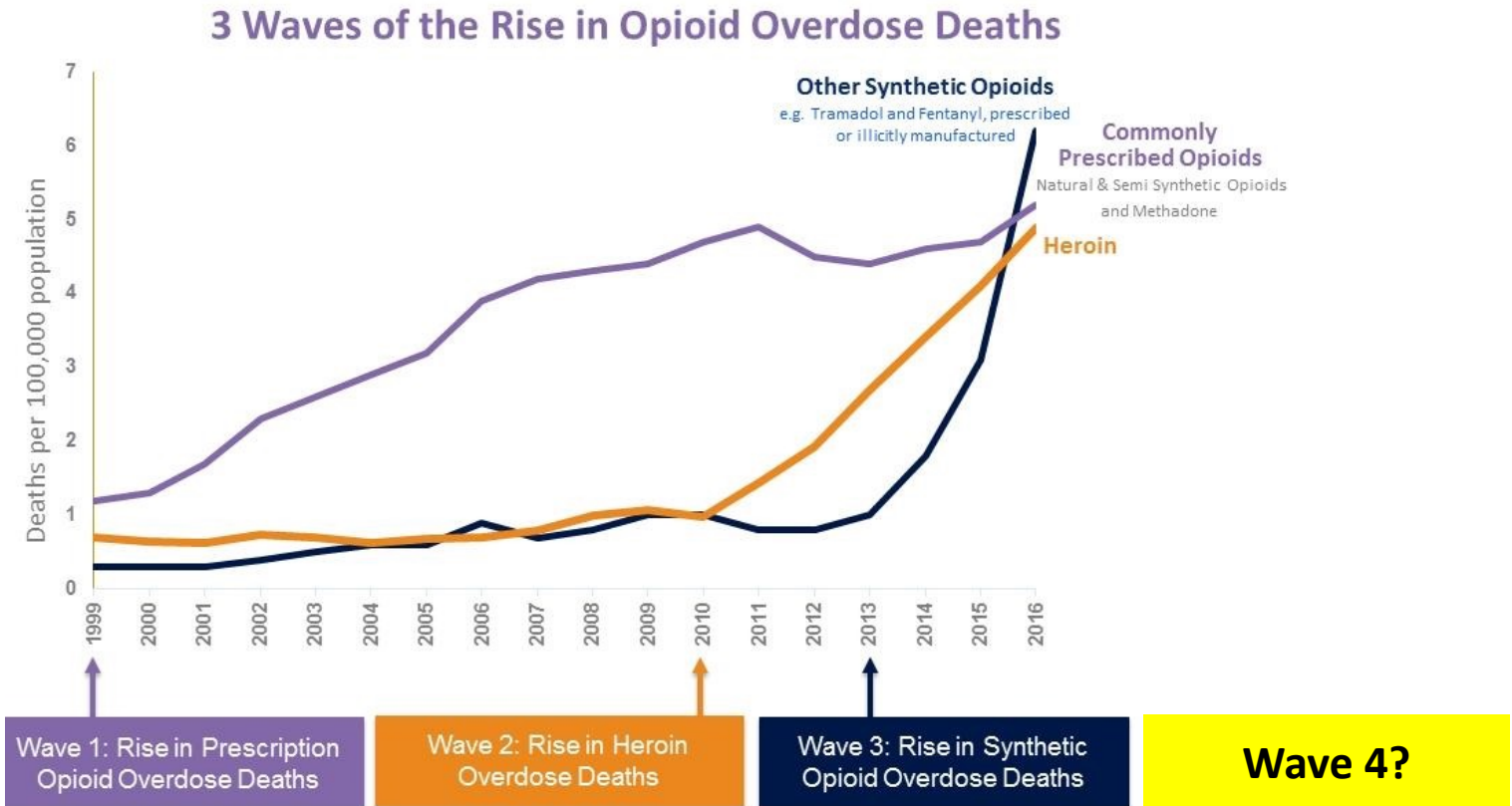
Waves of the Opioid Crisis

3 Waves of the Rise in Opioid Overdose Deaths



SOURCE: National Vital Statistics System Mortality File.

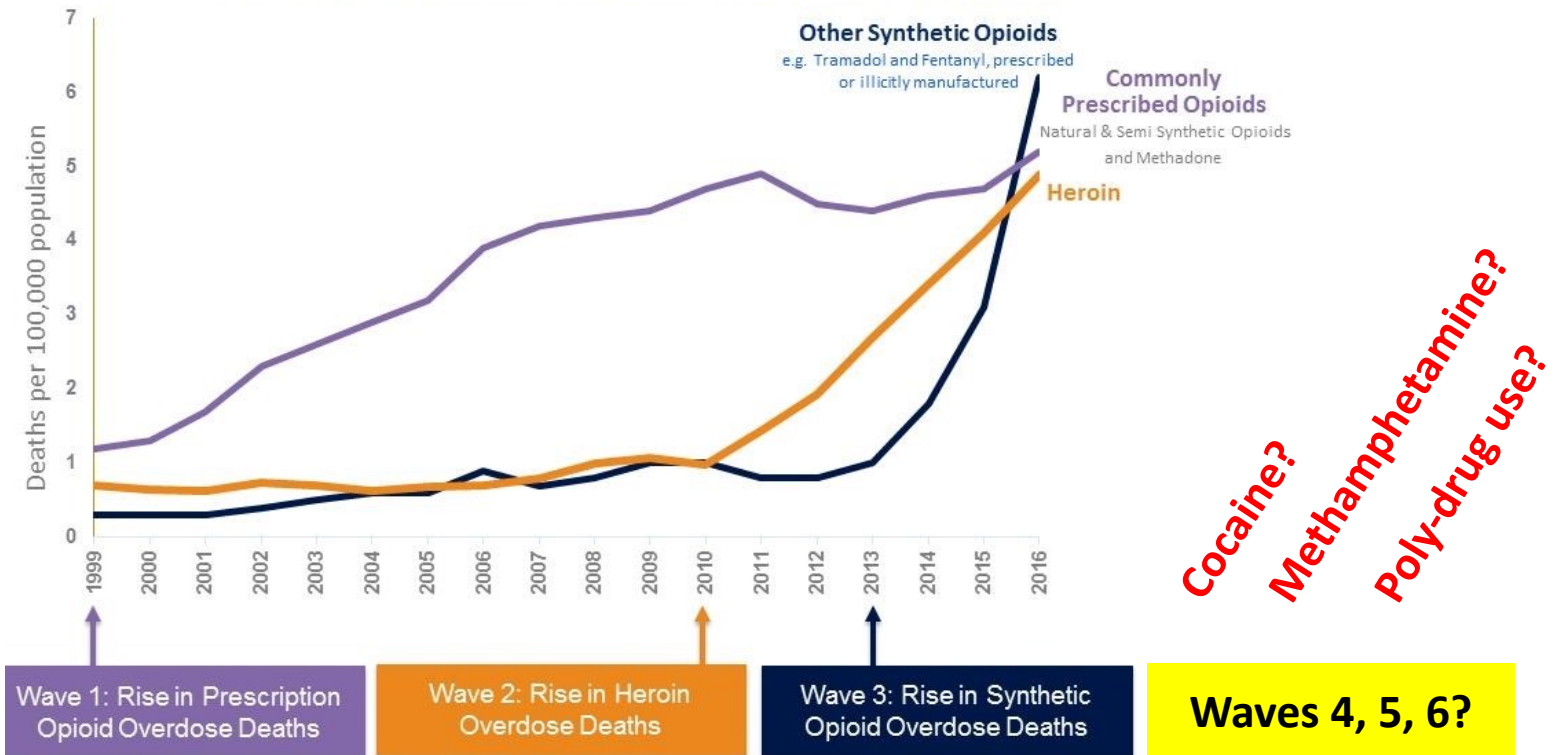
Waves of the Opioid Crisis



SOURCE: National Vital Statistics System Mortality File.

Waves of the Opioid Crisis

3 Waves of the Rise in Opioid Overdose Deaths



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Drug Combinations

- Opioids and stimulants
 - Fentanyl and cocaine
 - Cyclopropylfentanyl and alpha-PHP
- Opioids and benzodiazepines
 - Fentanyl and alprazolam
 - Fentanyl and etizolam
- Opioids and synthetic cannabinoids?

OUTBREAK INVESTIGATION

Fentanyl and Synthetic Cannabinoids

- Our first incidence → July 2018
- Philadelphia, PA, and surrounding suburbs (NJ)
- Overdose outbreak



Fentanyl and Synthetic Cannabinoids

Google

PubMed



Fentanyl and Synthetic Cannabinoids

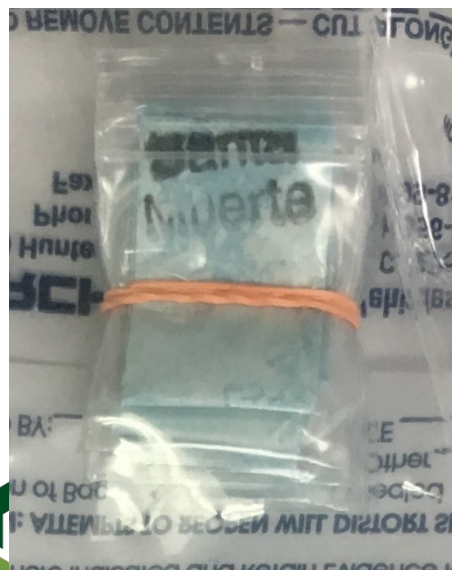
- Our first incidence → July 2018
- Philadelphia, PA and surrounding suburbs (NJ)
- Overdose outbreak involving a product called “Santa Muerte”
- Believe to be the last of the “uncontaminated” or “pure” heroin left in the city

“Santa Muerte” Background

- **Mass overdoses are reported in Philadelphia**
 - Friday July 20th to Sunday July 22nd
 - Estimated more than 160 overdoses
 - Following administration of naloxone, patients were reported to be agitated and confused
- **Timeline**
 - 7/20: First overdose reported
 - 7/24: Received and analyzed powder; results reported by EOB
 - 7/26 and 7/27: Received biological samples and additional seized powder; results reported by end of next business day

Seized Powder Exhibits

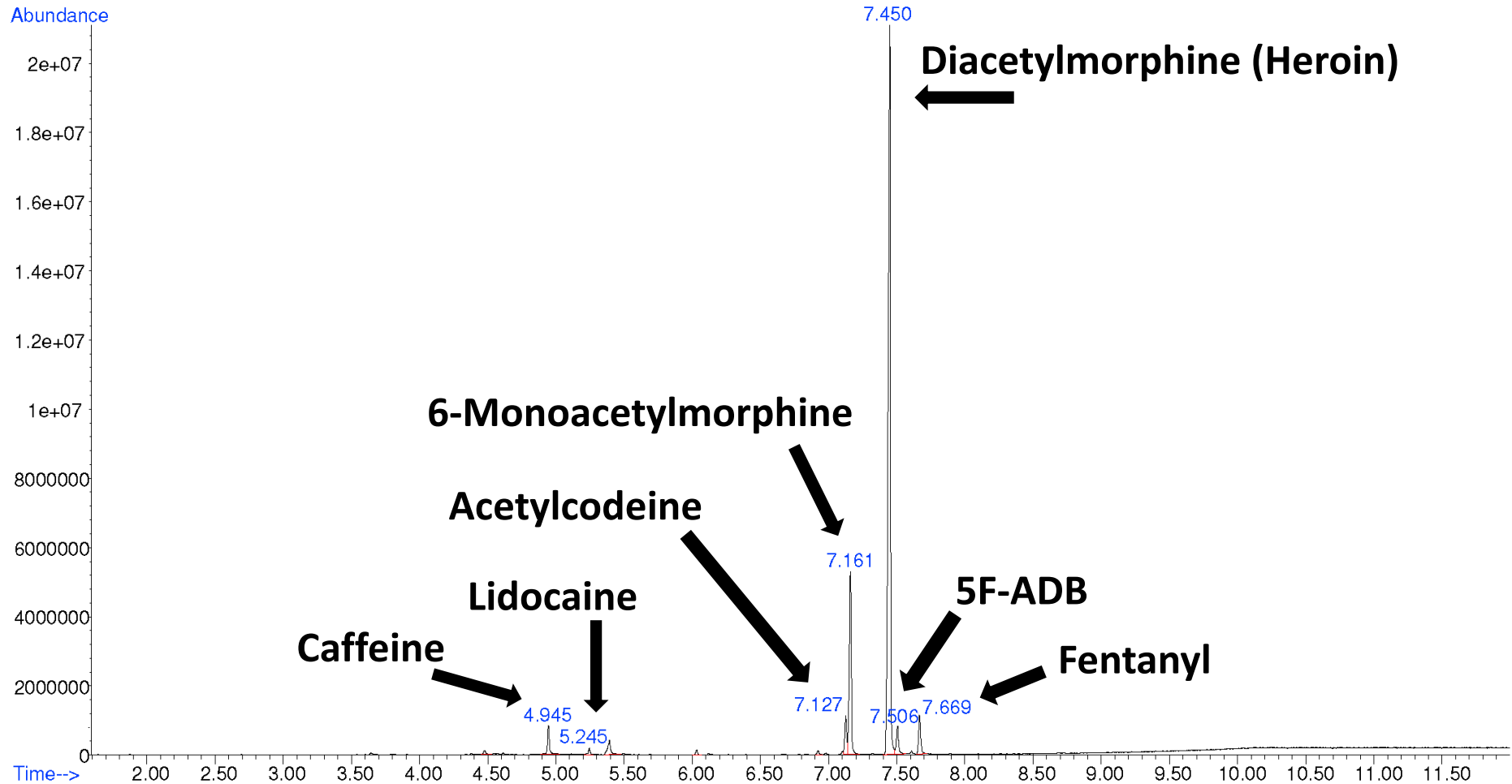
- Seized exhibits received from “two sources”
 - Allegedly purchased in Philadelphia (Kensington area)
 - Stamped with “Santa Muerte” in red and black ink
 - Containing a light tan powder



Seized Powder Exhibits

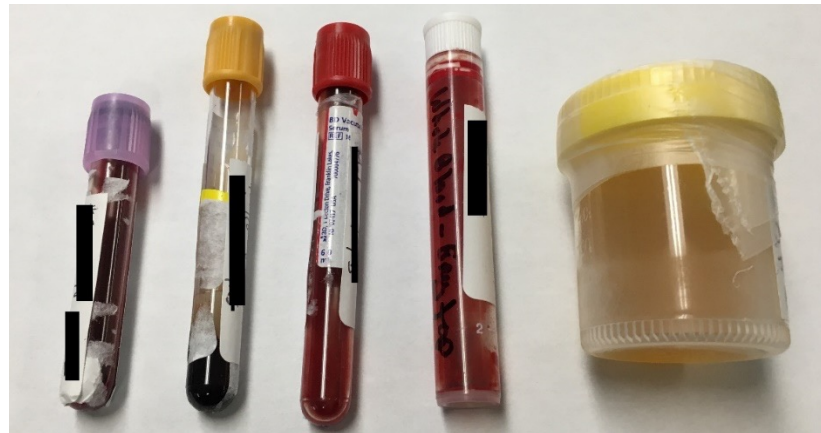
- Sample Preparation: Acid-base extraction
- Analysis: GC-MS and LC-QTOF-MS
- Positive Results: 5F-ADB, Fentanyl, Heroin
 - Heroin was the primary component
 - All 15 “Santa Muerte” stamped exhibits received were found to contain the sample substances, in the same relative intensities

Seized Powder Exhibits



Biological Samples

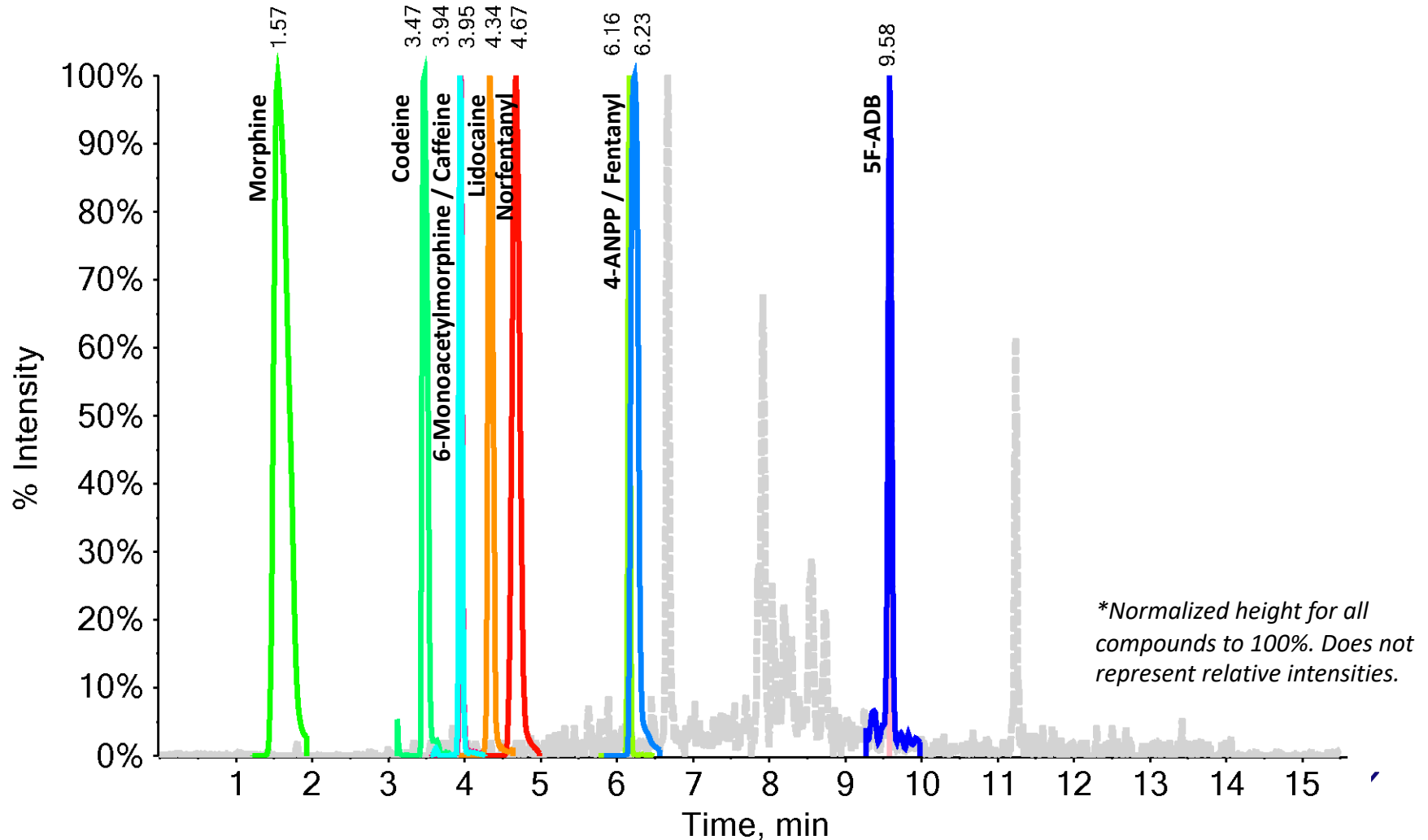
- Biological samples received from three hospitals
 - Apparent overdose patients presenting to ED
 - One patient had stamped “Santa Muerte” product in his possession
 - Blood, serum/plasma, and urine samples



Biological Samples

- Broad Drug Screening
 - Sample Preparation: Basic (pH 10.4) liquid-liquid extraction
 - Analysis: LC-QTOF-MS (15 minute method)
 - Data Processing: Database containing >700 analytes
- Synthetic Cannabinoid Testing
 - Sample Preparation: Blood – Basic (pH 10.2) liquid-liquid extraction; Urine – solid phase extraction
 - Analysis: LC-QTOF-MS (7 minute method)
 - Data Processing: Database containing >250 synthetic cannabinoid parent compounds and metabolites

Biological Samples



Biological Samples

- In total, 61 samples were received from a suspected 19 overdose patients
- 6 patients were positive for 5F-ADB, fentanyl, heroin, and/or their metabolites
 - 6 patients were positive for fentanyl only (no heroin metabolites identified)
 - 6 patients were negative for fentanyl, heroin, and 5F-ADB
 - 1 patient sample had insufficient volume for analysis

Questions?

- Why was a synthetic cannabinoid found in a batch of heroin?
- How often are synthetic cannabinoids found with fentanyl/heroin?
- Do we really know the extent of this phenomenon?

Adding Synthetic Cannabinoids...

- ...helps potentiate the nod (“blissful oblivion”)
- ... slows down how quickly the body metabolizes the drug
- ...can help offset sickness

****All anecdotal – but firsthand from drug users****

Adding Fentanyl...



[REDACTED]
[REDACTED] apparently it was also cut with other stuff as well /: dealers tend to add fentanyl in a small amount so you feel your drugs more, and then you think they have good stuff so you continue to buy and sometimes they add just enough to kill you, most of the time not even on purpose...

8h Like Reply

SEIZED DRUG DATA

Data from NJ DMI

- New Jersey Drug Monitoring Initiative
- Data from NJSP drug testing laboratories
 - Heroin/Fentanyl/FUB-144
 - FUB-144/Fentanyl/Heroin
 - Heroin/Fentanyl/Acetylfentanyl/5F-ADB
 - Etc.

“CLINICAL” INVESTIGATIONS

DRE Evaluations

- Oral fluid samples collected in Philadelphia, PA, in collaboration with Pennsylvania State Police
 - 5F-MDMB-PICA and Fentanyl
 - 4F-MDMB-BINACA and Fentanyl

11:30 a.m. - 11:45 a.m.

K50

The Effects of Synthetic Cannabinoids and Poly-Drug Use on Drug Recognition Expert Evaluations

Amanda L.A. Mohr, MSFS; Judith Rodriguez Salas, MS; Alex J. Krotulski, MS; David Andrascik, BS; Barry K. Logan, PhD*

FORENSIC TOXICOLOGY CASES

Toxicology Cases

- Sample-mining for emerging synthetic cannabinoids
 - Received basic demographic information and reported results (NMS Labs)
- Pair synthetic cannabinoid positive results with fentanyl positive results
 - 29 cases from 5/2018 to 11/2019

Date Received	Compound	Reported Results
5/30/2018	5F-PB-22	Fentanyl, Methamp.
7/17/2018	5F-ADB	Fentanyl, Alprazolam
7/25/2018	MMB-FUBINACA	Fentanyl
9/27/2018	ADB-FUBINACA	Fentanyl, Methamp.
10/2/2018	5F-MDMB-PICA	Fentanyl, Methamp.
10/10/2018	5F-ADB	Fentanyl
11/14/2018	5F-MDMB-PICA	Fentanyl, Alprazolam
12/18/2018	5F-MDMB-PICA	Fentanyl, THC
12/18/2018	4F-MDMB-BINACA	Fentanyl, Morphine, Alprazolam
1/3/2019	5F-MDMB-PICA	Fentanyl, Morphine, Cocaine
1/4/2019	APP-BINACA	Fentanyl, Etizolam, Oxycodone
1/24/2019	MMB-FUBINACA	Fentanyl, Fentanyl Analogues, Morphine
2/23/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl, Heroin
4/2/2019	4F-MDMB-BINACA, APP-BINACA, 5F-MDMB-PICA	Fentanyl, Morphine
4/19/2019	5F-MDMB-PICA, MDMB-FUBICA	Fentanyl, Heroin
5/10/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl, Morphine, Alprazolam
5/28/2019	4F-MDMB-BINACA	Fentanyl, THC
6/25/2019	5F-MDMB-PICA	Fentanyl
6/27/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl
7/10/2019	5F-MDMB-PICA	Fentanyl, Xylazine
8/20/2019	4F-MDMB-BINACA	Fentanyl
8/23/2019	5F-MDMB-PICA	Fentanyl, THC
8/27/2019	5F-MDMB-PICA	Fentanyl, U-47700, Morphine, Alprazolam, Methamp.
9/4/2019	5F-MDMB-PICA	Fentanyl, Methadone, BZE
9/17/2019	4F-MDMB-BINACA	Fentanyl, THC
9/18/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl, Morphine, Alprazolam, Methamp.
9/18/2019	4F-MDMB-BINACA	Fentanyl
10/7/2019	4F-MDMB-BINACA	Fentanyl, Morphine
11/13/2019	MDMB-4en-PINACA	Fentanyl, THC

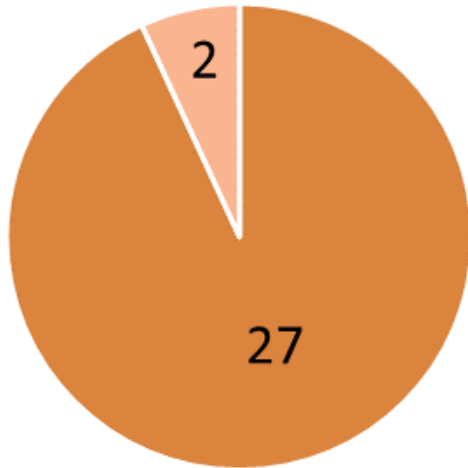
Date Received	Synthetic Cannabinoid	Reported Results
5/30/2018	5F-PB-22	Fentanyl, Methamp.
7/17/2018	5F-ADB	Fentanyl, Alprazolam
7/25/2018	MMB-FUBINACA	Fentanyl
9/27/2018	ADB-FUBINACA	Fentanyl, Methamp.
10/2/2018	5F-MDMB-PICA	Fentanyl, Methamp.
10/10/2018	5F-ADB	Fentanyl
11/14/2018	5F-MDMB-PICA	Fentanyl, Alprazolam
12/18/2018	5F-MDMB-PICA	Fentanyl, THC
12/18/2018	4F-MDMB-BINACA	Fentanyl, Morphine, Alprazolam
1/3/2019	5F-MDMB-PICA	Fentanyl, Morphine, Cocaine
1/4/2019	APP-BINACA	Fentanyl, Etizolam, Oxycodone
1/24/2019	MMB-FUBINACA	Fentanyl, Fentanyl Analogues, Morphine
2/23/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl, Heroin
4/2/2019	4F-MDMB-BINACA, APP-BINACA, 5F-MDMB-PICA	Fentanyl, Morphine
4/19/2019	5F-MDMB-PICA, MDMB-FUBICA	Fentanyl, Heroin
5/10/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl, Morphine, Alprazolam
5/28/2019	4F-MDMB-BINACA	Fentanyl, THC
6/25/2019	5F-MDMB-PICA	Fentanyl
6/27/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl
7/10/2019	5F-MDMB-PICA	Fentanyl, Xylazine
8/20/2019	4F-MDMB-BINACA	Fentanyl
8/23/2019	5F-MDMB-PICA	Fentanyl, THC
8/27/2019	5F-MDMB-PICA	Fentanyl, U-47700, Morphine, Alprazolam, Methamp.
9/4/2019	5F-MDMB-PICA	Fentanyl, Methadone, BZE
9/17/2019	4F-MDMB-BINACA	Fentanyl, THC
9/18/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Fentanyl, Morphine, Alprazolam, Methamp.
9/18/2019	4F-MDMB-BINACA	Fentanyl
10/7/2019	4F-MDMB-BINACA	Fentanyl, Morphine
11/13/2019	MDMB-4en-PINACA	Fentanyl, THC

Case Information (+Fentanyl)

Received Date	Syn Cann	Case Information
10/2/2018	5F-MDMB-PICA	Inmate found in cell
11/14/2018	5F-MDMB-PICA	Suspected OD, drinking "lean"
12/18/2018	5F-MDMB-PICA	History of drug abuse (K2, cocaine), found deceased in bathroom
2/23/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Found deceased, drug paraphernalia
4/19/2019	5F-MDMB-PICA, MDMB-FUBICA	Suspected OD
8/20/2019	4F-MDMB-BINACA	Suspected OD
9/4/2019	5F-MDMB-PICA	Suspected OD
9/18/2019	4F-MDMB-BINACA, 5F-MDMB-PICA	Suspected OD
9/18/2019	4F-MDMB-BINACA	Suspected heroin OD
11/13/2019	MDMB-4en-PINACA	Found unresponsive at residence

Demographics

Case Type

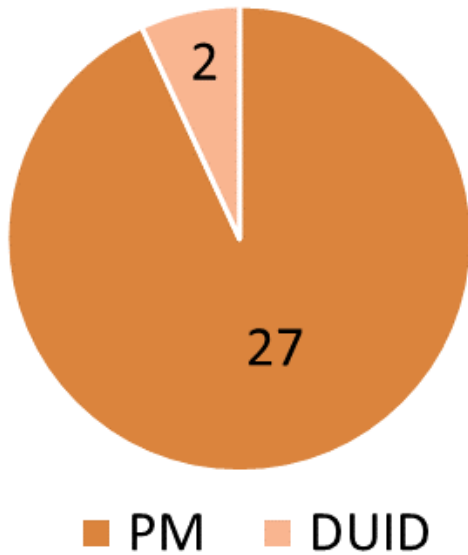


■ PM ■ DUID

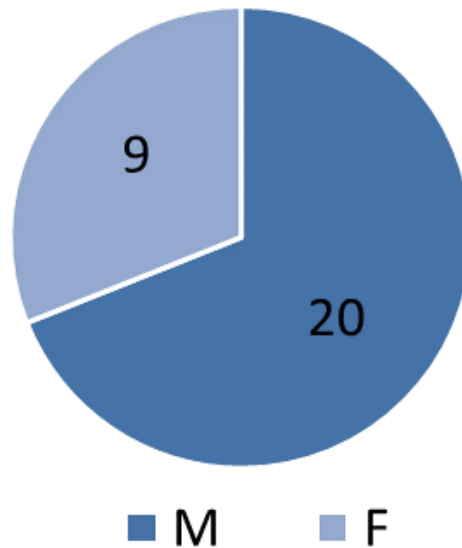
Case Type	Synthetic Cannabinoid	Reported Results
DUID	4F-MDMB-BINACA APP-BINACA 5F-MDMB-PICA	Fentanyl Morphine
DUID	5F-MDMB-PICA	Fentanyl

Demographics

Case Type

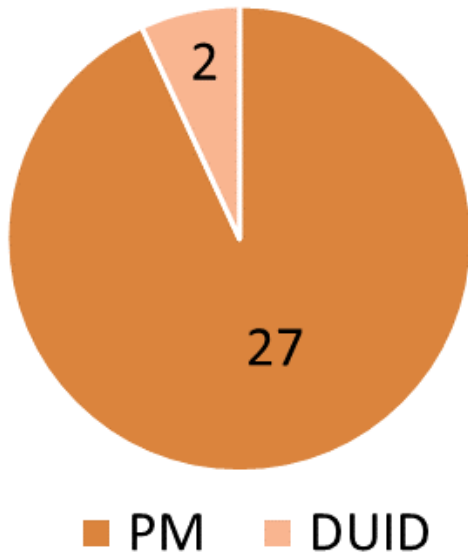


Sex

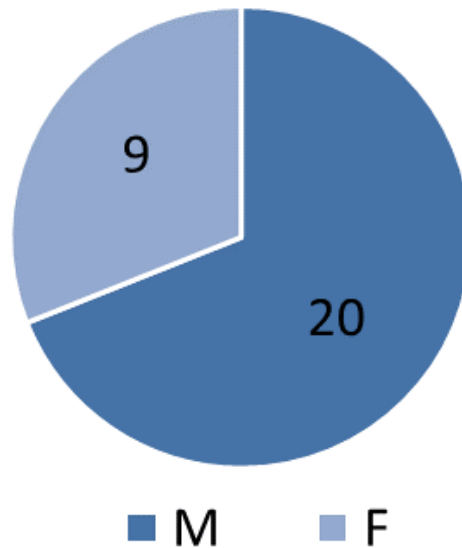


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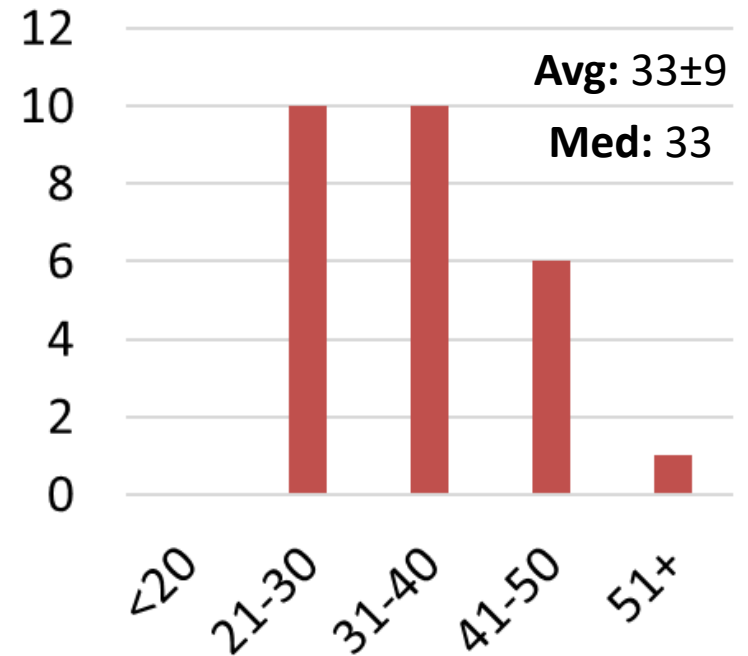
Case Type



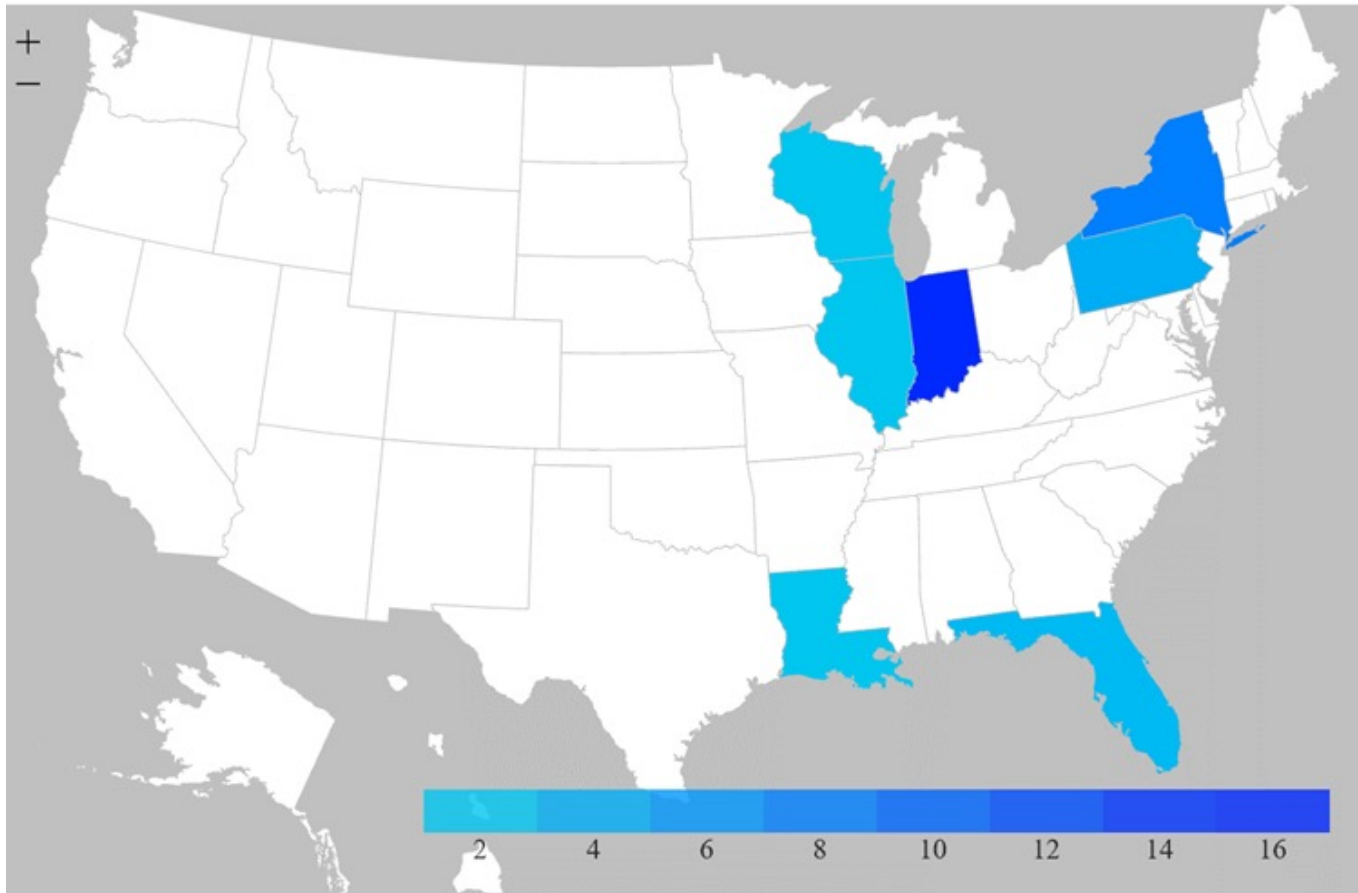
Sex



Age



Geographic Locations



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NPS DISCOVERY

DISCUSSION / CONCLUSION

What is the extent?

- We do not know

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- Seized drug analysis:
 - The amount of synthetic cannabinoid is often very small, pushing limits of sensitivity, issues with sampling protocols
 - New synthetic cannabinoids may not be in library databases
 - Co-elution with heroin/fentanyl can be problematic

What is the extent?

- We do not know
- Seized drug analysis:
 - The amount of synthetic cannabinoid is often very small, pushing limits of sensitivity, issues with sampling protocols
 - New synthetic cannabinoids may not be in library databases
 - Co-elution with heroin/fentanyl can be problematic
- Toxicology:
 - Not all samples are subjected to synthetic cannabinoid testing, especially when opioids are present
 - Current testing methodologies do not allow for comprehensive drug detection (differing chemistries)

Conclusions

- Forensic science, law enforcement, public health communities, etc., should be aware that synthetic cannabinoids can be found in combination with fentanyl
- Laboratories should consider developing approaches that allow for accurate and complete characterization of these cases
- **Analytical testing of samples from overdose outbreaks is critical in all scenarios**

Acknowledgements

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- Sara Walton

- **NJ DMI**

- Adam Polhemus

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