Trends, Analysis & Threats

Overdose Response Strategy Webinar Series

Funded by the Office of National Drug Control Policy and the Centers for Disease Control and Prevention

This webinar series is supported in-part by the Centers for Disease Control and Prevention (CDC) of the U.S. Department of Health and Human Services (HHS) as part of a financial assistance award totaling $11,000,000 with 100 percent funded by CDC/HHS. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement by, CDC/HHS, the U.S. Government, or the CDC Foundation.

Agenda

Opening Remarks

Christopher Jakim, HIDTA Deputy National Coordinator, Overdose Response Strategy

Speaker Briefings

Thom Browne, Chief Executive Officer
The Colombo Plan – Drug Advisory Program (DAP)

Ed Sisco, Research Chemist
National Institute of Standards and Technology (NIST)

Dr. Nabarun Dasgupta, Senior Scientist
University of North Carolina Drug Analysis Lab

Q&A and Closing Remarks

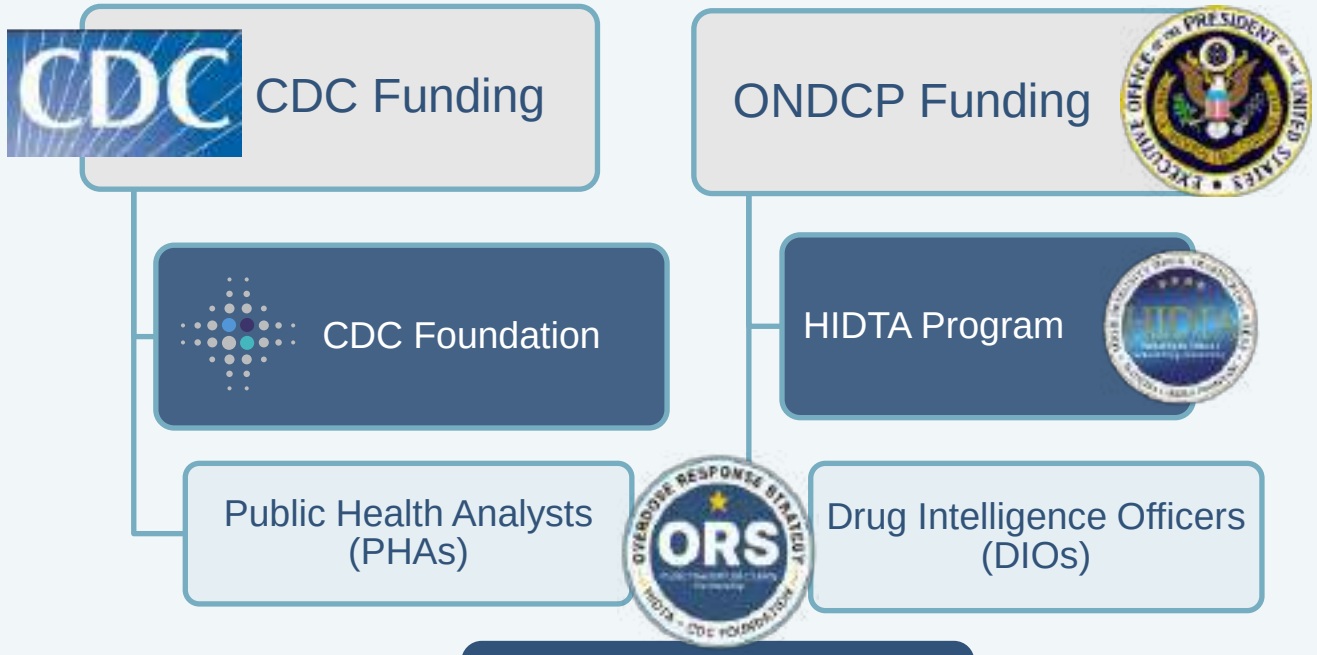
Scan for Q&A

Overdose Response Strategy

About the ORS

The ORS is a nationally coordinated, cross-sector collaboration between public health and public safety.

The mission of the ORS is to **help communities reduce fatal and non-fatal drug overdoses** by connecting public health and public safety agencies, sharing information and supporting evidence-based interventions.



The ORS Team

The ORS is implemented by 61 teams of DIOs and PHAs covering all 50 states, D.C., Puerto Rico, and the U.S. Virgin Islands.

Overdose Response Strategy

Program Goals

1. **Share data systems** to inform rapid and effective community overdose prevention efforts
2. Support immediate, **evidence-based response** efforts that can directly reduce overdose deaths
3. Design and use promising strategies at the **intersection of public health and public safety**
4. Support the implementation of **evidence-informed prevention strategies** that can reduce substance use and overdose

Connect

1. Go to www.orsprogram.org

2. Visit **"ORS Interactive Teams Map"** for team contact information

3. View contact information by geography

Trends, Analysis & Threats Webinar: Acknowledgement of Data Sensitivity and Use

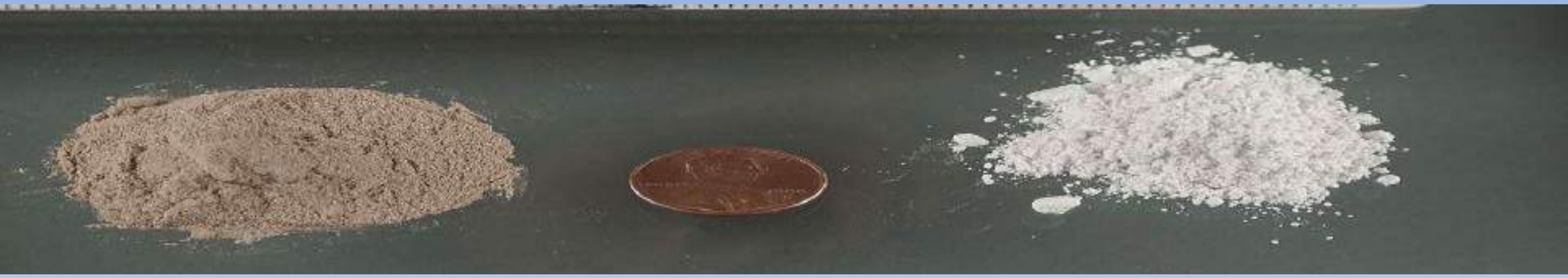
The information presented and discussed at ORS Trends, Analysis & Threats (TAT) meetings is shared voluntarily by data owners, often in advance of public release and is often preliminary and incomplete. The Overdose Response Strategy (ORS) does not own or manage any of the data presented.

Partner Briefings

Newly Emerging Lethal Synthetics and Complex Drug Mixtures

ORS-TAT Webinar
July 2, 2025

Thom Browne, Jr.
CEO
The Colombo Plan
July 2025



U.S. Street-level Drug Samples (1980s)

New York (3)	Chicago (2)	Los Angeles (2)	Detroit (2)	Miami (3)
Heroin	Crack Cocaine	Fentanyl	Heroin	Cocaine
Lactose	Lidocaine	Caffeine	Quinine	Caffeine
Quinine				Lidocaine

Legend:

Black = controlled drugs

Purple = fentanyls

Red = adulterants

U.S. Street-level Drug Samples (2020 - 2021)

OH #56 (15)	FL #792 (17)	NH #1099 (13)	Illinois #1452 (12)
Heroin	***Heroin***	Heroin	Heroin
Cocaine	Ketamine	***Tramadol***	MDMA
Tramadol	Fentanyl	Acetylfentanyl	Fentanyl
Butyryl Fentanyl	Acetyl Fentanyl	Fentanyl	Acetylfentanyl
Fentanyl	Butyryl Fentanyl	Gabapentin	Alprazalom
Acetylfentanyl	Tramadol	Eutylone	Gabapentin
Xylazine	Metamizole	Levamisole	~~Diphenhydramine~~
Metamizole	Xylazine	Xylazine	Acetaminophen
Levamisole	Phenacetin	Phenacetin	Quetiapine
Diphenhydramine	Aminopyrine	Lidocaine	Quinine
Lidocaine	Procaine	Caffeine	Acetylcodeine
Quinine	Lidocaine	Acetylcodeine	6-MAM
6-MAM	Quinine	6-MAM	
Acetylcodeine	6-MAM, Acetylcodeine		
Morphine	Morphine, Codeine		

Legend:

Black = controlled drugs

Purple = fentanyls

Red = adulterants

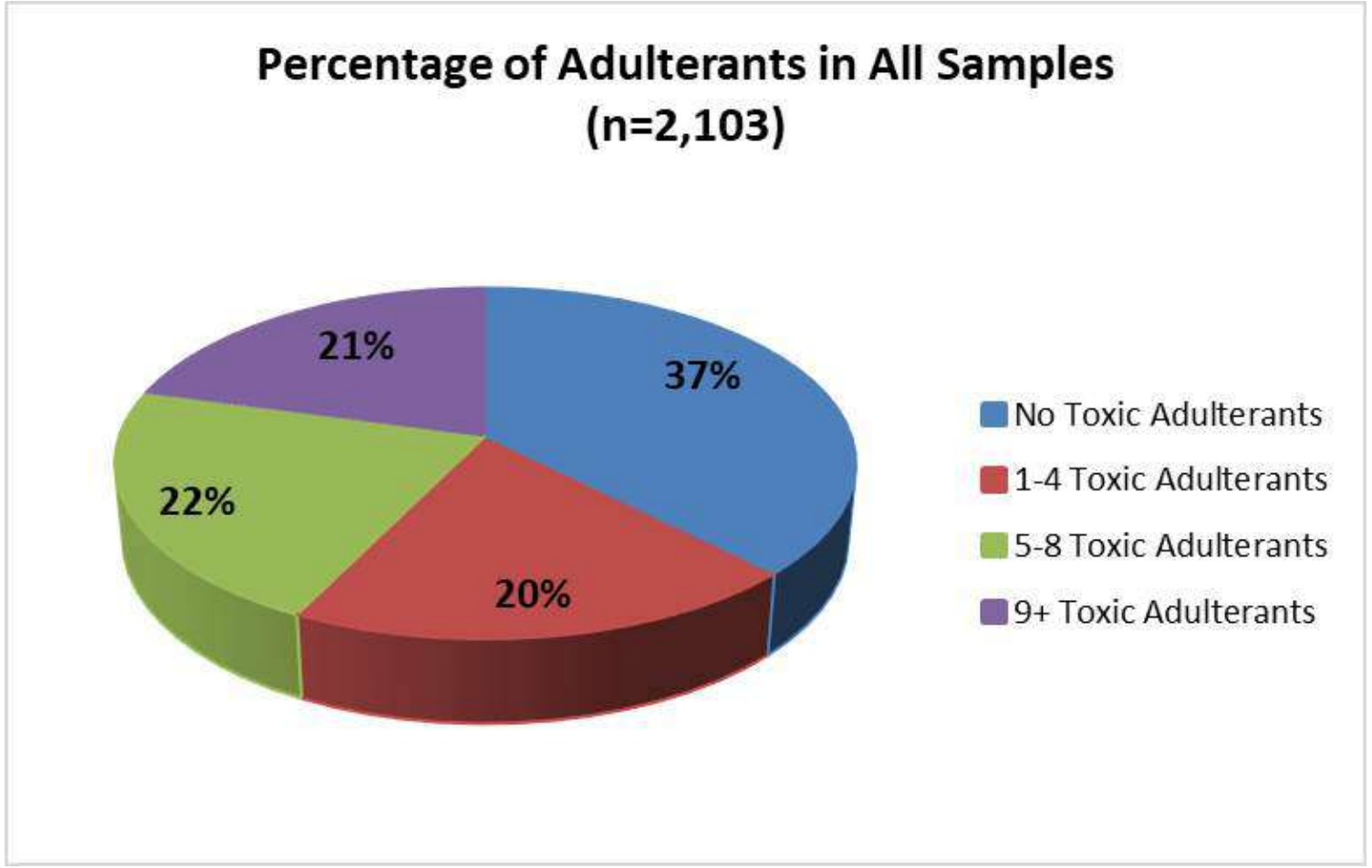
Blue = synthetic cathinones

Green = impurities

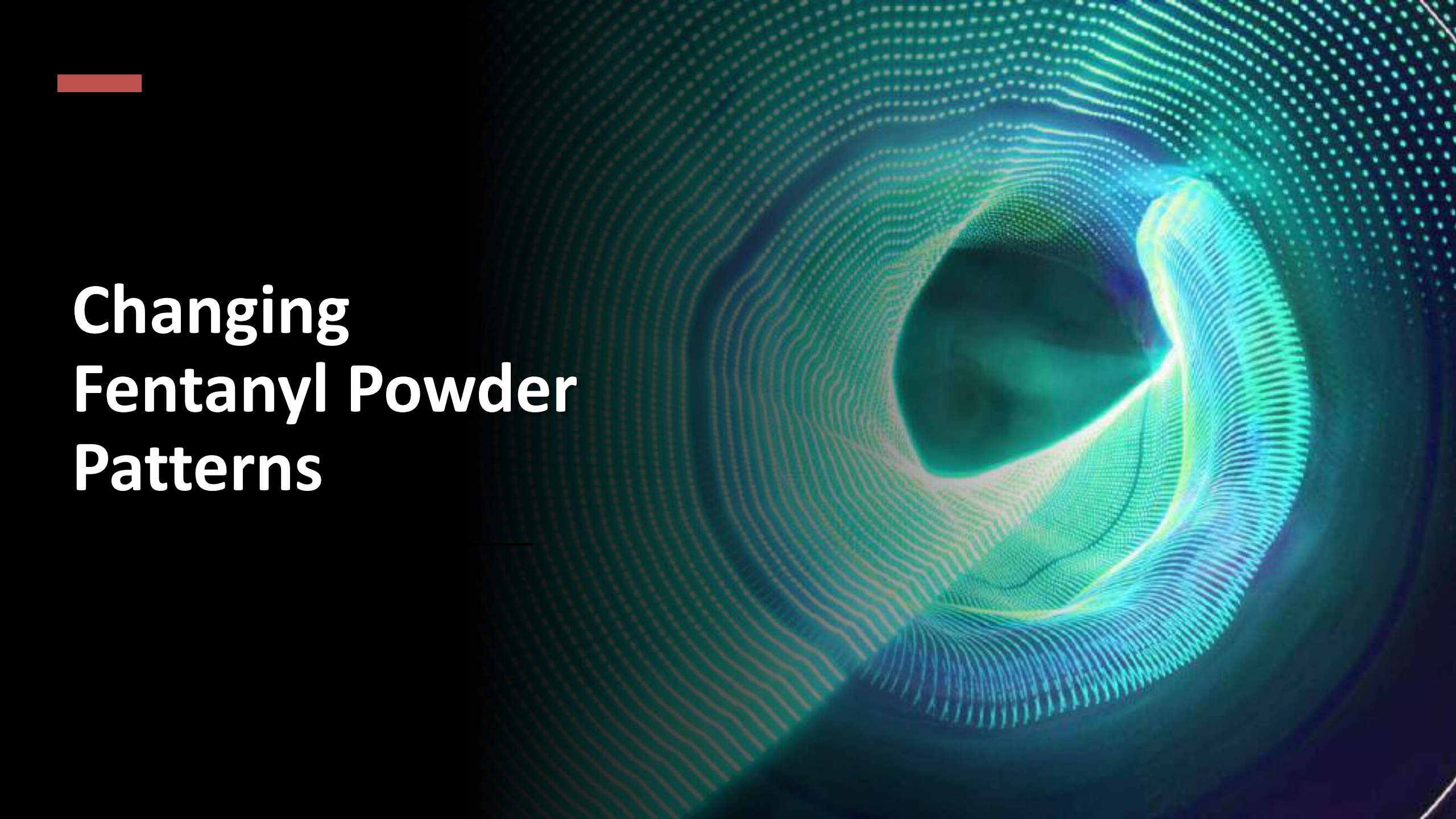
Underline/Italics = primary constituent

Phase VI – Qtof Data

- Current round
  - 21% had 9+ adulterants
- During previous round
  - 9% had 9+ adulterants
- Increase of 133% in samples containing 9 or more adulterants



Changing Fentanyl Powder Patterns



One Fentanyl in Street-level Drug Samples (2016 - 2017)

VT #156	VT #160	KY #26	KY #105
Heroin	Heroin	Heroin	Heroin
Cocaine	Cocaine	Cocaine	Cocaine
Tramadol	Fentanyl	Tramadol	Fentanyl
Ketamine	Levamisole	Fentanyl	4-ANPP
Fentanyl	Acetaminophen	4-ANPP	Acetaminophen
Aminopyrine	Quinine	Aminopyrine	Diphenhydramine
Diltiazem	Lidocaine	Diphenhydramine	Levamisole
Quinine	Procaine	Quinine	Phenacetin
Quetiapine	Caffeine	Lidocaine	Quinine
Caffeine	Acetylcodeine	Metamizole/Dipyrone	Caffeine
Acetylcodeine	6-MAM	Caffeine	Acetylcodeine
6-MAM	Papaverine	Acetylcodeine	6-MAM
Noscapine	Noscapine	6-MAM	Papaverine
Papaverine		Papaverine	Noscapine
Morphine		Noscapine	

Legend:

Black = drugs and adulterants

Purple = fentanyl compounds

Green = impurities from heroin manufacturing process

Multiple Fentanyl & Toxic Compounds in Street-level Drugs

Legend:

Black = controlled drugs

Purple = fentanyl compounds

Orange = synthetic opioid

Blue = synthetic benzo

Red = traditional & emerging adulterants

Grey = synthetic hallucinogenic

Green = impurities from heroin manufacturing process

Yellow = xylazine

VT #296 (17)	GA #433 (11)	W VA #41 (17)	IL #1155 (22)	OH #721 (13)
Fentanyl	Fentanyl	Fentanyl	Fentanyl	Fentanyl
Fluorofentanyl	Phenethyl 4-ANPP	Fluorofentanyl	Fluorofentanyl	Fluorofentanyl
Acetylfentanyl	Heroin	4-ANPP	Benzyl Fentanyl	Phenethyl 4-ANPP
Bromofentanyl	Cocaine	Phenethyl 4-ANPP	Phenethyl 4-ANPP	3-OH-PCP
4-ANPP	Xylazine	Heroin	Protonitazene	Diclazepam
Phenethyl 4-ANPP	Diphenhydramine	Tramadol	Clonazolam (0.5 mg = OD?)	Clonazolam (0.5 mg = OD?)
Heroin	Lidocaine	Cocaine	Heroin, Morphine	Cocaine
Morphine	Quinine	Methamphetamine	Cocaine	Heroin
Xylazine	Hydroquinidine	Xylazine	Quetiapine	Xylazine
Lidocaine	Noscapine	Lidocaine	Xylazine	Quinine
Quinine	6-MAM	Acetaminophen	Quinine, Cinchonine	Lidocaine
Caffeine		Diphenhydramine	Hydroquinidine	Acetaminophen
Codeine		Phenacetin	Nicotinamide	6-MAM
6-MAM, Acetylcodeine		Caffeine, Quinine	Doxylamine, Risperidone, Lidocaine	
Papaverine, Noscapine		6-MAM, Acetylcodeine	6-MAM, Papaverine, Acetylcodeine, Noscapine	

Emerging Nitazene/Fentanyl Drug Mixtures in Street-level Drugs

Legend:

Black = legacy drugs

Purple = fentanyl compounds

Orange =other synthetic opioid

Blue = synthetic benzo

Red = traditional & emerging adulterants

Grey = synthetic hallucinogenic

Green =synthetic ketamine

Yellow = vet adulterants

KY #245 (18)	OH #808 (23)	NH #990 (30)	IL #1135 (24)	IL #1212 (16)
Fentanyl	Fentanyl	Fentanyl	Fentanyl	Fentanyl
Fluorofentanyl	Methyl Fentanyl	Fluorofentanyl	Fluorofentanyl	Carfentanil
Acetylfentanyl	Acetyl Fentanyl	Acetyl Fentanyl	Acetyl Fentanyl	4-ANPP
4-ANPP	Fluoro Fentanyl	4-ANPP	4-ANPP	Brorphine
Metonitazene	4-ANPP	Metonitazene	Metoitazene	Metonitazene
ISO/Protonitazene	N-desethyl Etonitazene	N-desethyl Etonitazene	N-Pyrrolidino Iso/Protonitazene	N-Pyrrolidino Iso/Protonitazene
Clonazolam (0.5 mg = OD?)	N-Pyrrolidino Iso/Protonitazene	ISO/Protonitazene	N-Pyrrolidino Metonitazene	N-Pyrrolidino Metonitazene
Medetomidine	2F-2OXO-PCE	Bromazolam	Clonazolam (0.5 mg = OD?)	N-Pyrrolidino Etonitazene
Xylazine	3-OH-PCP	Flubromazepam	Medetomidine	Medotesnitazene
Dipenhydramine	Medetomidine	2F-2OXO-PCE	Xylazine	Iso/Protonitazene
Phenacetin	Xylazine	Tiletamine	Heroin	Clonazolam (0.5 mg = OD?)
Quinine	Methamphetamine	Xylazine	Acetaminophen	Heroin
	Cocaine	Methamphetamine		
	Tramadol	Heroin, Tramadol		

Illinois (Cook): Street-level Drug Samples That Deplete WBCs

Legend:

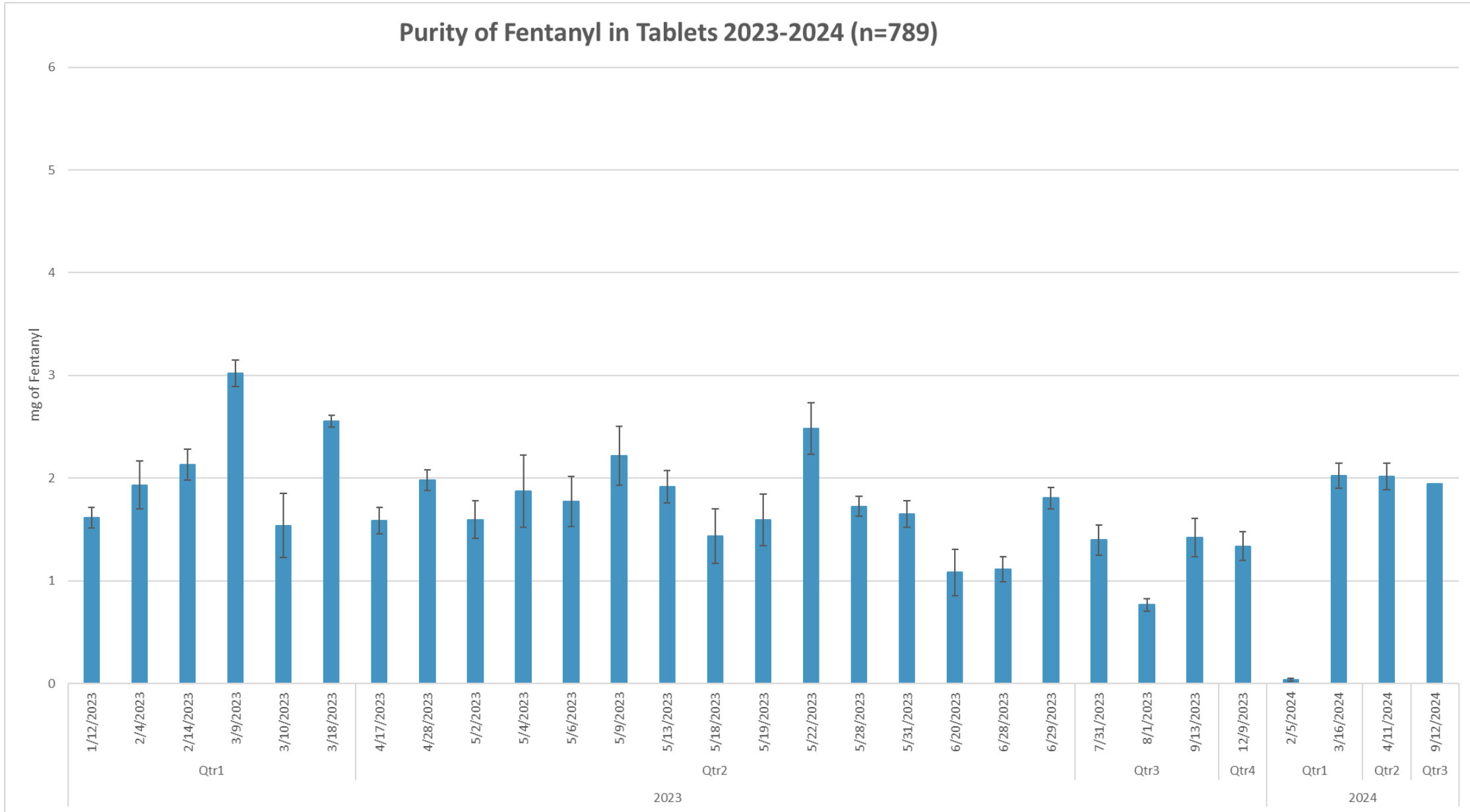
Black = drugs and adulterants

Yellow = depletes WBCs

Green = impurities from heroin manufacturing process

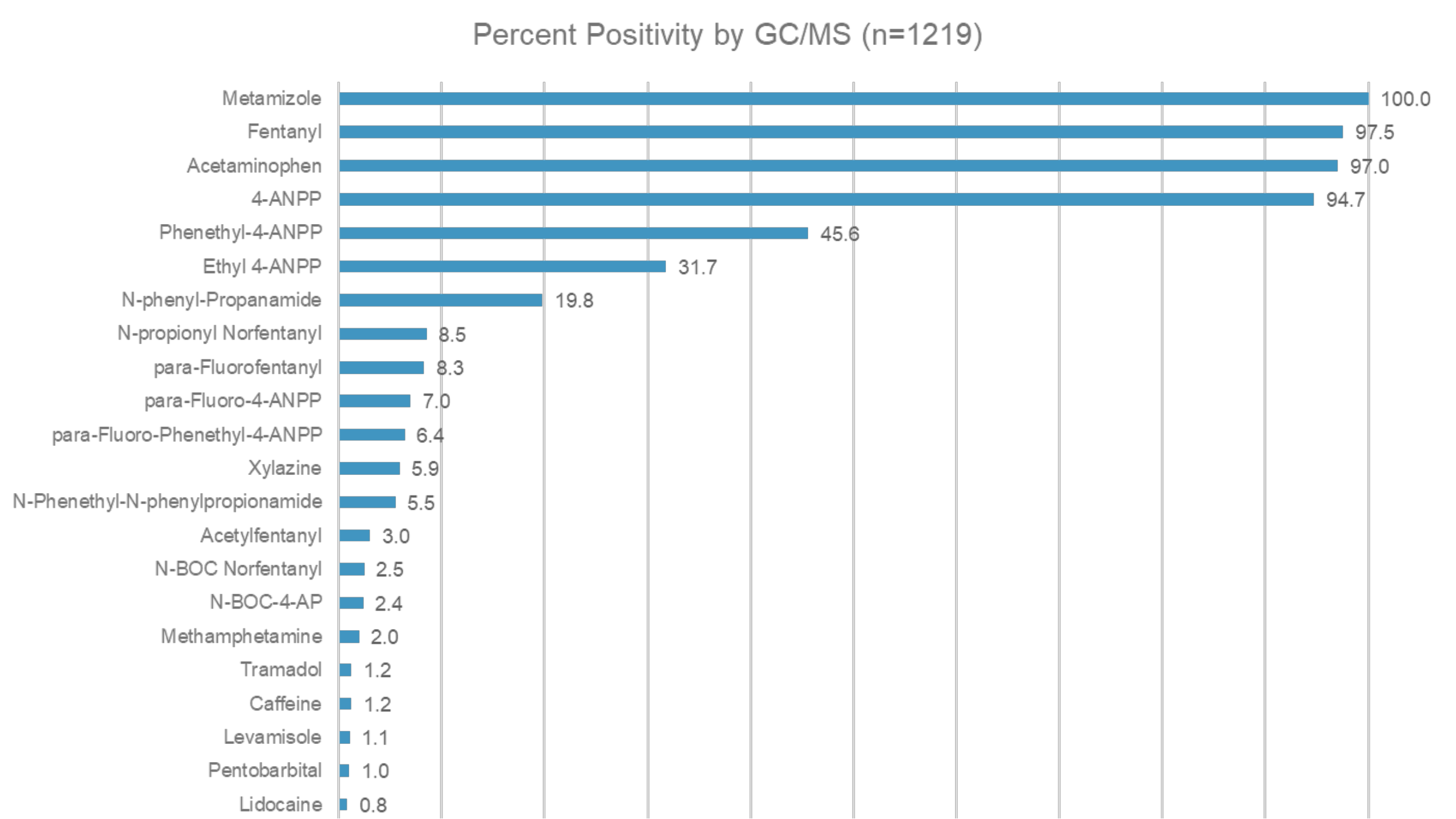
Cook #1511 (3)	Cook #1554 (3)	Cook #1555 (4)	Cook #1486 (0)	Cook # 1452 (1)
Heroin	Heroin	Heroin	Heroin	Heroin
Acetyl Fentanyl	Acetylfentanyl	Diphenhydramine	Diphenhydramine	Diphenhydramine
Fentanyl	Tramadol	Ketamine	Fentanyl	Fentanyl
Tramadol	Xylazine	Fentanyl	Tramadol	Acetylfentanyl
Levamisole	Metamizole	Acetylfentanyl	PCP	Alprazolam
Metamizole	Aminopyrine	Xylazine	Lidocaine	Gabapentin
Aminopyrine	Diphenhydramine	Tramadol	Ephedrine	MDMA
Cocaine	Quinine	Levamisole	6-MAM	Quetiapine
Ketamine	Procaine	Metamizole		Quinine
Phenacetin	Morphine	Aminopyrine		Acetaminophen
Quinine	Acetylcodeine	Quetiapine		Acetylcodeine
Diphenhydramine	6-MAM	Trazadone		6-MAM
Lidocaine		Acetaminophen		
Morphine, 6-MAM		Morphine, 6-MAM		
Acetylcodeine, Codeine		Acetylcodeine, Codeine		

Fentanyl Pill Composition


Purity of Fentanyl in Tablets 2023-2024 (n=789)
mg of Fentanyl
0
1
2
3
4
5
6
1/12/2023
2/4/2023
2/14/2023
3/9/2023
3/10/2023
3/18/2023
4/17/2023
4/28/2023
5/2/2023
5/4/2023
5/6/2023
5/9/2023
5/13/2023
5/18/2023
5/19/2023
5/22/2023
5/28/2023
5/31/2023
6/20/2023
6/28/2023
6/29/2023
7/31/2023
8/1/2023
9/13/2023
12/9/2023
2/5/2024
3/16/2024
4/11/2024
9/12/2024
Qtr1
Qtr2
Qtr3
Qtr4
Qtr1
Qtr2
Qtr3
2023
2024

Fentanyl Pill Mixtures

Ex	GC/MS Findings	Physical Dimensions	Monogram Dimensions
1	Fentanyl, para-Fluorofentanyl, Methamphetamine Metamizole Despropionyl para-fluorofentanyl, para-Fluorophenethyl 4-ANPP	6.57 D 3.12 W	“M” square 5.124 “0” height 1.967
2	Fentanyl, Methamphetamine Acetaminophen, Metamizole 4-ANPP	6.42 D 3.33 W	“M” square 5.349 “0” height 2.042
3	Fentanyl, para-Fluorofentanyl, Pentobarbital Acetaminophen, Metamizole Despropionyl para-fluorofentanyl, para-Fluorophenethyl 4-ANPP	6.57 D 3.06 W	“M” square 5.381 “0” height N/A
4	Fentanyl, para-Fluorofentanyl, Methamphetamine Acetaminophen, Metamizole, Lidocaine, Levamisole 4-ANPP, Despropionyl para-fluorofentanyl, para-Fluorophenethyl 4-ANPP	6.59 D 3.43 W	“M” square 4.953 “0” height 1.543
5	Fentanyl, para-Fluorofentanyl, Methamphetamine, Pentobarbital Acetaminophen, Metamizole, Xylazine Despropionyl para-fluorofentanyl, para-Fluorophenethyl 4-ANPP	6.60 D 3.62 W	“M” square 5.852 “0” height 1.498
6	Fentanyl, para-Fluorofentanyl Acetaminophen, Metamizole 4-ANPP	6.53 D 3.33 W	“M” square 5.787 “0” height 2.209


Percent Positivity by GC/MS (n=1219)
Metamizole 100.0
Fentanyl 97.5
Acetaminophen 97.0
4-ANPP 94.7
Phenethyl-4-ANPP 45.6
Ethyl 4-ANPP 31.7
N-phenyl-Propanamide 19.8
N-propionyl Norfentanyl 8.5
para-Fluorofentanyl 8.3
para-Fluoro-4-ANPP 7.0
para-Fluoro-Phenethyl-4-ANPP 6.4
Xylazine 5.9
N-Phenethyl-N-phenylpropionamide 5.5
Acetylfentanyl 3.0
N-BOC Norfentanyl 2.5
N-BOC-4-AP 2.4
Methamphetamine 2.0
Tramadol 1.2
Caffeine 1.2
Levamisole 1.1
Pentobarbital 1.0
Lidocaine 0.8

Metamizole/Dipyrone

Metamizole is a pain reliever, fever reducer, and spasm reliever

Side effect of agranulocytosis (a dangerously suppressed immune system that places user at very high risk for serious infections due to a severely lowered white blood cell count)*

Combining dipyrone with opiates like heroin results in analgesic potentiation and produces supra-additive effects**

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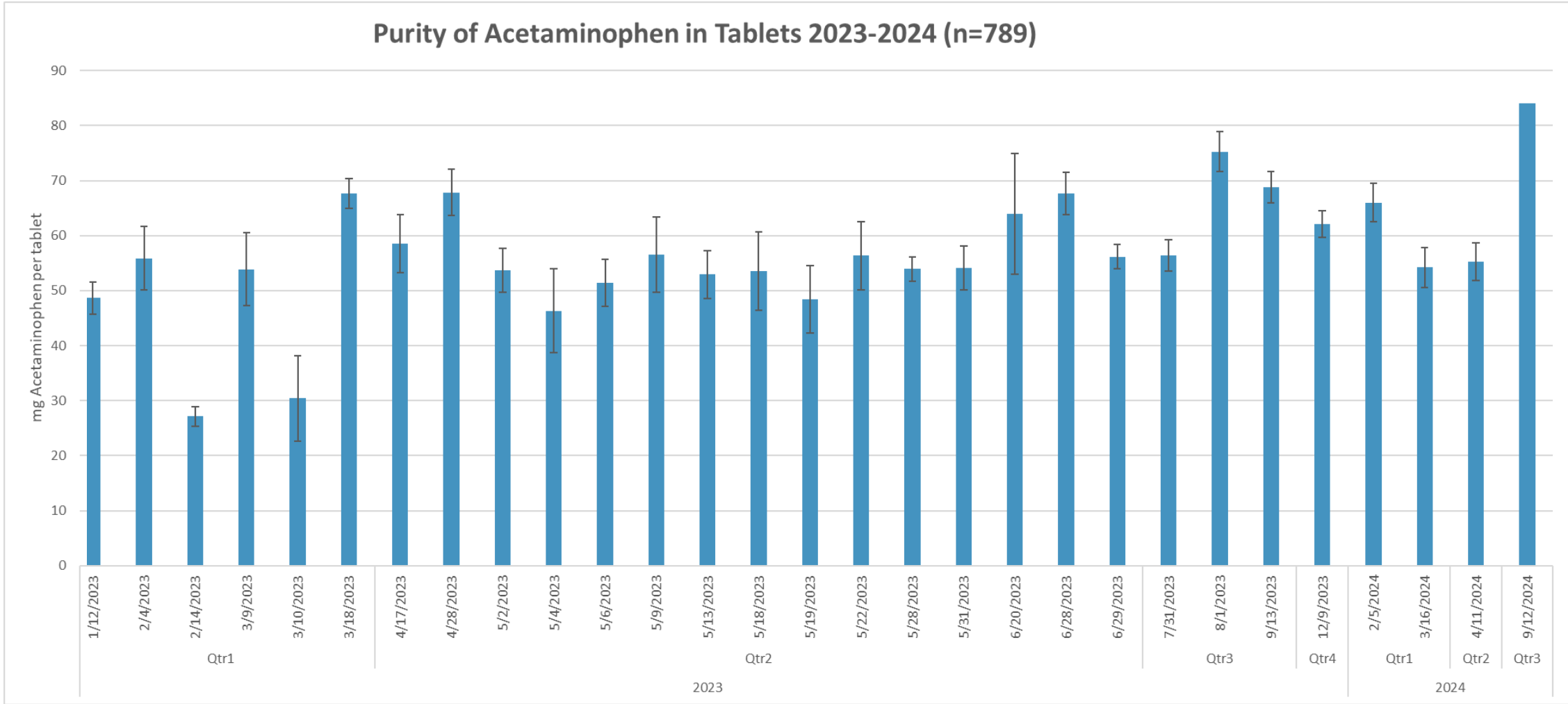
* Brack A, Rittner HL, Schäfer M (March 2004). "Nichtopioidanalgetika zur perioperativen Schmerztherapie" [Non-opioid analgesics for perioperative pain therapy. Risks and rational basis for use]. Der Anaesthesist (in German). 53 (3): 263–80.

** Hernandez-Delgadillo G & Cruz S. (2004). Dipyrone potentiates morphine-induced antinociception in dipyrone-treated and morphine-tolerant rats. Eur. J. of Pharmacol. 502, 67-73.


Purity of Acetaminophen in Tablets 2023-2024 (n=789)
mg Acetaminophen per tablet
90
80
70
60
50
40
30
20
10
0
1/12/2023
2/4/2023
2/14/2023
3/9/2023
3/10/2023
3/18/2023
4/17/2023
4/28/2023
5/2/2023
5/4/2023
5/6/2023
5/9/2023
5/13/2023
5/18/2023
5/19/2023
5/22/2023
5/28/2023
5/31/2023
6/20/2023
6/28/2023
6/29/2023
7/31/2023
8/1/2023
9/13/2023
12/9/2023
2/5/2024
3/16/2024
4/11/2024
9/12/2024
Qtr1
Qtr2
Qtr3
Qtr4
Qtr1
Qtr2
Qtr3
2023
2024

Acetaminophen

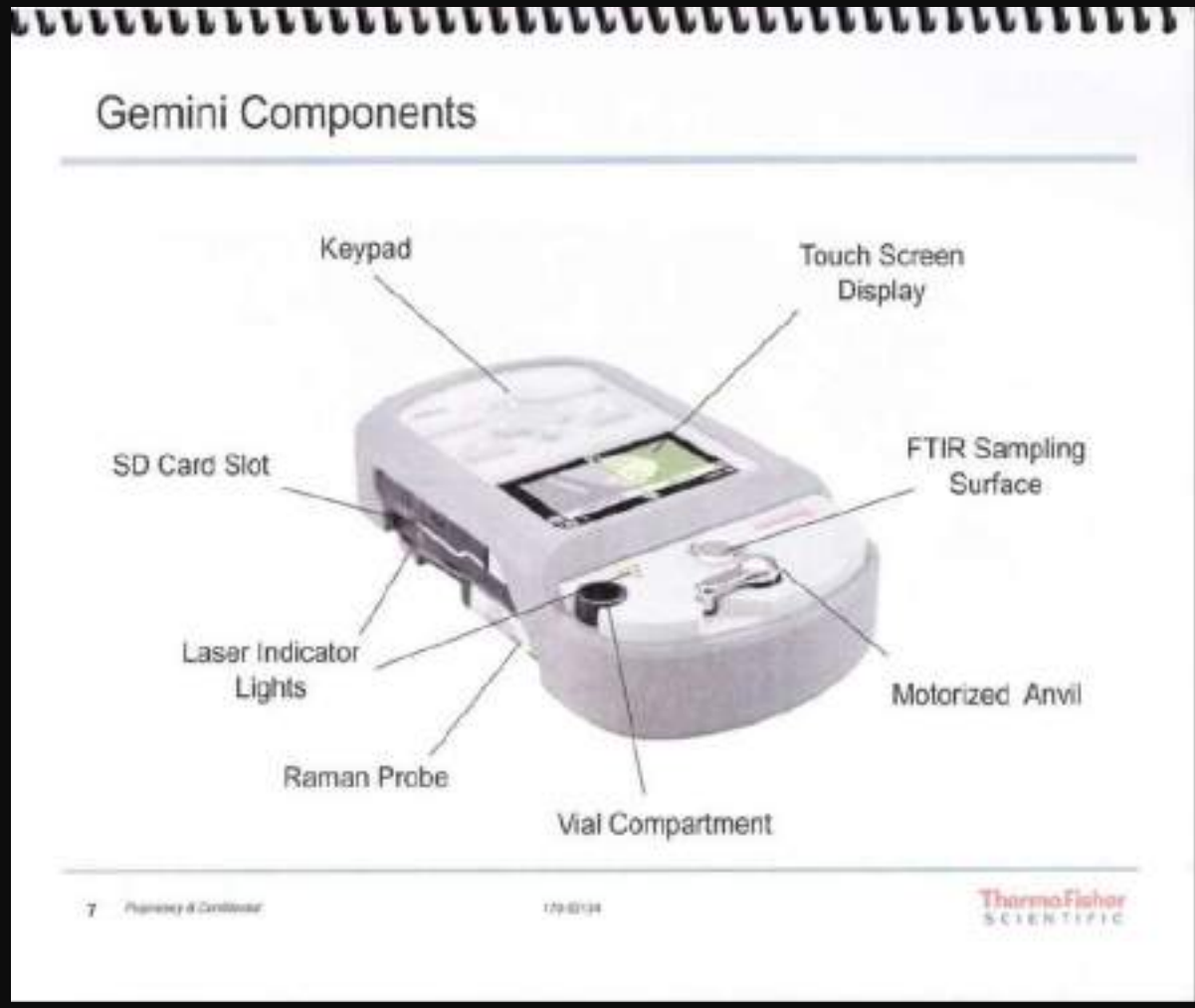
Acetaminophen is an over-the-counter pain relief medication responsible at high chronic doses for liver damage

Cases of **severe liver damage** have occurred in patients who:

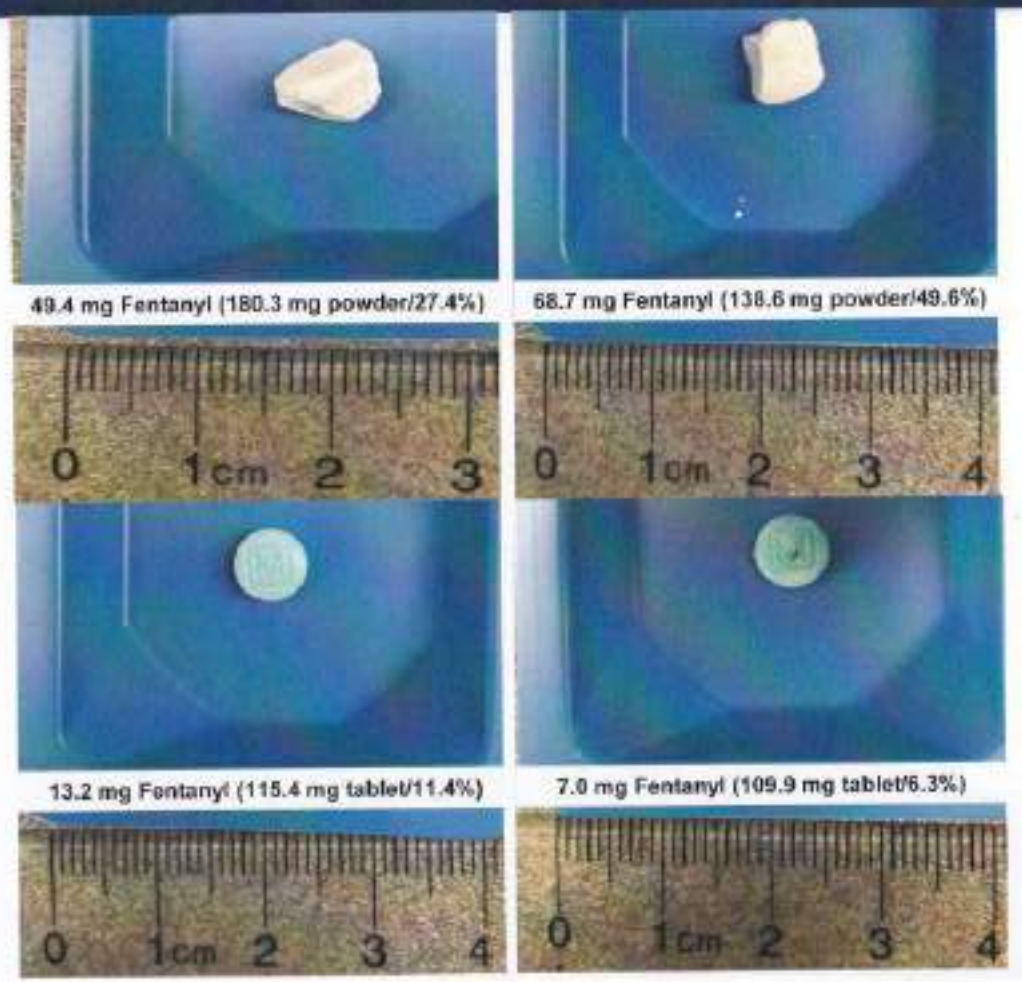
- took more than the prescribed dose in a 24-hour period (i.e., 3 grams or **3,000 mg**)

Why High Concentrations of Acetaminophen in Fentanyl Samples?

- **Acetaminophen and fentanyl have similar IR peaks.**
- **With some portable mass spectrometry methods, the acetaminophen would overwhelm the detector.**



DEA-2024-1930/1932/1936/1938 (July 2024; Seattle, WA) (Fatal)



Global Nitazene Threats

Semi to Novel Synthetic Opioids

Phenanthrene (heroin, oxycodone)

Phenylpiperidines (fentanyl, fluorofentanyl)

Benzimidazoles/Nitazenes (isotonitazene, etonitazene)

Benzamides (U-47700, U-51754, AH-7921, U-49900)

Acetamides (U-50488, U-51754)

Piperazines (MT-45)

Cinnamylpiperazines (AP-238, 2-methyl AP 237)

Global Nitazene Concerns: Australia

- 18/07/24 There is concern that **protonitazene** is now present in illicit oxycodone tablets in the community.
- 02/07/24 A white powder sold in Melbourne as cocaine contains the potent opioid **'protonitazene'**.
- 29/05/24 Four people have been hospitalized across Sydney with severe opioid overdose caused by **nitazenes**.

- People who thought they were taking etazene were taking a more potent nitazene (**N-pyrrolidino protonitazene**) and a potent novel benzodiazepine (**bromazolam**).*
- 18/05/24 A granular brown powder sample tested at CanTEST was found to contain **N-pyrrolidino protonitazene**, a potent synthetic opioid that is stronger than other opioids, including fentanyl.

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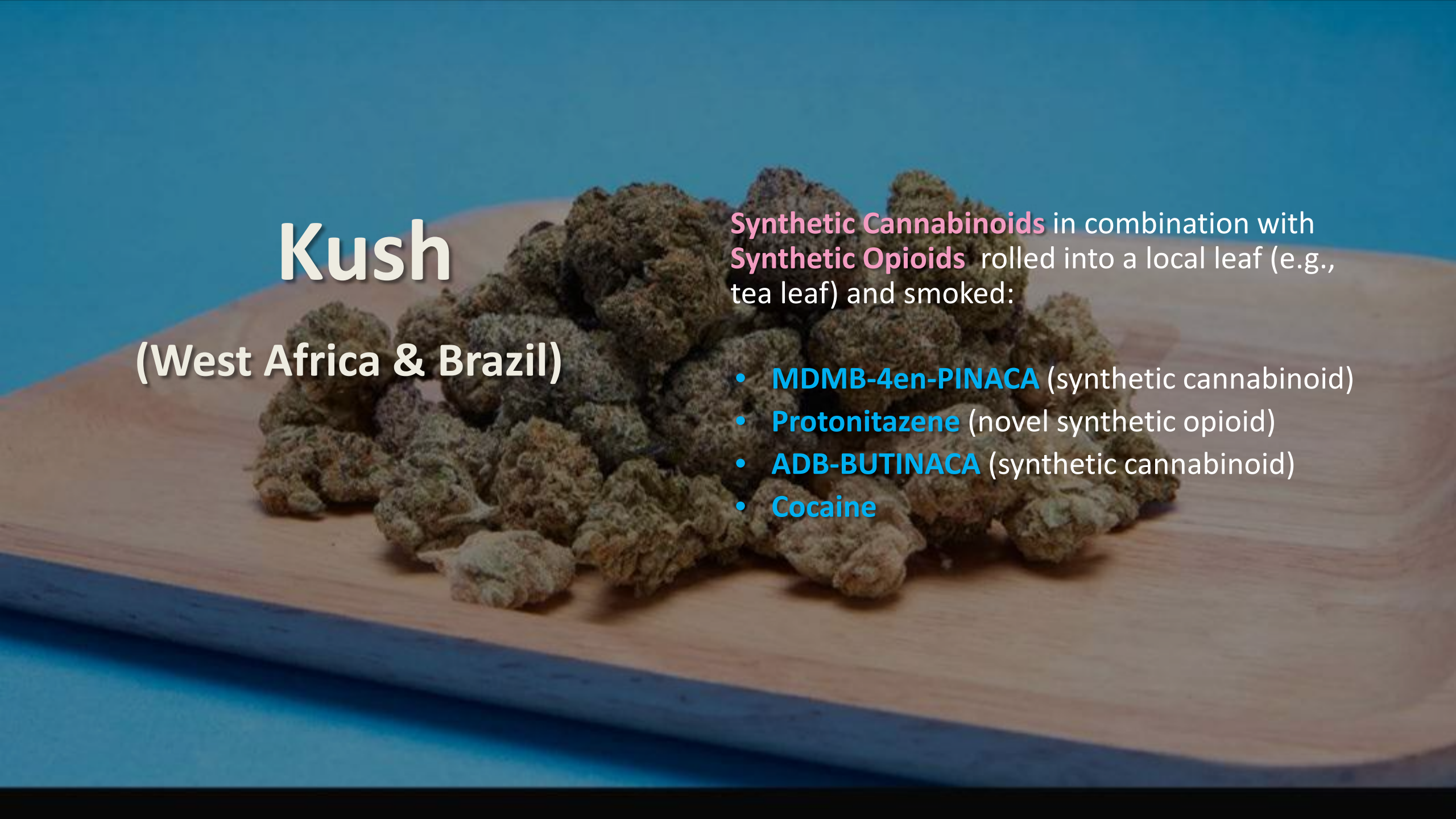
* Both benzodiazepines and opioids inhibit respiration so that the effects of the combination may be additive.

Global Nitazene Concerns: Europe

- Recently reported nitazenes in the **UK** (54 deaths)
- **Sweden** (over 3,000 fake oxycodone tablets containing **metonitazene** in Nov. 2023)
- **Finland** (1000 fake buprenorphine tablets containing **metonitazene** in 2024)
- **Latvia**
- **Estonia**
- **Ireland**
- **Belgium**
- **Slovenia**



Kush

(West Africa & Brazil)

Synthetic Cannabinoids in combination with **Synthetic Opioids** rolled into a local leaf (e.g., tea leaf) and smoked:

- **MDMB-4en-PINACA** (synthetic cannabinoid)
- **Protonitazene** (novel synthetic opioid)
- **ADB-BUTINACA** (synthetic cannabinoid)
- **Cocaine**


Potential Threat:
Nitazene Pills

Nitazene Pills

Potency Compared to Fentanyl (Vandeputte et al.)	Compound
20x higher	N-desethyl-isotonitazene Etonitazene
1.5x – 10x higher	Isotonitazene Metonitazene N-desethyl-etonitazene Protonitazene
2x – 10x lower	Butonitazene Clonitazene Isotodesnitazene Etodesnitazene
12x – 50x lower	4'-OH-nitazene 5-aminoisotonitazene Flunitazene Metodesnitazene

Nitazene Pills

Exhibit 1

- Metonitazene (***35 mg***)
  (175 X lethal dose)

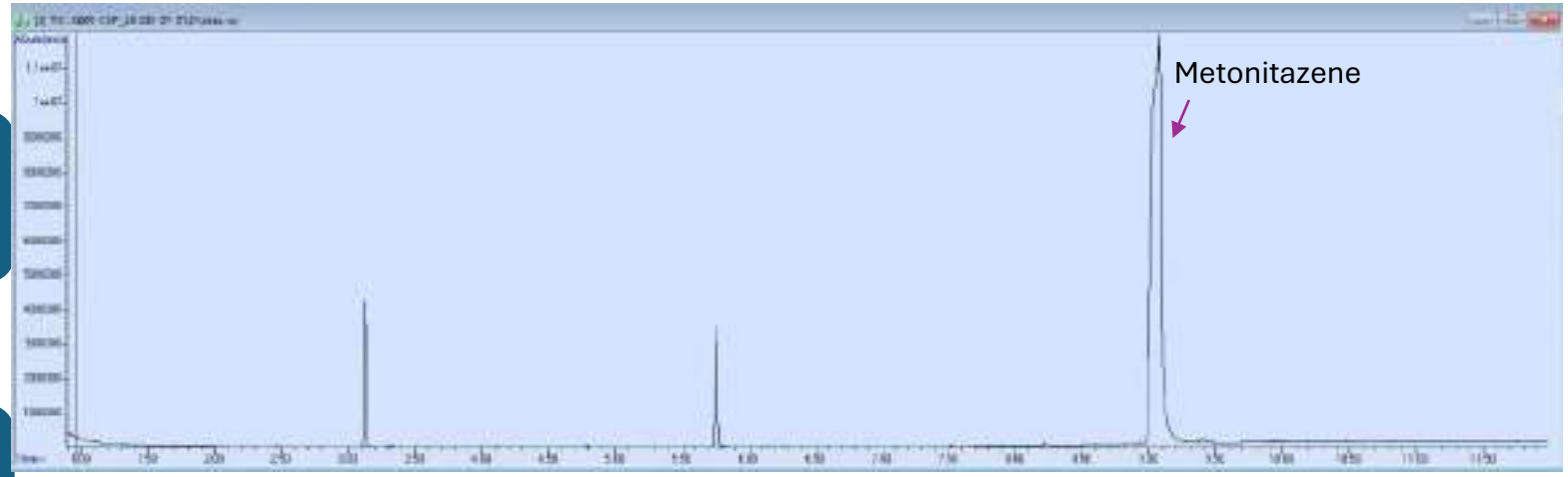
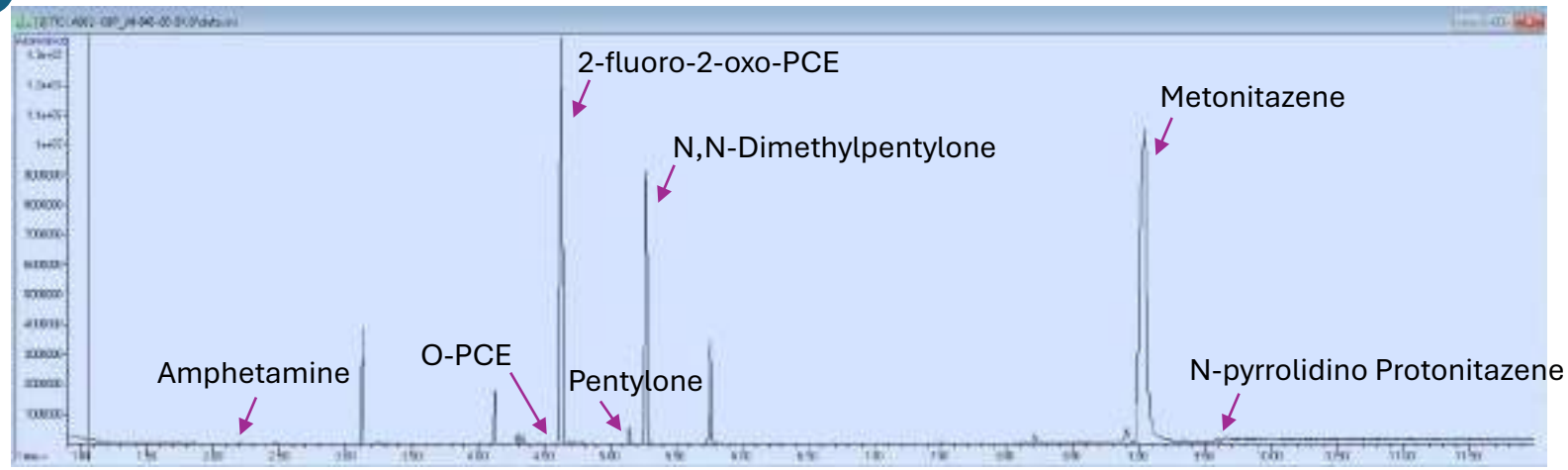


Exhibit 3

- P2P
- Amphetamine
- O-PCE
- 2-fluoro-2-oxo-PCE
- Pentylone
- N,N-Dimethylpentylone
- Metonitazene (***24 mg***)
  (120 X lethal dose)
- N-pyrrolidino Protonitazene
- N-desethyl-metonitazene



Yellow – ***Nitazene***; **Green** – ***Syn. Cathinone***; **Orange** – ***Novel Hallucinogen***; **Blue** - ***Amphetamine***

Synthetic Benzos of Concern

Clonazolam

- One of most potent synthetic benzodiazepines
- Doses as small as **0.5 mg** can induce **intense sedation**

Flubromazolam

Another highly potent synthetic benzodiazepine

Seizures in Sweden, Switzerland, U.K., U.S., and Australia

Life-threatening adverse reactions have been observed at doses of only **3 mg**

Pink Cocaine

2C-B

Synthetic analog of mescaline synthesized in 1974 by Alexander Shulgin, a biochemist and pharmacologist

A powerful stimulant and hallucinogenic drug whose effects are a cross between ecstasy and LSD

Drug Mixtures in Latin America

Pink Cocaine ('Tuci') designed to mimic the powerful stimulant/hallucinogenic 2C-B

- **Colombia**: **Cocaine, Ketamine, and MDMA** or **Meth, Ketamine, and MDMA**
- **Uruguay**: **Cocaine, Meth, and LSD**
- **Venezuela**: **LSD and MDMA**
- **El Salvador**: **Cocaine, MDMA, and Ketamine**
- **Panama**: **Tramadol and Ketamine**

Dragonfly Cocaine – El Salvador

- **Combination of:**
  - *Cocaine*
  - *MDMA/Ecstasy*
  - *Ketamine*

- **Used as substitute for 2C-B**

Dangers of Mixing Ketamine with Other Drugs

Stimulants

- Mixing ketamine with stimulants, like cocaine, methamphetamine, and MDMA (ecstasy), is risky. Stimulants speed up the nervous system, while ketamine slows it down. This creates a conflicting effect on the body, putting immense stress on the heart and other organs.

- The combination of ketamine with stimulants leads to an increased risk of heart attack, stroke, and other cardiovascular problems.

Opioids

- Ketamine and opioids pose a high risk when combined. Both substances have strong sedative effects, leading to extreme drowsiness and respiratory depression. The risk of overdose gets higher when these drugs are used together.

- Opioids can enhance the effects of ketamine, making users more prone to losing consciousness and experiencing life-threatening breathing problems.

Middle East Captagon (Chronic Health Effects)

- **Methamphetamine** – stimulant (**cardiac arrhythmia**)
- **Amphetamine** – stimulant (**cardiac arrhythmia**)
- Ephedrine – stimulant (**cardiac arrhythmia**)
- Caffeine – stimulant (**rapid heartbeat**)
- **Theophylline** – bronchodilator (potentiates stimulants, **cardiac arrhythmia**)
- Acetaminophen – analgesic (**liver damage**)
- Diphenhydramine – antihistamine (**cardiac arrhythmia**)
- Lidocaine – local anesthetic (**cardiac arrhythmia**)
- Procaine – local anesthetic (slow/**irregular heartbeat**)
- Quinine – antimalarial (**cardiac arrhythmia**)
- Allopurinol – xanthine oxidase inhibitor (**lowers WBCs/liver damage**)
- Trimethoprim – antibiotic (**lowers WBCs/liver damage**)
- Chlorphenamine - antihistamine (**cardiac arrhythmia**)
- Diphenylamine – fungicide (**heart, liver, kidney damage/destroys RBCs**)
- 1-Phenyl-1-Proponal – preservative for cosmetics (acute oral toxicity)

Since stimulants cause the heart to beat faster and with greater force, both of which can raise blood pressure, they may cause short-term spikes in the risk of heart rhythm disorders (arrhythmias) and other cardiovascular problems. [Harvard Health Publishing. *"How stimulants may affect your heart."* 2/1/2022]

Fentanyl Test Strips

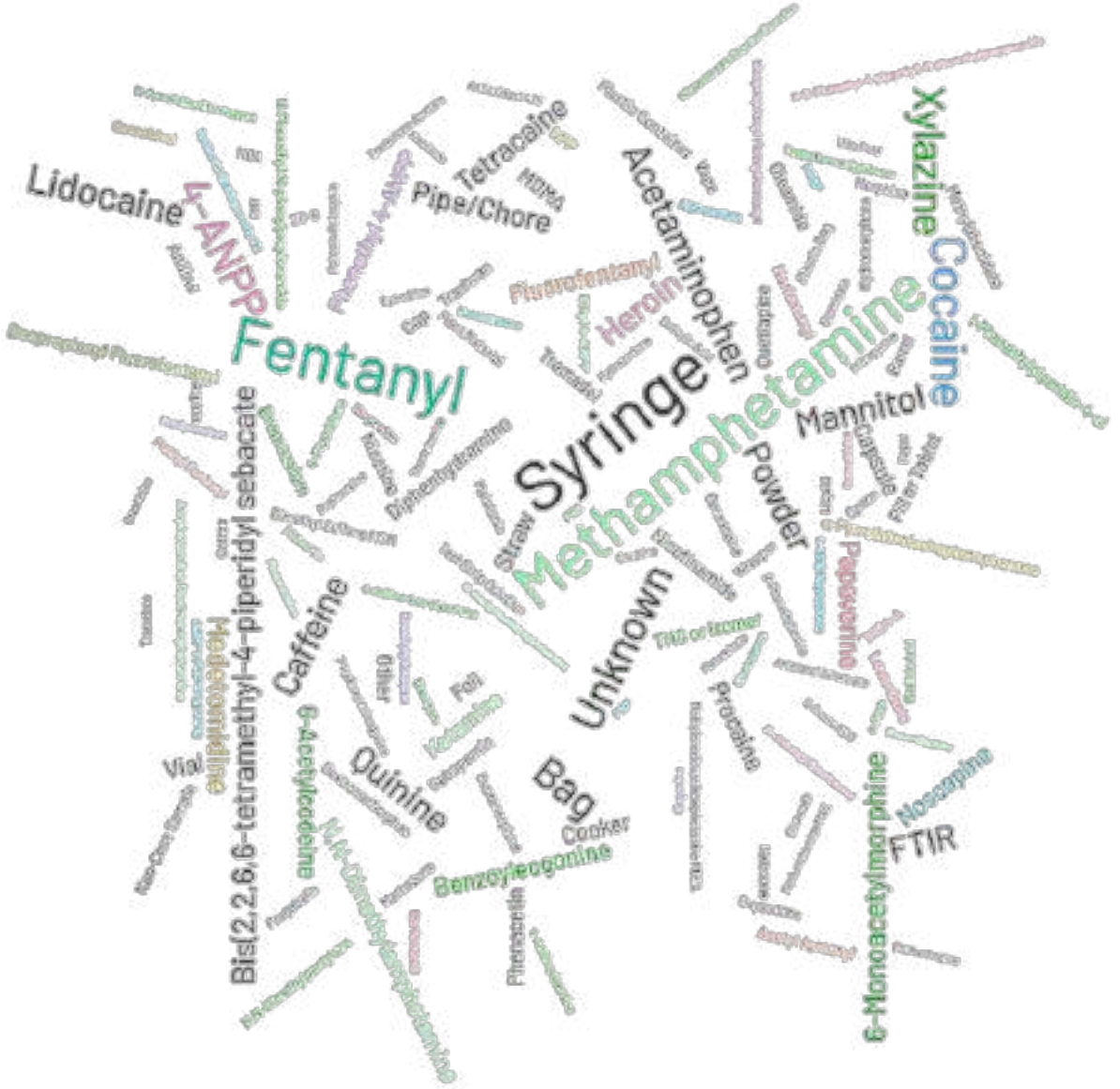
- A useful tool to address overdose potential
- A positive FTS result may lead drug users not to use the drug, to use less of the drug, or to use the drug with people who have naloxone available to reverse possible overdose.
- Information allows users to adjust their dose and pace themselves
- Limitations due to composition of today's street drugs

Submit your Questions

Scan for Q&A

Recent Trends in Received Street Drug Samples – Qualitative and Quantitative

Edward Sisco
Research Chemist



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RaDAR Rapid Drug Analysis & Research

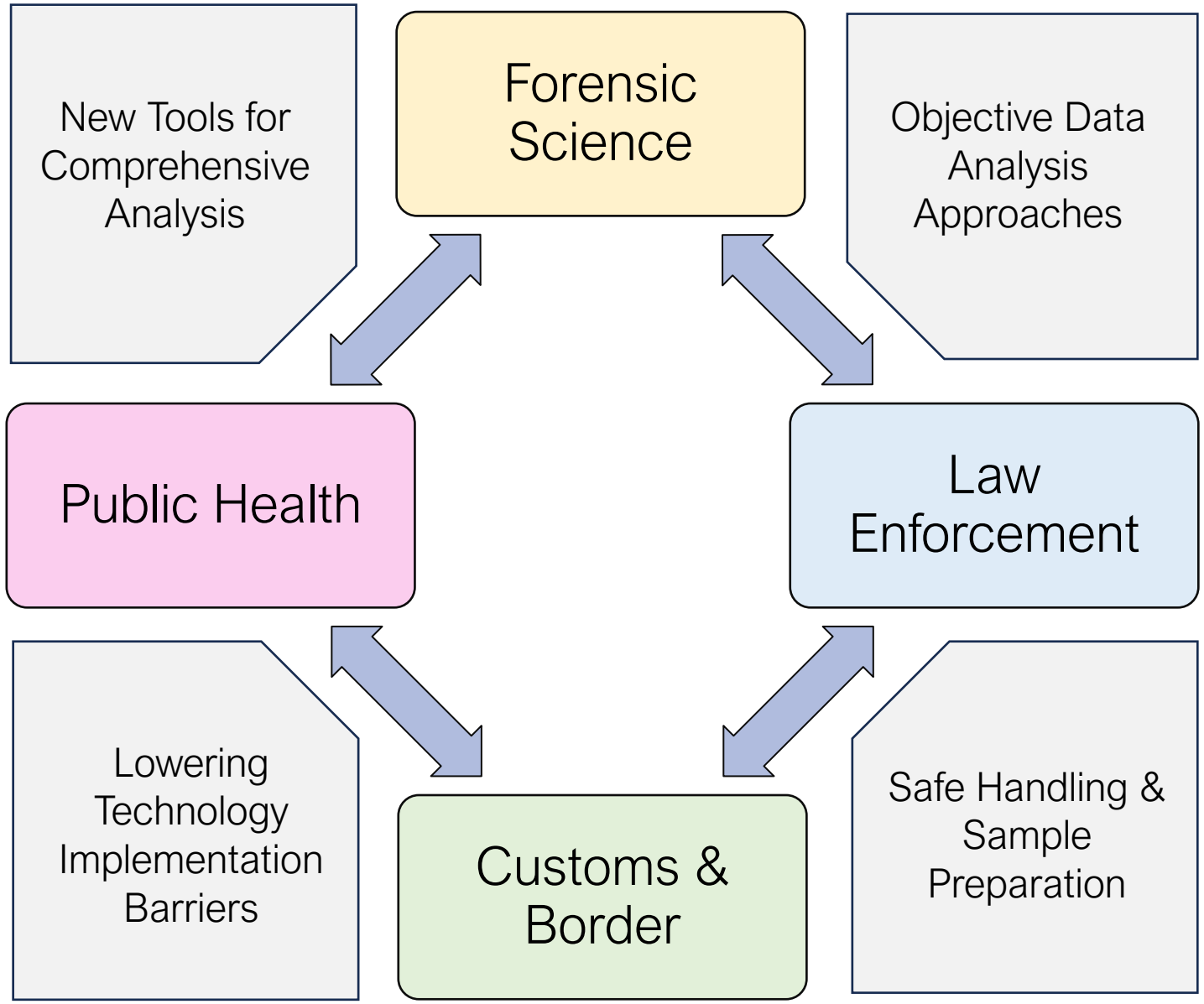
Certain commercial products are identified in order to adequately specify the procedure; this does not imply endorsement or recommendation by NIST, nor does it imply that such products are necessarily the best available for the purpose.

These opinions, recommendations, findings, and conclusions do not necessarily reflect the views or policies of NIST or the United States Government.

What We Do

Research Philosophy:

Support local, state, and federal partners address **critical measurement challenges** by developing **implementable solutions** through **collaborative research**.



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Rapid Drug Analysis and Research (RaDAR) Program

The RaDAR program was established to provide near real-time street drug composition information to public health and public safety entities.

<48 Hour Turnaround.
(Qualitative Testing)

No Cost Supplies & Testing.
(Excluding Shipping)

Near-Complete Chemical Information.

Multiple Sample Collection Modalities.

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RaDAR Rapid Drug Analysis & Research

How It Works

Partners

- Public Health & Harm Reduction
- Law Enforcement *(Informational Use Only)*
- Emergency Department
- Medical Examiner / Coroner

Sample Types

Drug Product
(≈5 mg to 10 mg of material)

Drug Paraphernalia Residue
(Collected using swabs)

Used Test Strip
(Eliminates need for second sampling)

Partner organizations collect samples using provided sample collection kits and ship materials to NIST for analysis.

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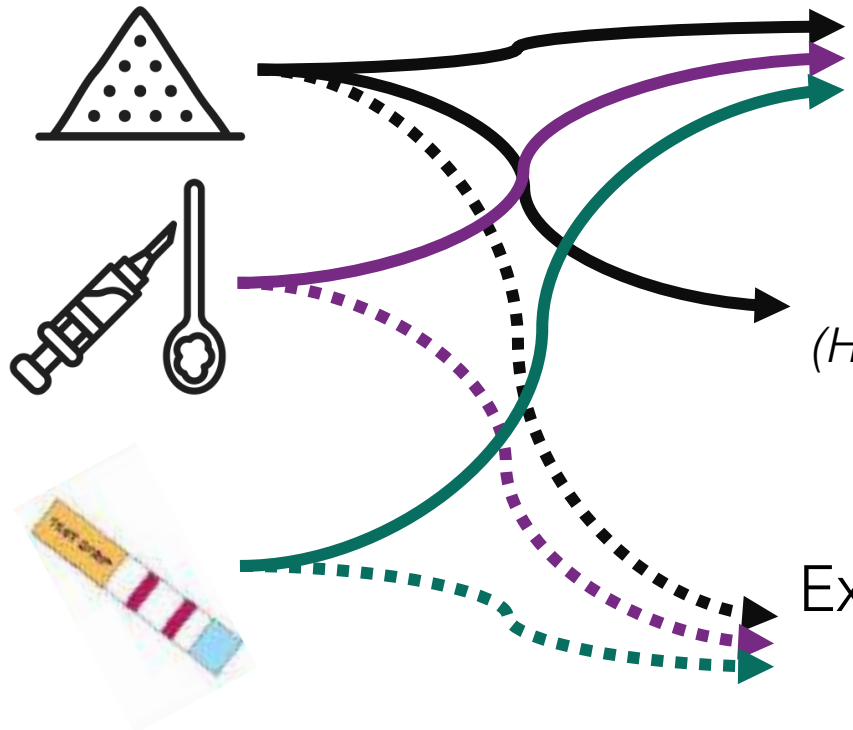
RaDAR Rapid Drug Analysis & Research

Note: *Many samples are convenience samples that may have been co-used. Data may not be representative.*

Analytical Testing

Sample Types



Testing Type

Qualitative
(What's in the sample?)

Quantitative
(How much is in the sample?)

Exploratory / Confirmatory
(What else is in the sample?)

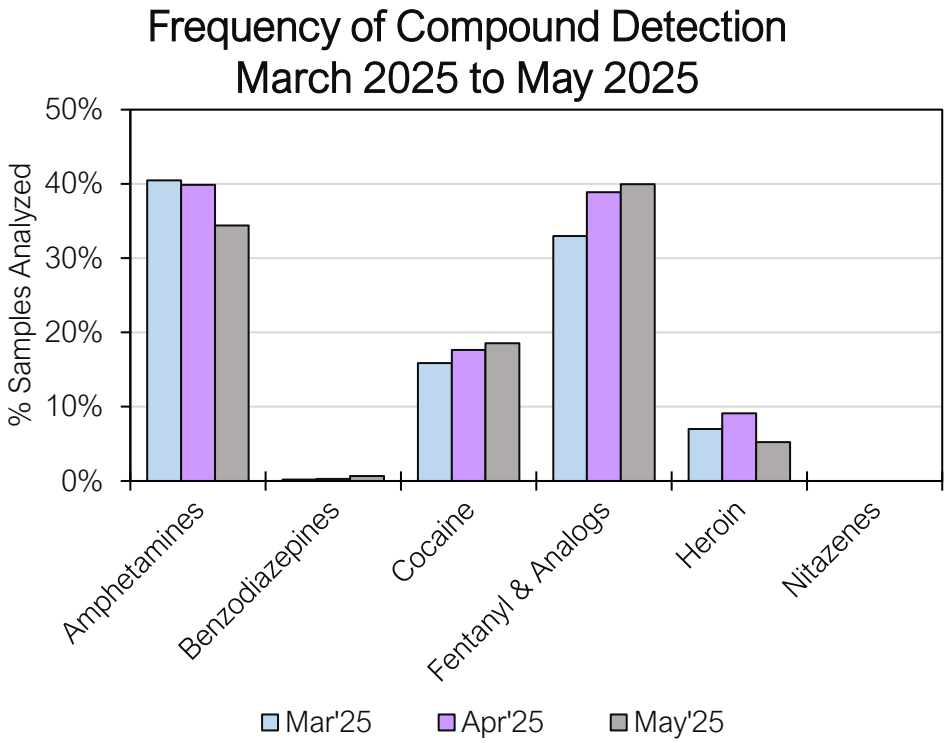
Approach

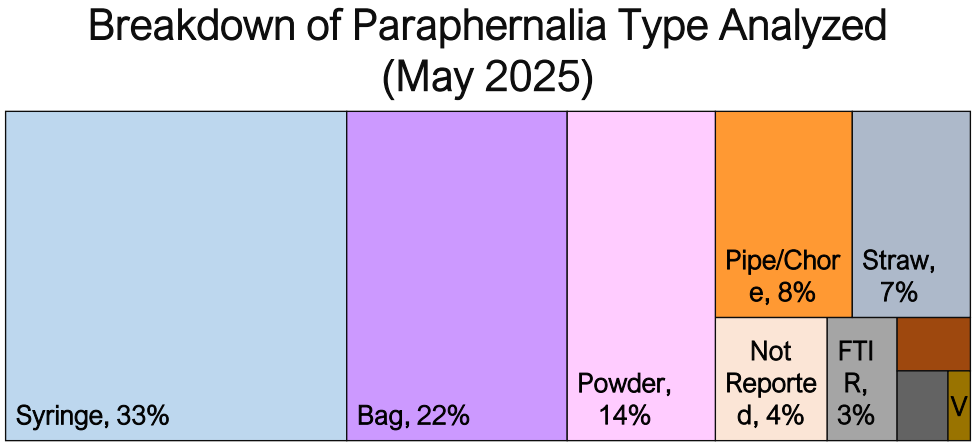
DART-MS
(≈1600 compounds)

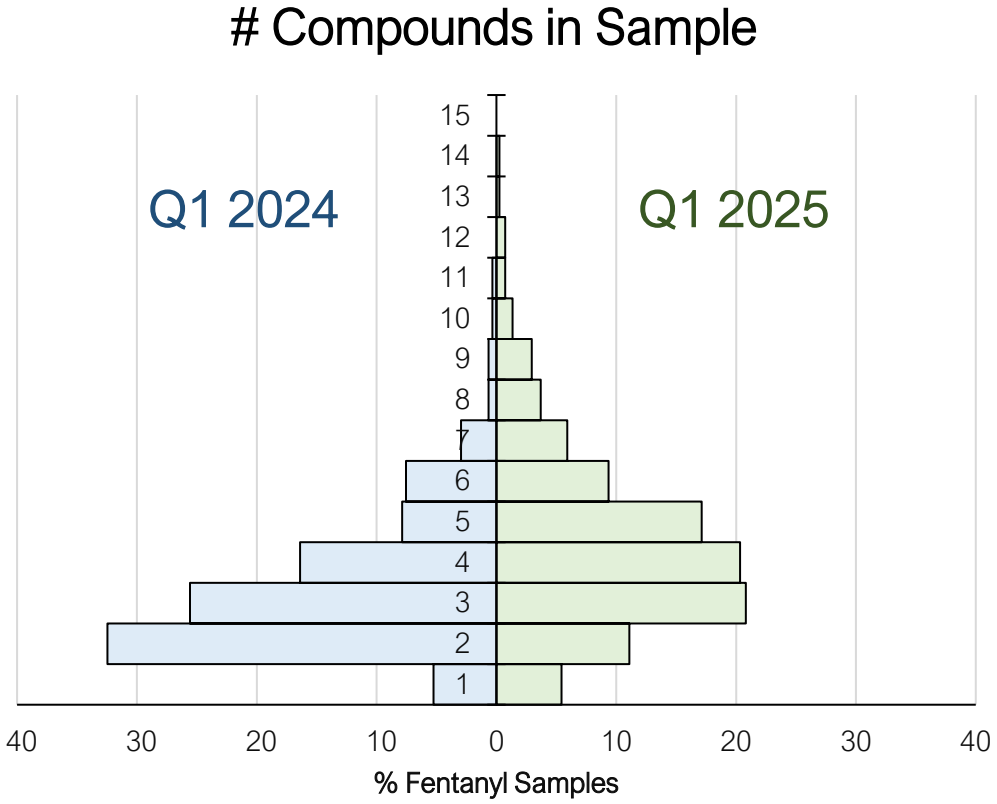
LC-MS/MS
(≈40 compounds)

GC-MS
&
LC-timsTOF

Sample Overview







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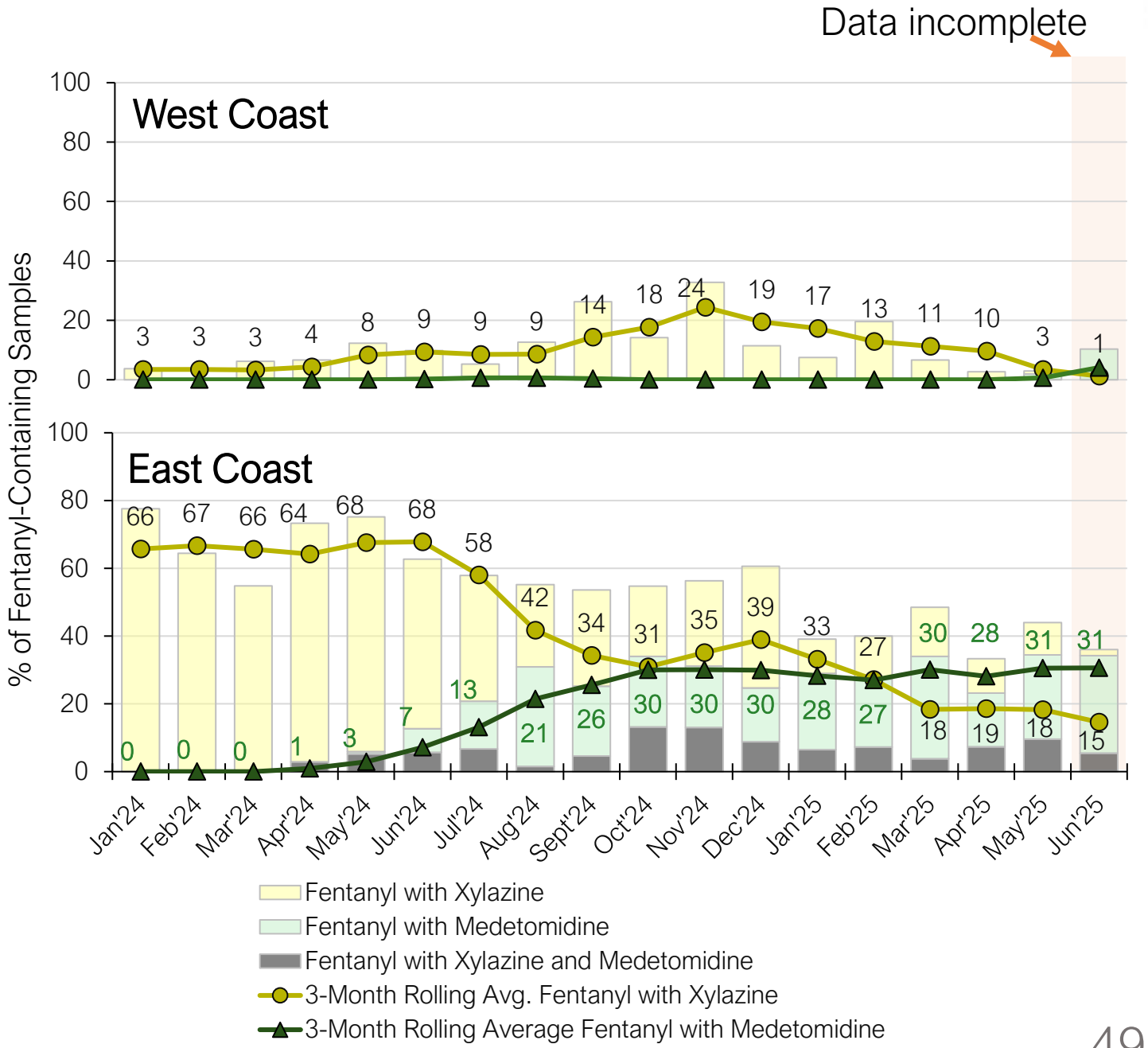
U.S. DEPARTMENT OF COMMERCE

RaDAR Rapid Drug Analysis & Research

α_2-Agonists

- Steady decline in xylazine prevalence across sites.
- Continued prevalence of medetomidine on East Coast.
- First sustained detections of medetomidine on West Coast appear to be beginning.



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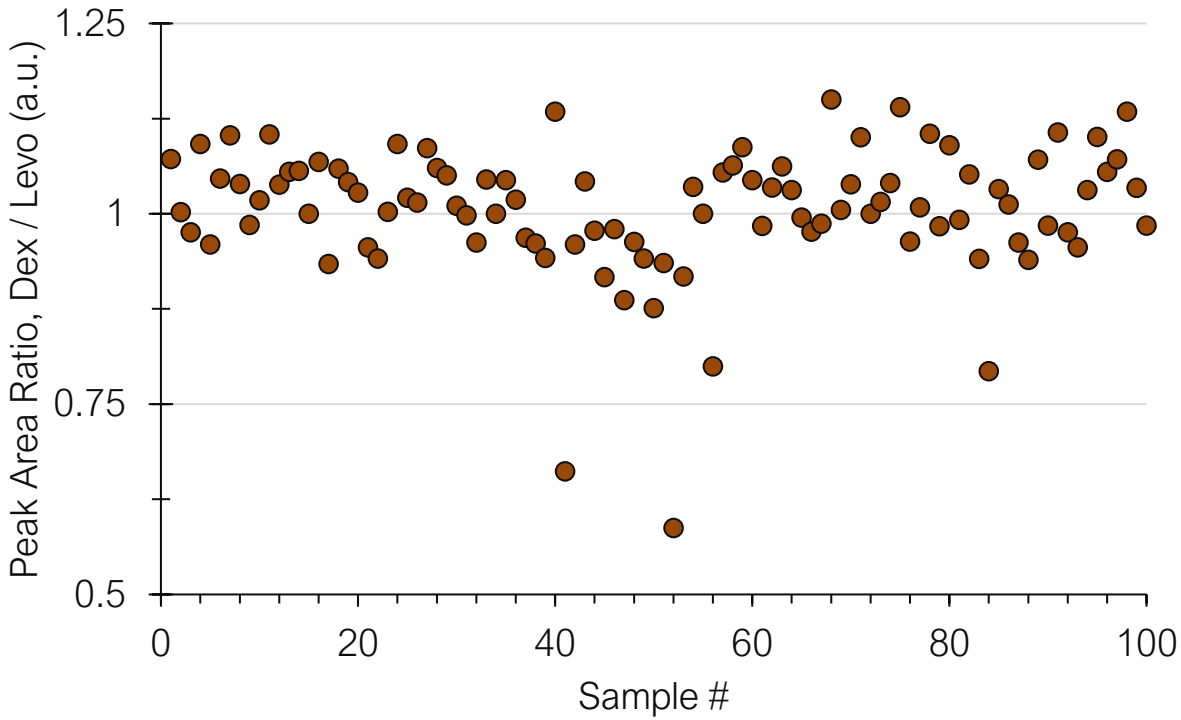
U.S. DEPARTMENT OF COMMERCE

RaDAR

Medetomidine Make-up

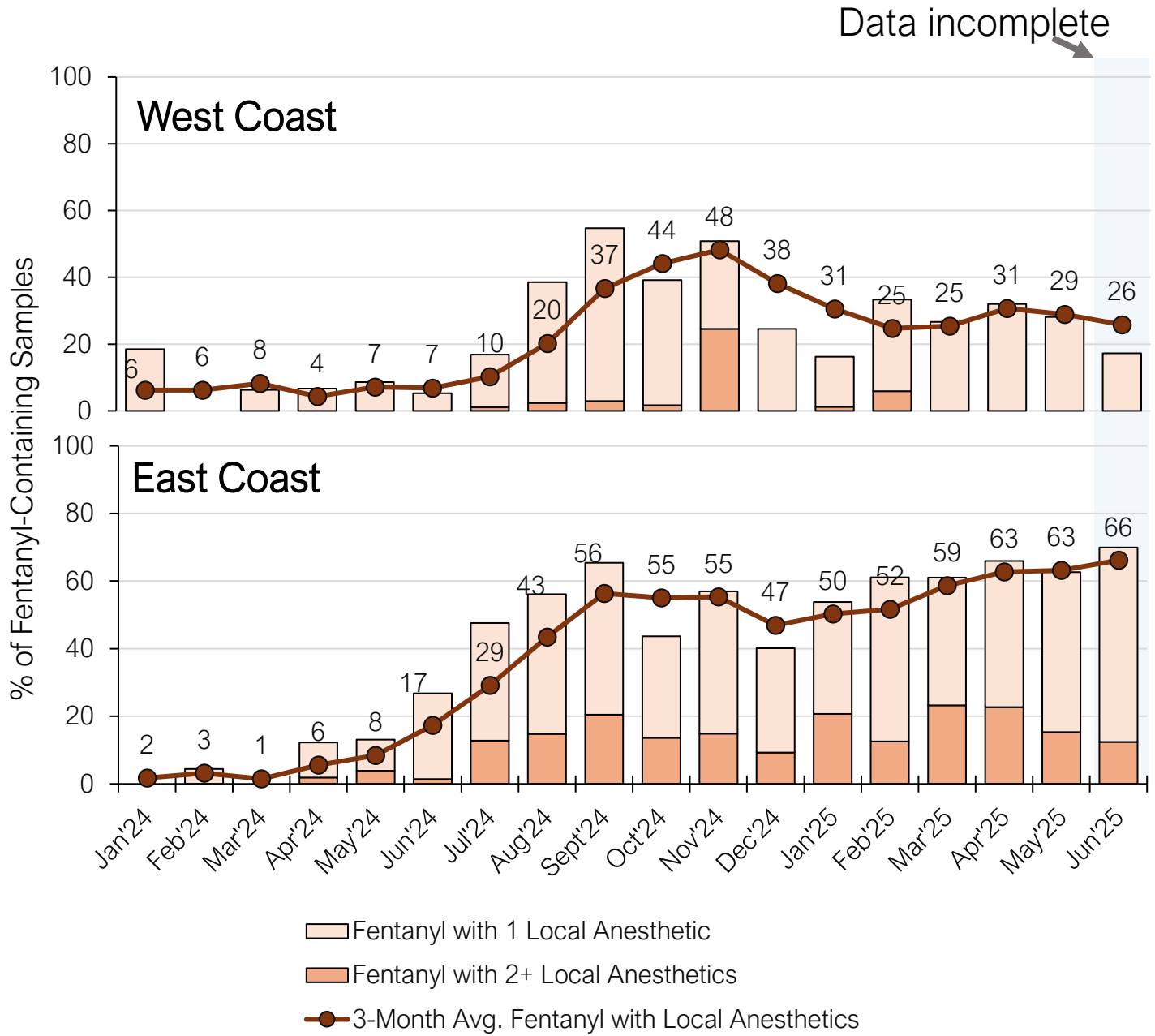
- "Medetomidine" generally refers to a mixture of two isomers:
  - Dexmedetomidine – Present in pharmaceutical preparations.
  - Levomedetomidine – Considered pharmaceutically inactive.
- Investigated 100 samples collected between August 2024 and February 2025, all found to be racemic.
- Important implications for detection and understanding diversion.
- Samples were found to illicit positive response on medetomidine test strips.



Pre-Print

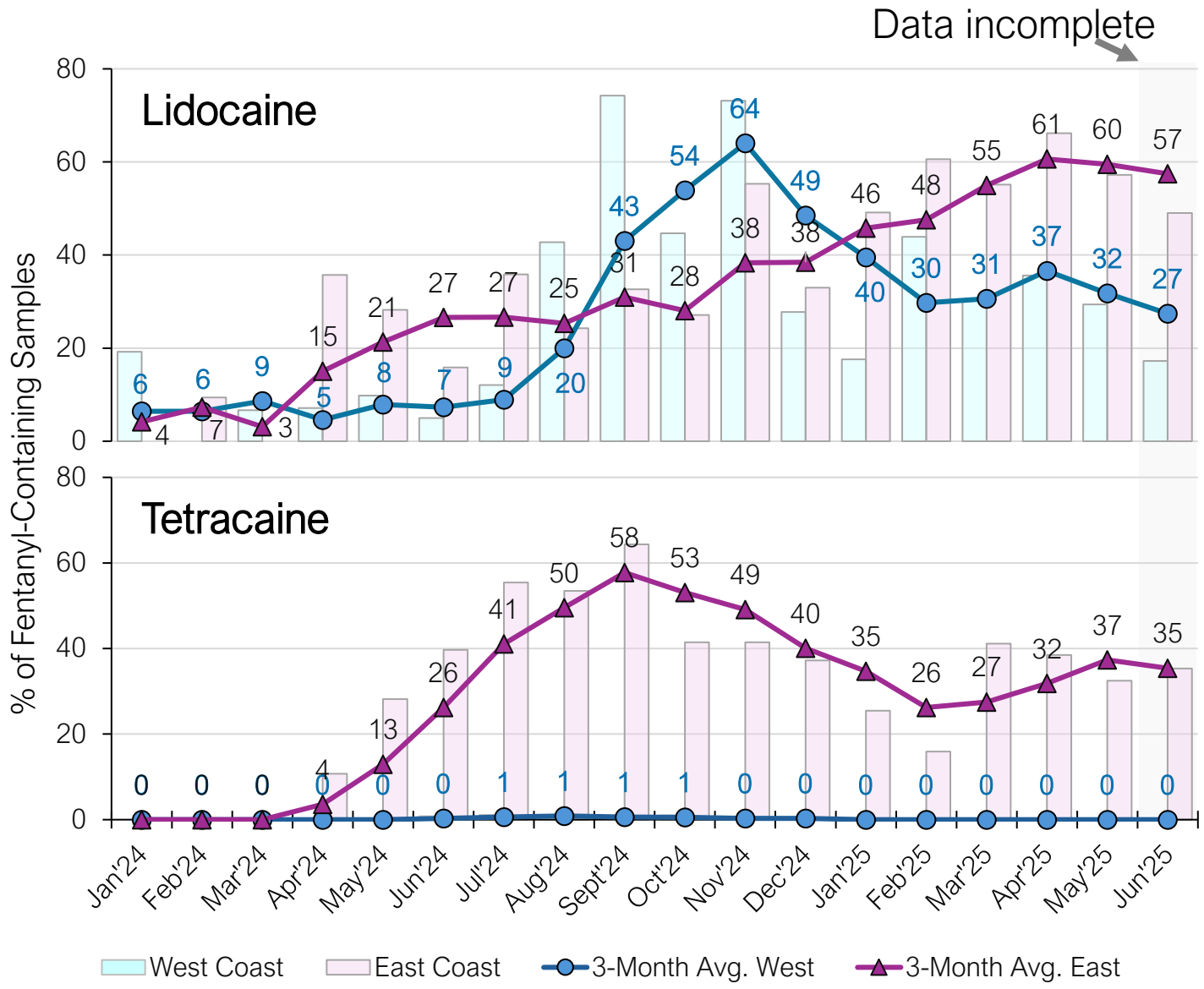
Local Anesthetics

- Substantial increase in the presence of local anesthetics in fentanyl samples.
- Commonly observe multiple anesthetics in a single East Coast sample.



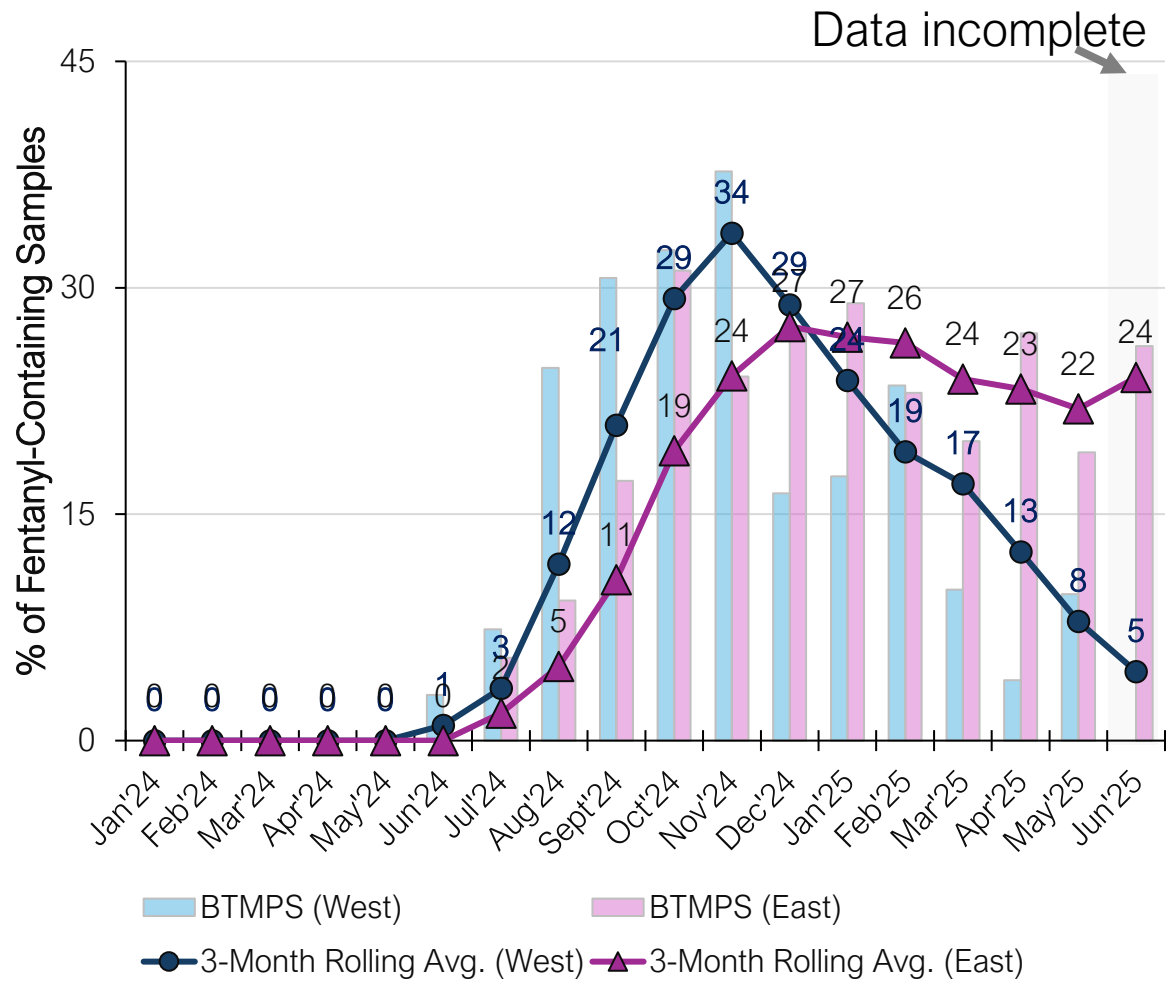
Local Anesthetics

- Lidocaine observed in samples across the country.
- Tetracaine dominating East Coast samples, often in combination with medetomidine.
- Procaine trend is mirroring tetracaine, at a lower overall prevalence.
- Other compounds detected include benzocaine, mepivacaine, ropivacaine.



BTMPS

- Continued observance of BTMPS in fentanyl samples since June 2024.
- During 2025, steady decline in West Coast samples.
- Found several samples containing tetramethyl-4-AP and tetramethyl-4-piperidonal in recent months.

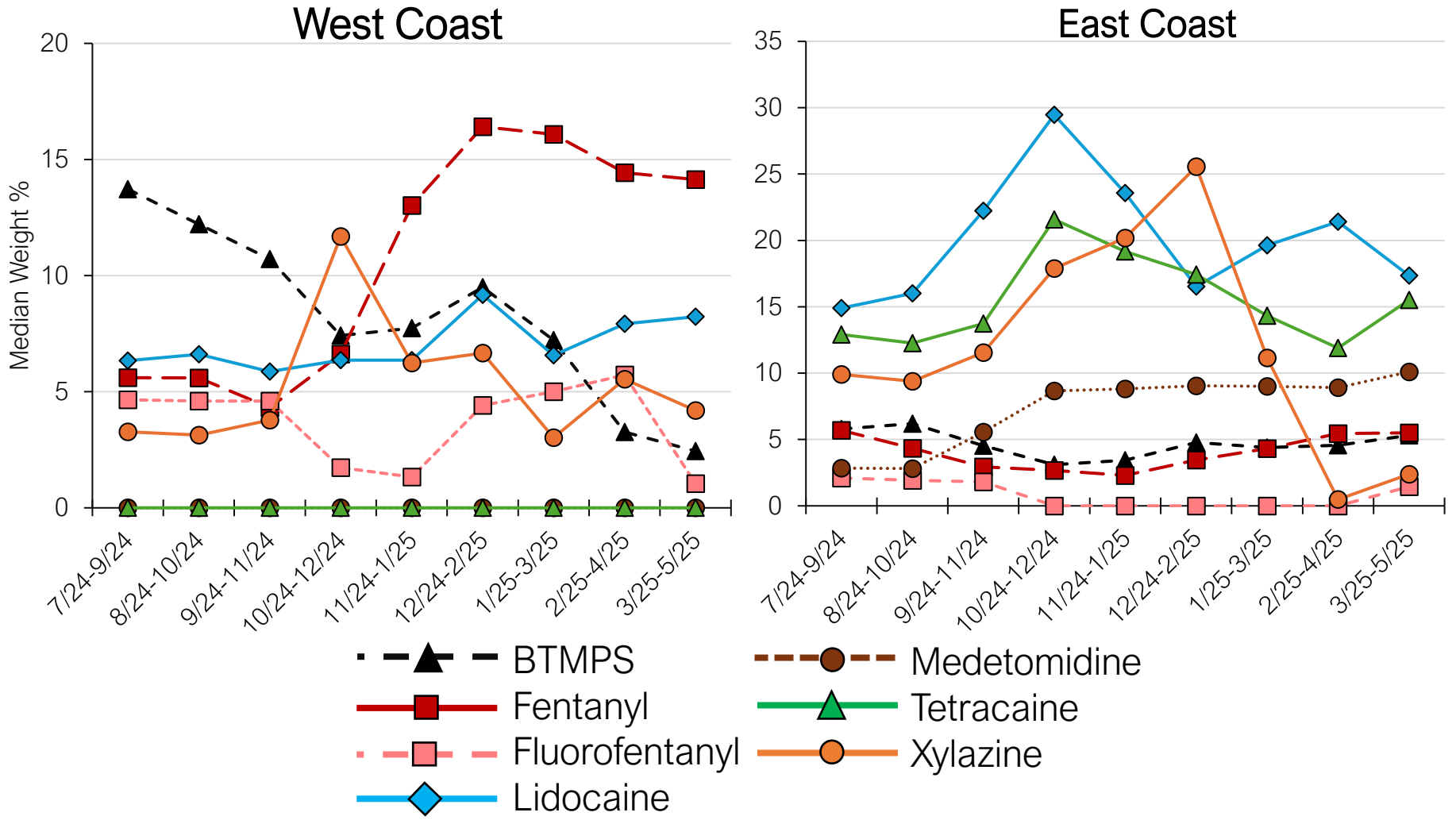


Nitazenes & Other New Compounds

- Nitazenes detected at a low frequency, however, the type of nitazene rapidly changes.
- Most recently detected nitazenes include:
  - Protodesnitazene
  - Methylenedioxynitazene
  - Fluetonitazene
  - N-desethyl Isotonitazene

- Substantial increase in the presence of synthetic cannabinoid 5-fluoro ADB in samples associated with an overdose.
- Continued prevalence of synthetic cathinone iso-PV8.
- Recent detections of α-pyrrolidinocyclohexanophenone.
- Several detections of synthetic tryptamine 4-OH-NiPT.
- Several detections of anti-psychotics in methamphetamine.
- A number of recent West Coast samples have had high levels of carfentanil.

Quantitative Trends



Test Strip Standard Development

- Working with AOAC International to develop minimum performance requirements and certification process for test strips.
- Input from public health, public safety, forensics, and customs.
- For analysis of drug product / drug product residue.
- Agnostic to test strip type.
- Expected to be completed by end of 2025.

Mobile Testing Laboratory

- Completing mobile testing laboratory for on-site RaDAR analyses and technology acceleration.

Newsletter

- Released on the 15th of every month:
  - Top ten compounds
  - Fentanyl adulteration trends
  - Newly detected compounds

Newsletter

CADS

- Panels of authentic, characterized drug samples for laboratories to use for research, development, and validation purposes.
- Panel 1 is released and has both traditional drugs as well as NPS.
- Panel 2 available in fall.

More Info

Questions, Comments, Want to Collaborate?

RaDAR@nist.gov

edward.sisco@nist.gov

More Info

Newsletter

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RaDAR Rapid Drug Analysis & Research

A portion of this work is funded by the Division of Overdose Prevention, National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention.

Submit your Questions

Scan for Q&A

Drug Supply and Overdose
Observations of a Shifting Landscape

Nabarun Dasgupta, MPH, PhD
University of North Carolina
Chapel Hill, NC, USA

July 2, 2025 • ORS-TAT • Webinar

Funding

We do not accept industry funding. Our views do not necessarily reflect those of funders.

Foundations & Non-profits

Vital Strategies
FORE
NACCHO
NASTAD

State

NC DHHS

NC General Assembly, via NC Collaboratory, using opioid settlement funds

Federal

US FDA

Fee-for-service

Drug checking kits, **at-cost or free**

County governments

University research

Disclosure

ND is an uncompensated Board member of the non-profit Remedy Alliance For The People, which provides technical assistance for drug checking, and distributes bulk naloxone and other supplies **at-cost or free**.

42%

Adults who have personally known someone who died of a drug overdose

Athey A. *American Journal of Public Health*. March 2024.

1.4 million

US children who have lost a family member to overdose

Verdery AM. *American Journal of Public Health*. September 2024

University of Kentucky UF FLORIDA UNC

Home Studies Code + Data Team News Contact

Opioid Data Lab

Theory

Foundational Studies

- Biostatistics
- Epidemiology methods
- Psychology of communication
- Pharmacology

Practice

Applied Research

- Pharmacy
- Medicine
- Vital statistics
- Harm reduction

Lived Experience

Science in Service

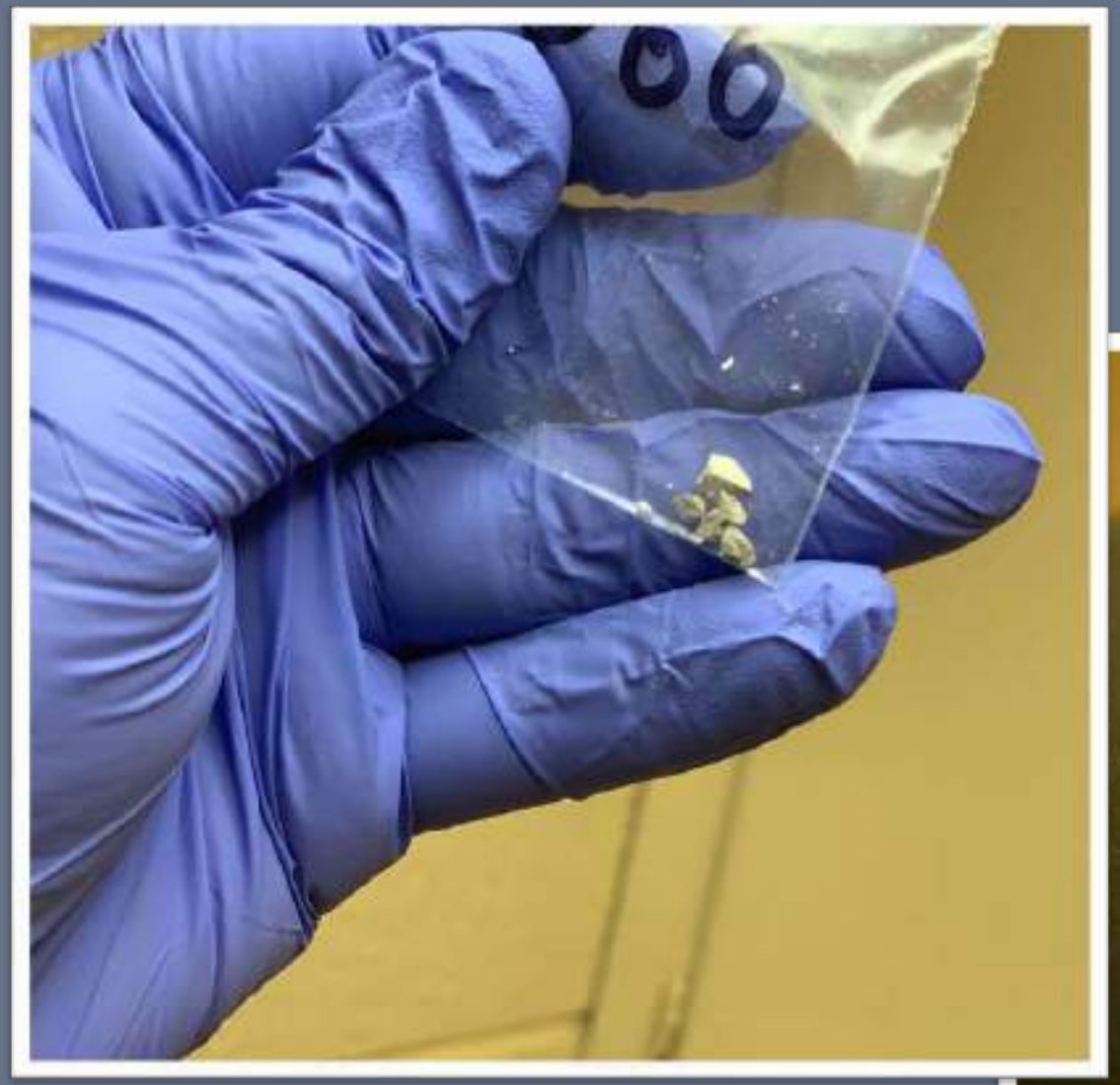
- Drug checking
- Sociology (qualitative)
- Evidence-making interventions
- History of asylums

Our Approach is Different.

Science

in

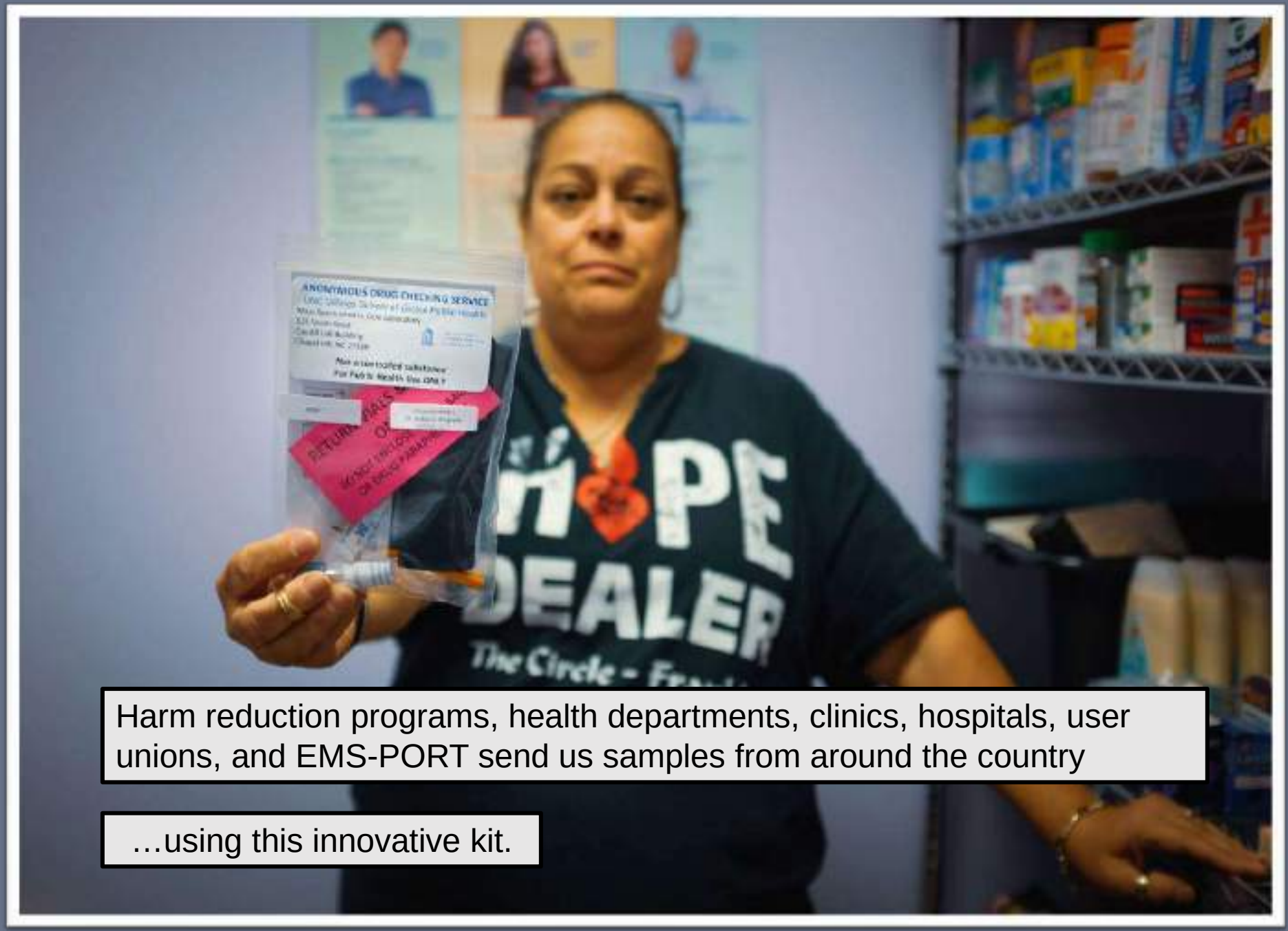
Service



In our lab on campus

we monitor street drugs

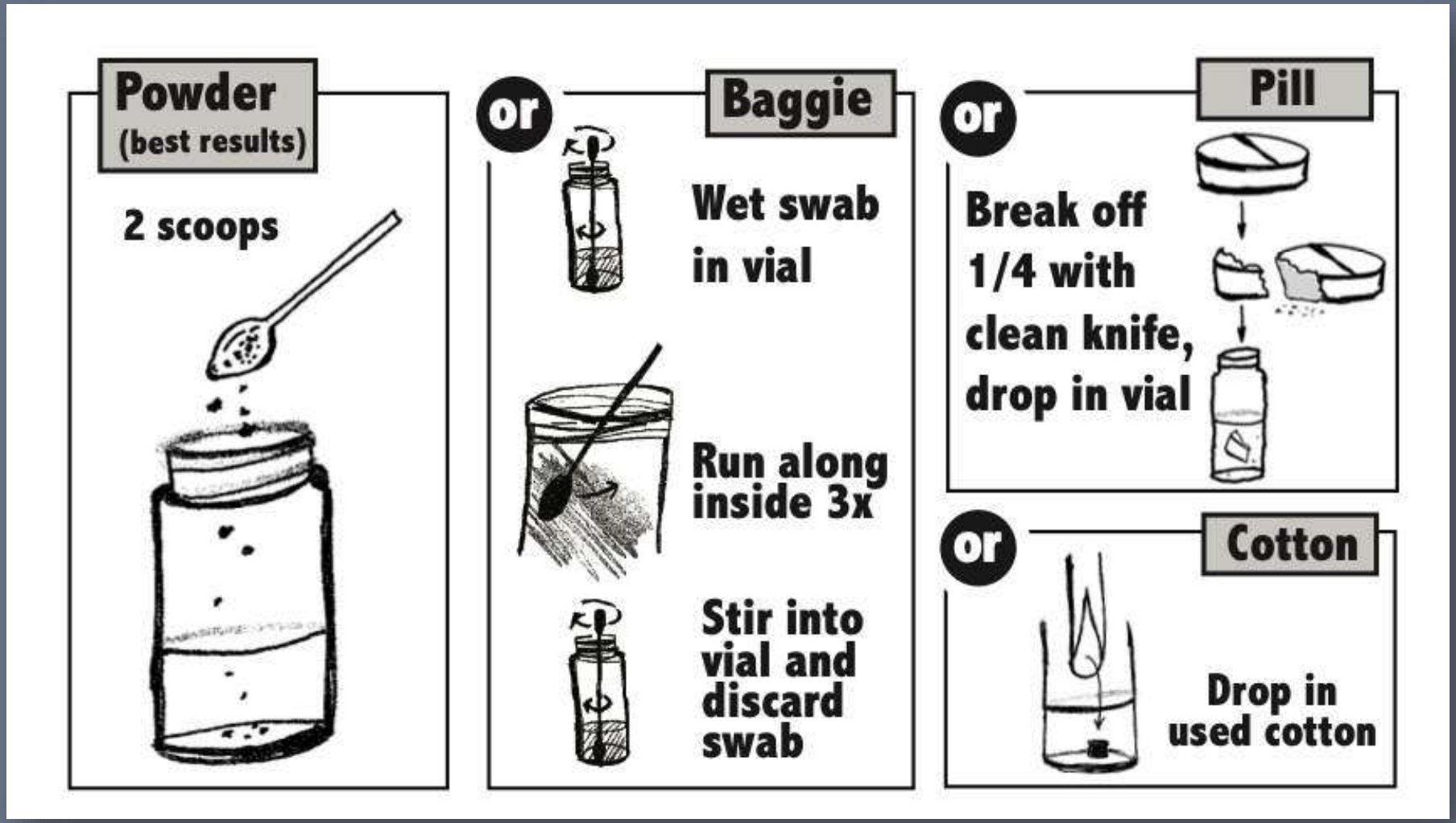
as a public service.



Harm reduction programs, health departments, clinics, hospitals, user unions, and EMS-PORT send us samples from around the country

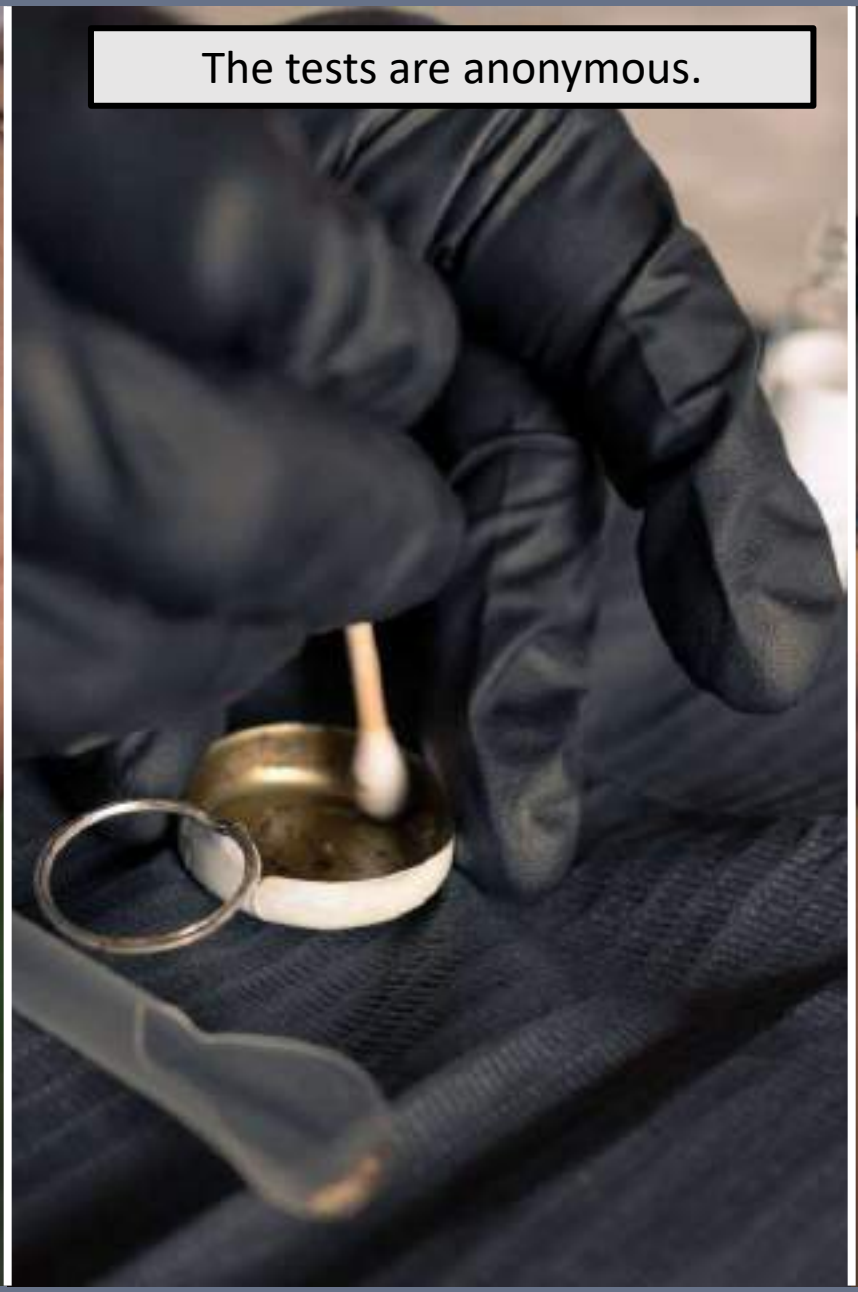
…using this innovative kit.

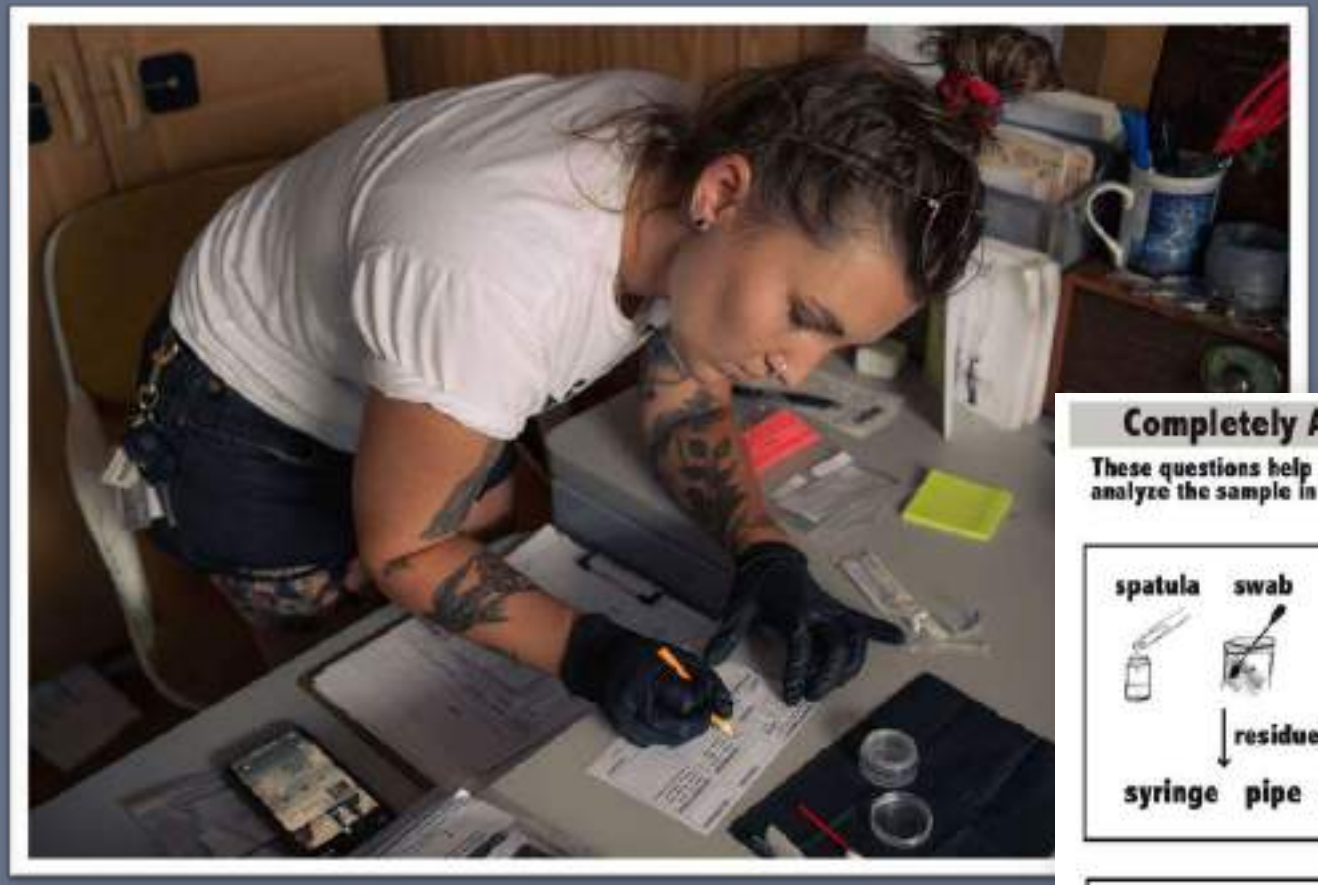
Samples can be collected via scoop, reside swab, pill fragment, or used cotton.



Samples are given voluntarily.

The tests are anonymous.





Programs share health information with us

Completely Anonymous

These questions help us figure out how to analyze the sample in our lab at UNC.

circle

spatula swab pill cotton

residue?

syringe pipe foil

today's date

month date

circle if involved in overdose

yes no don't know

describe the overdose to warn others:

overdose

describe color and markings

circle expected drugs

heroin fentanyl xylazine

cocaine crack meth

ketamine weed M30

benzo other:

MDMA

unknown

circle textures

crystals pill fake pill

powder edibles oil/wax

plant/leaf tar

chunky

shiny other:

flaky

dull

city or neighborhood

circle & describe sensations

normal nice weird

weaker stronger long

more up unpleasant

more down hallucinations

sedating unusual taste

describe:

sensations

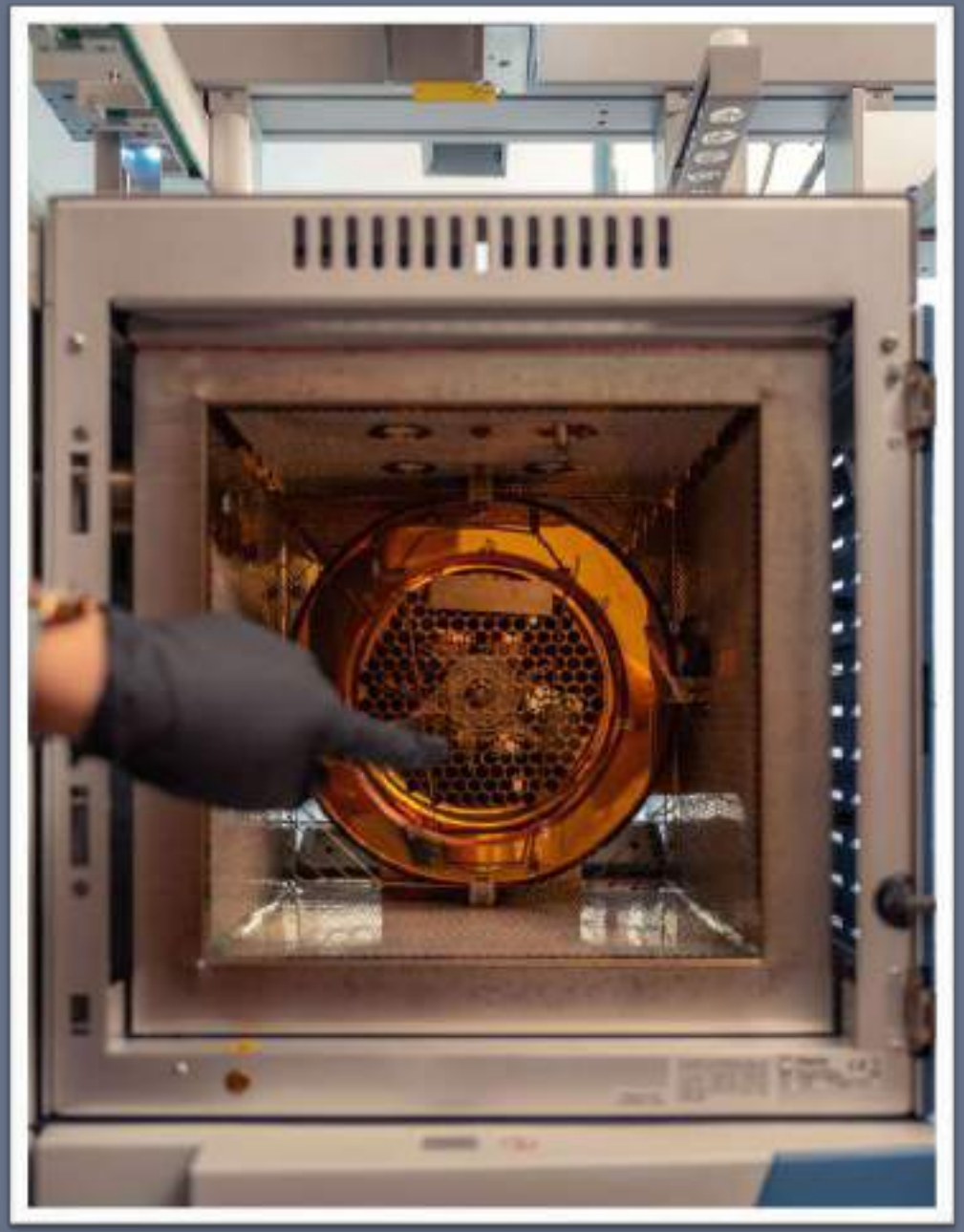
sample number

to give human context beyond molecules.

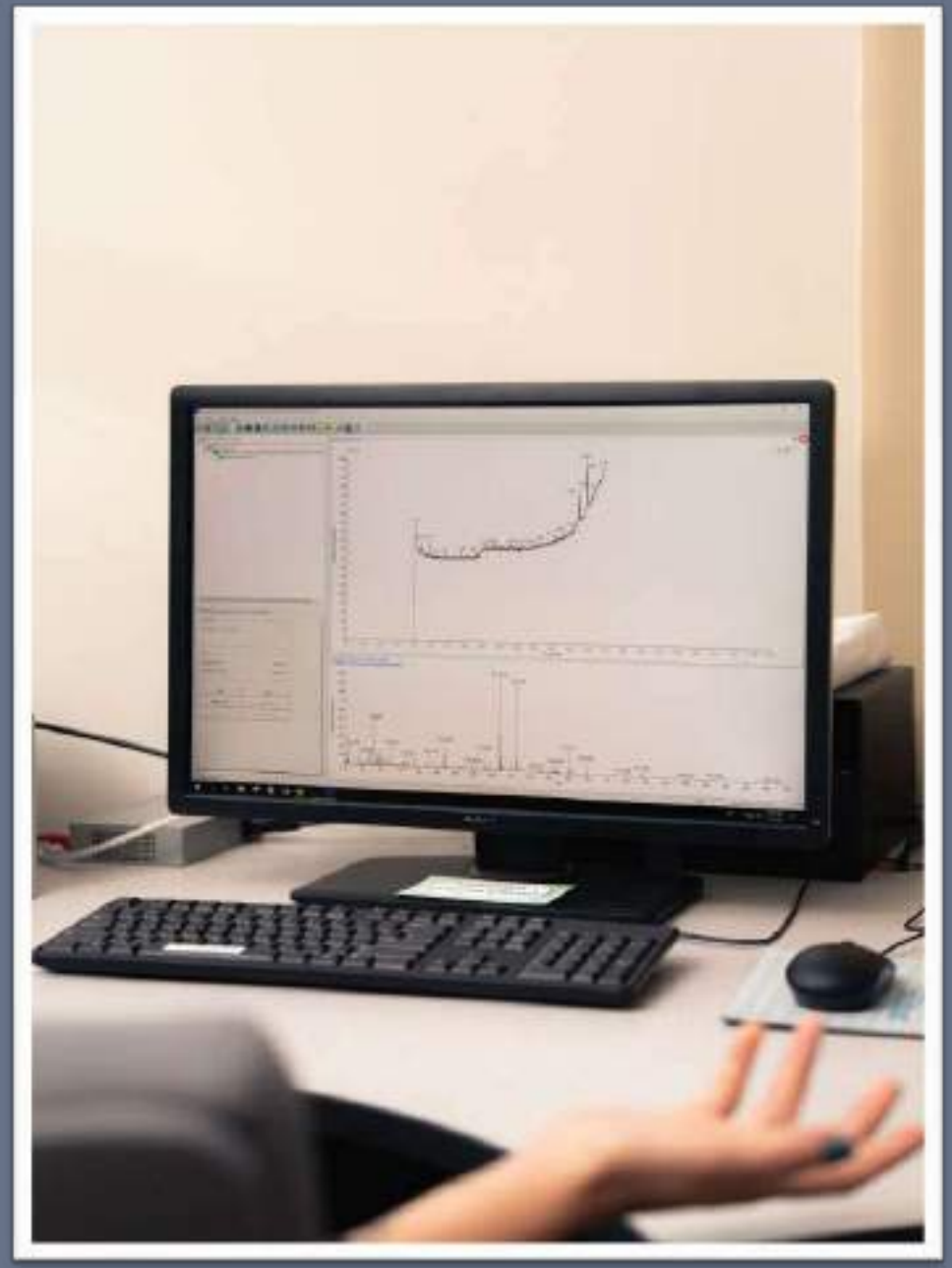
Packages arrive on campus

in compliance with drug and postal laws.

We do *untargeted* search,



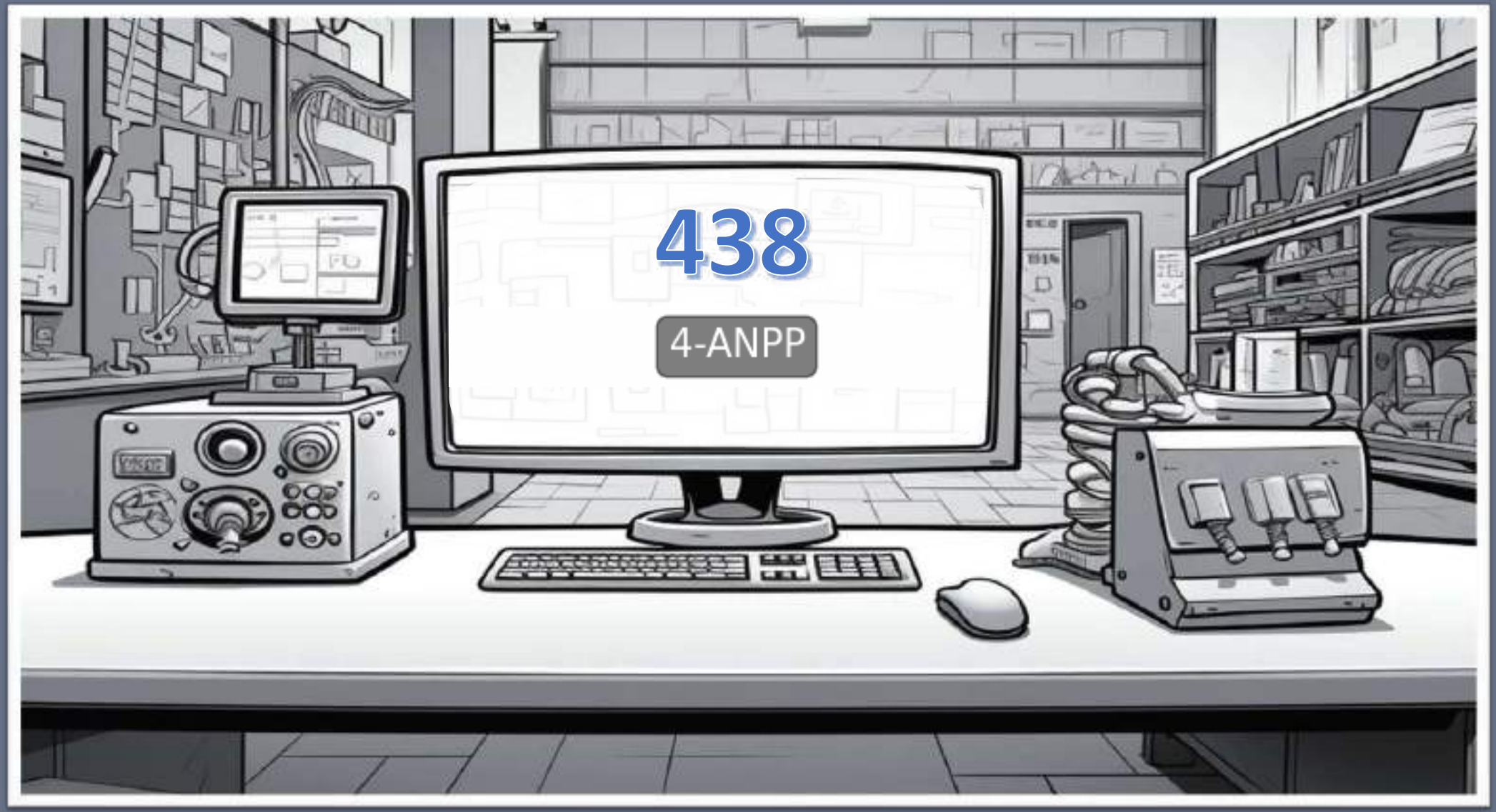
to determine what's in the sample with atomic precision.



March 2022 to Friday July 1, 2025

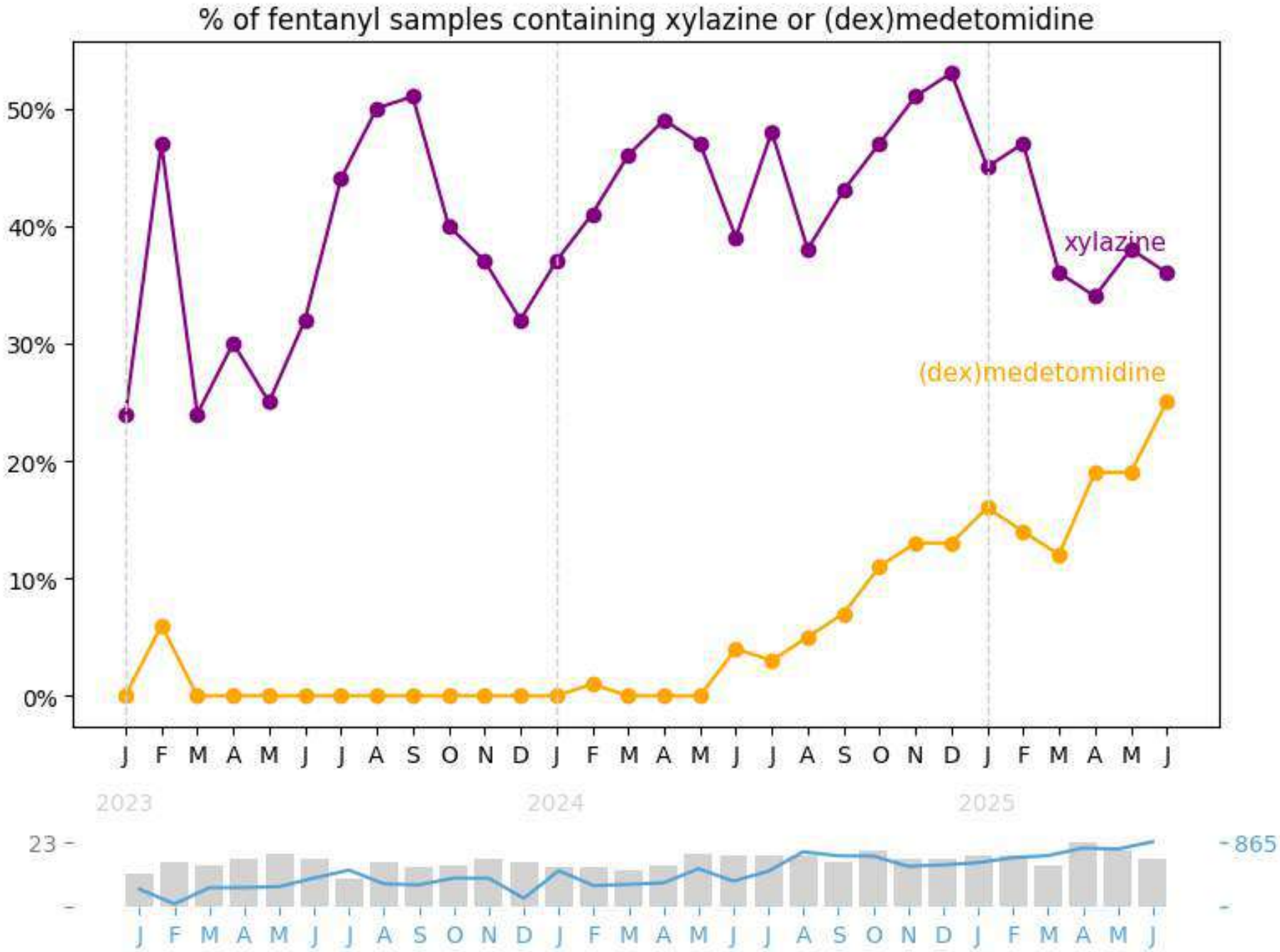
N = 14,100 samples analyzed
Serving 171 harm reduction programs
Including **56 FTIR drug checking services**
Reaching 255 counties in **43 states**

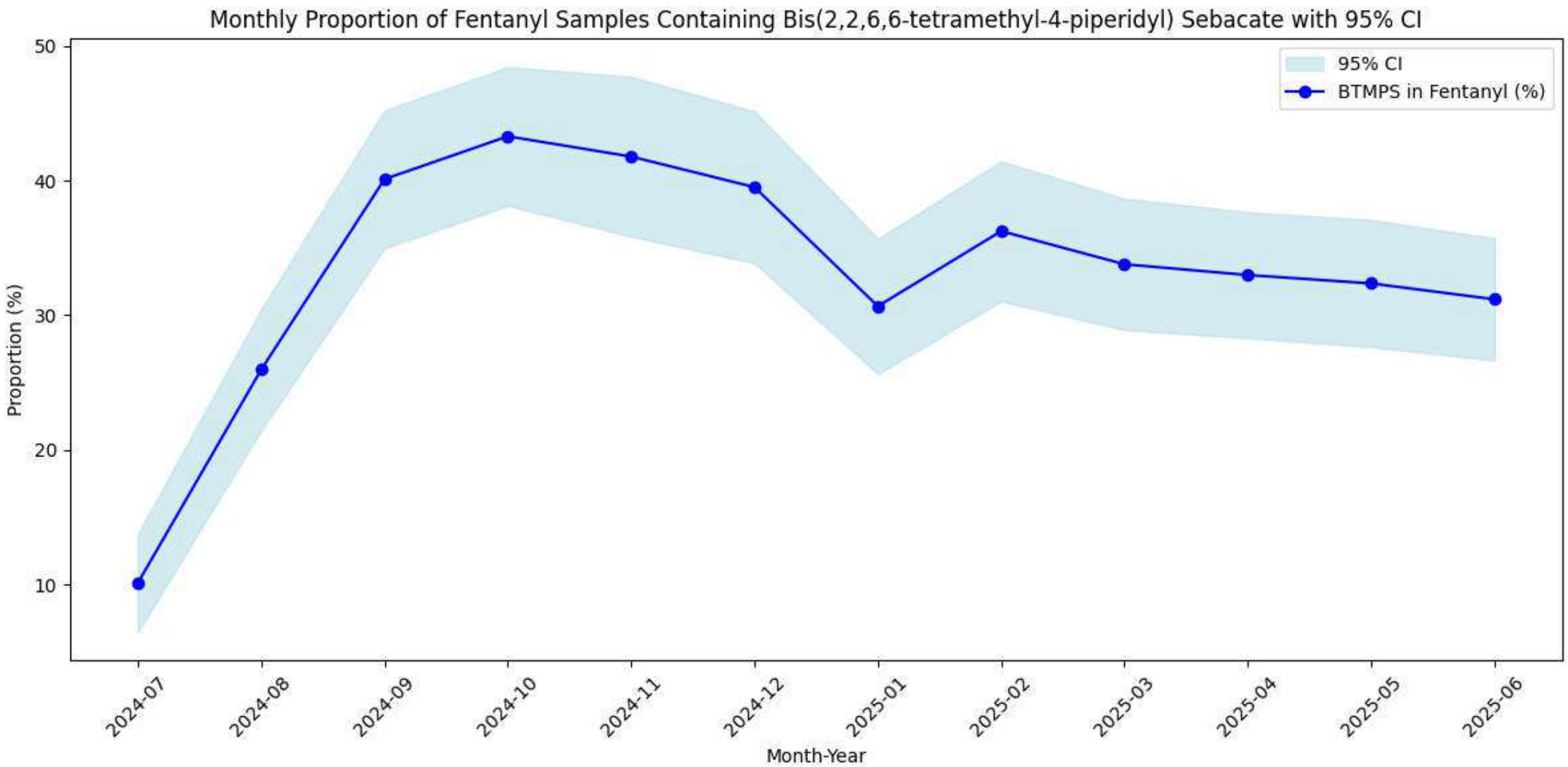
We’ve detected a multitude of substances in drug supply.



FTIR Point-of-Care Drug Checking

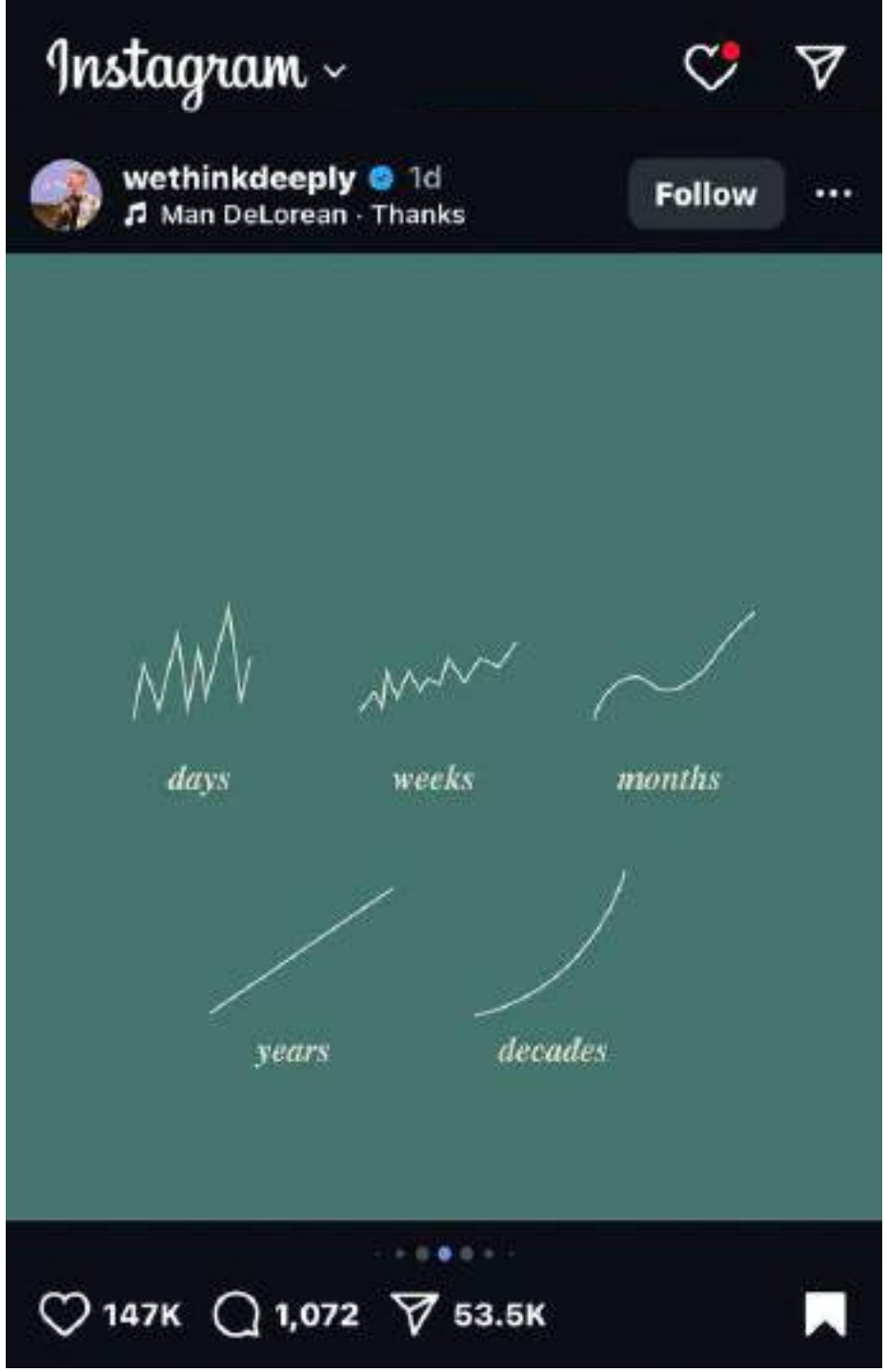
Don Jackson, NC Survivors Union


% of fentanyl samples containing xylazine or (dex)medetomidine
50%
40%
30%
20%
10%
0%
xylazine
(dex)medetomidine
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
2023
2024
2025
23
865
All UNC samples (blue line), originating states (grey bars), and max per month


Monthly Proportion of Fentanyl Samples Containing Bis(2,2,6,6-tetramethyl-4-piperidyl) Sebacate with 95% CI
95% CI
BTMPS in Fentanyl (%)
Proportion (%)
50
40
30
20
10
2024-07
2024-08
2024-09
2024-10
2024-11
2024-12
2025-01
2025-02
2025-03
2025-04
2025-05
2025-06
Month-Year

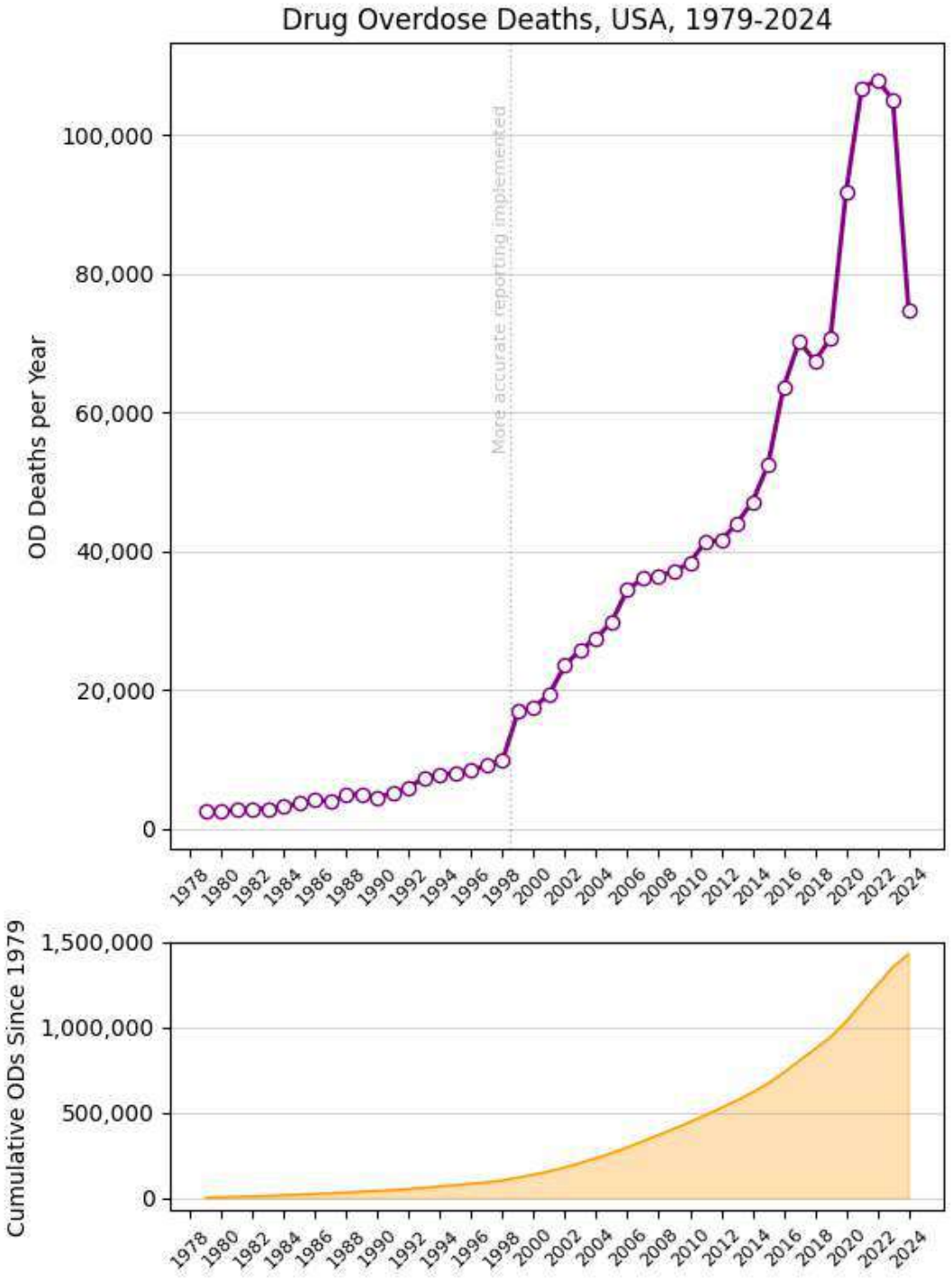
Are ODs down?

A look at national overdose death data


Instagram
wethinkdeeply 1d
Man DeLorean · Thanks
Follow
days
weeks
months
years
decades
147K
1,072
53.5K

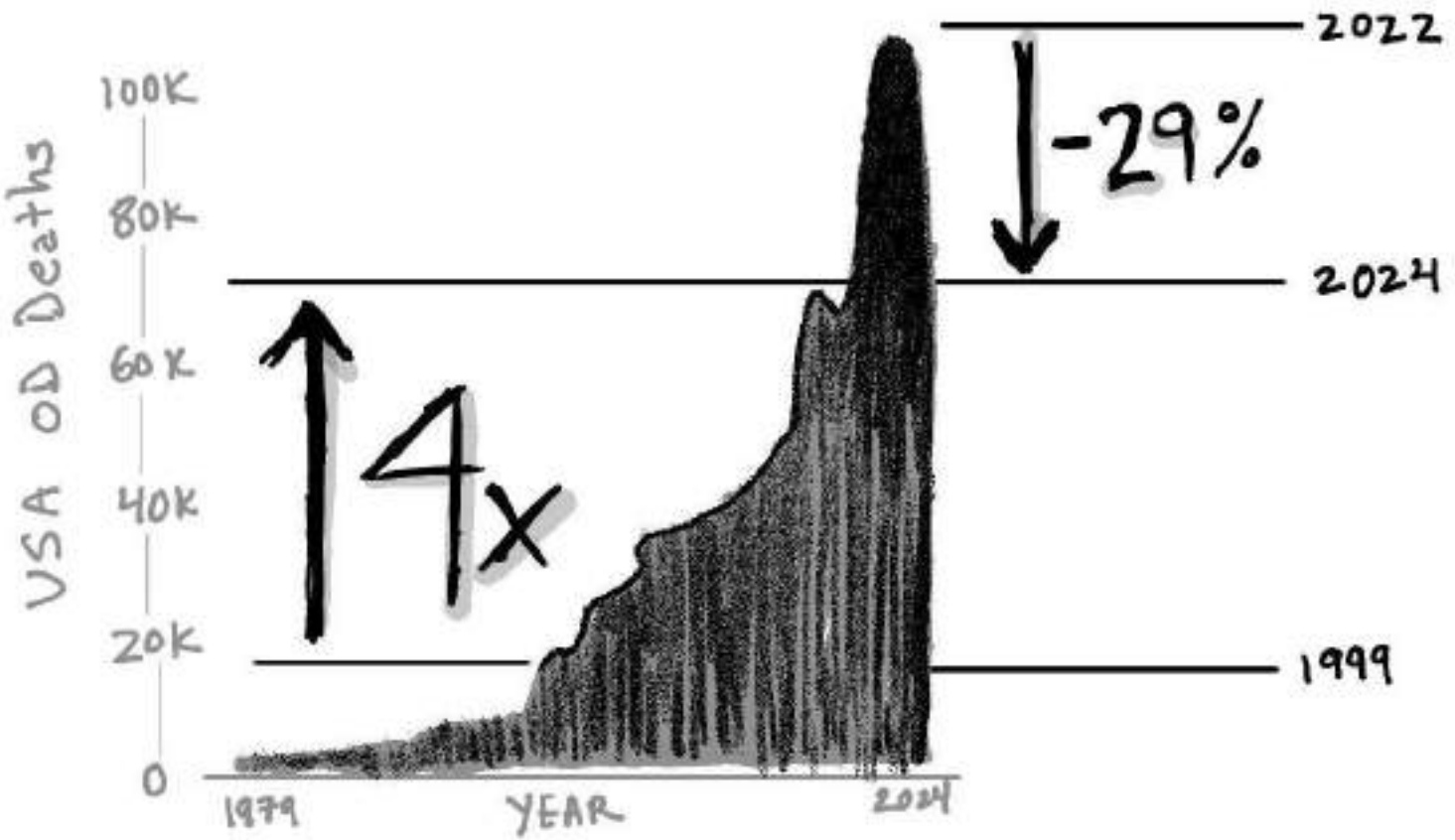
-29%

reduction in all drug overdose mortality from peak June 2023 vs. Dec 2024



↑4x

increase in all drug overdose mortality from 1999 vs. 2024



We are still losing too many people we love.

Was this a sudden decline?

Implications for causality…

Drug overdose deaths peaked at different times across the U.S. They're now down everywhere

A band of states across Appalachia — Kentucky, West Virginia, Ohio, Pennsylvania and Maryland — all saw overdose deaths peak in 2021. West Coast states peaked more recently, but deaths are falling there too.

Source: Nabarun Dasgupta, University of North Carolina at Chapel Hill, based on provisional overdose data compiled by the Centers for Disease Control and Prevention

Credit: Brent Jones/NPR

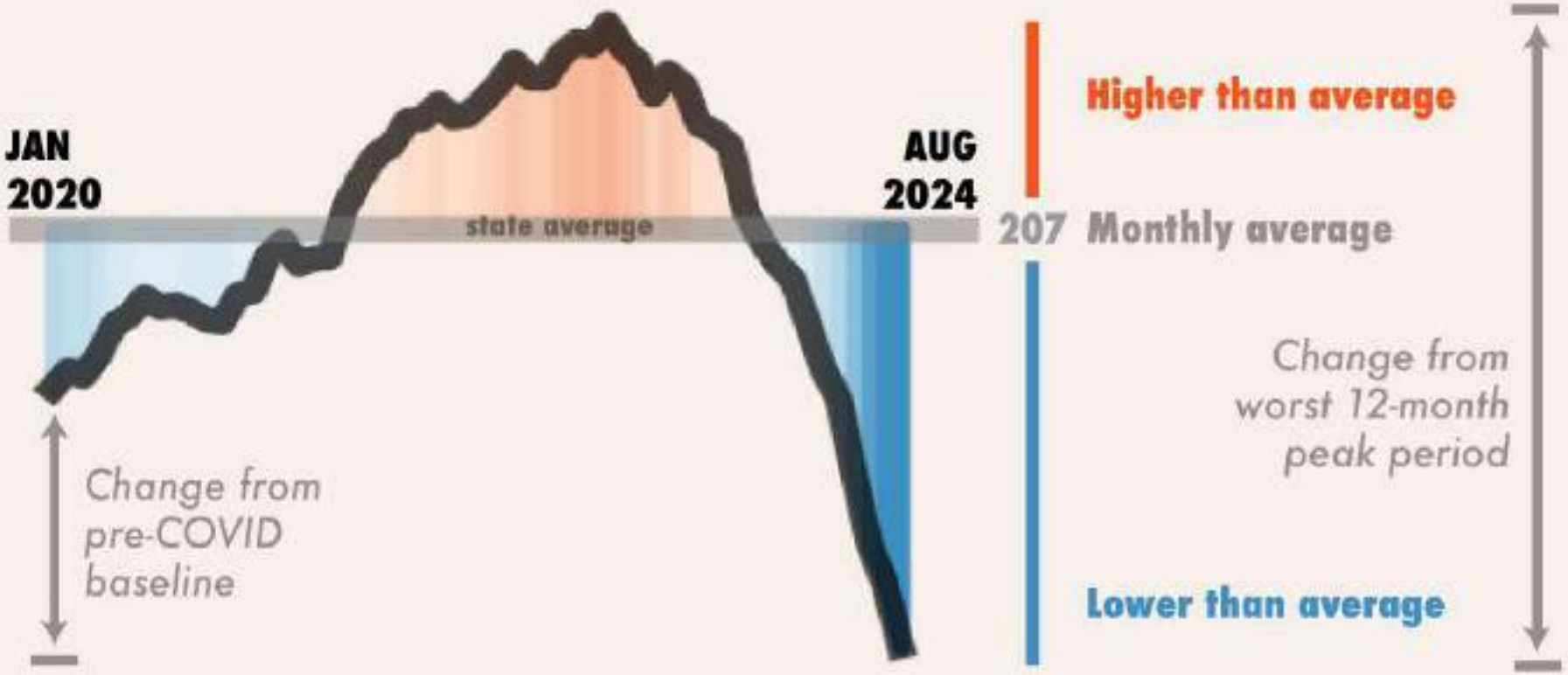
The US experienced a gradual decline in overdose deaths over 3 years.

The decline started at different times throughout the country.

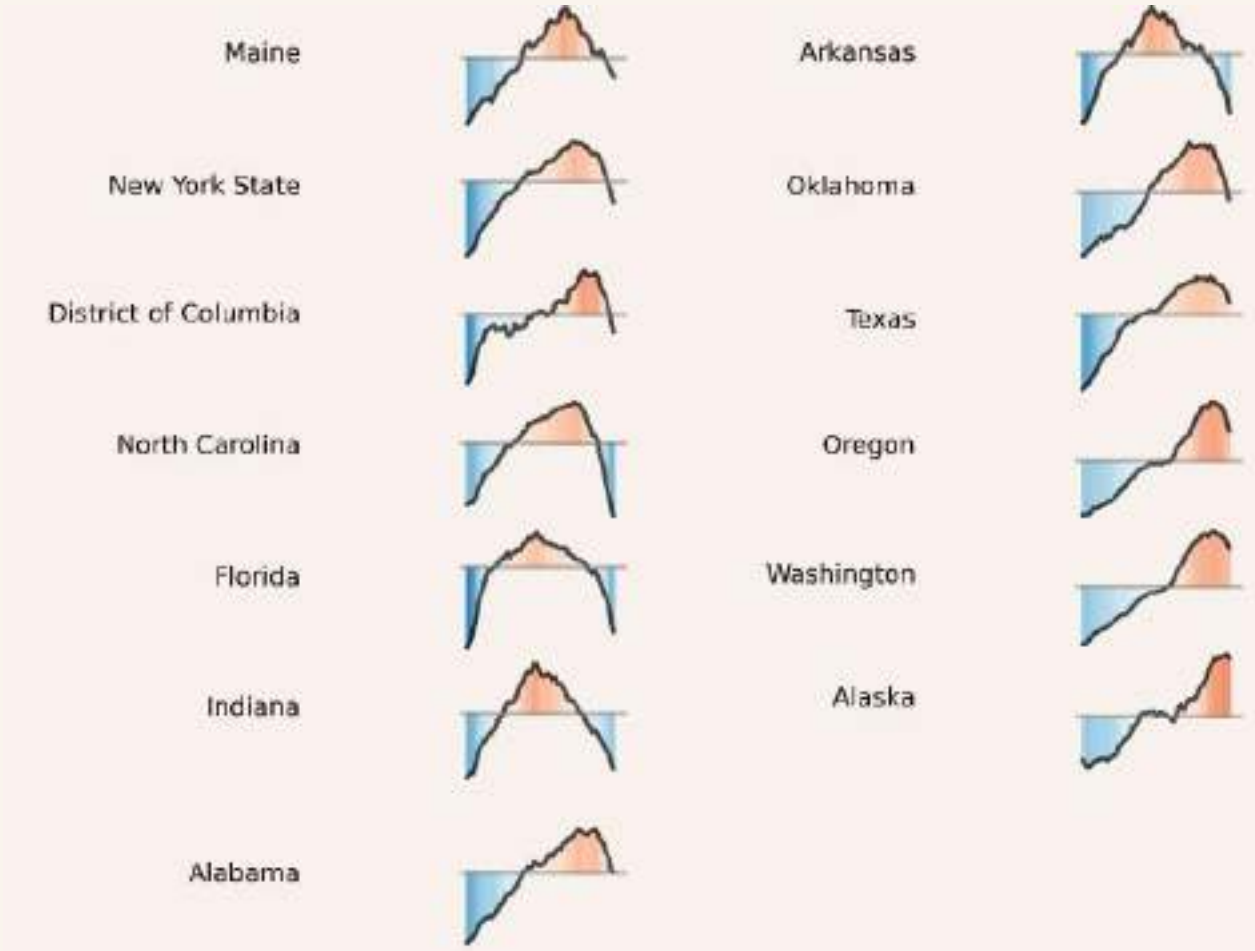
The Shape of Overdose Declines

In-depth analysis of overdose death rates

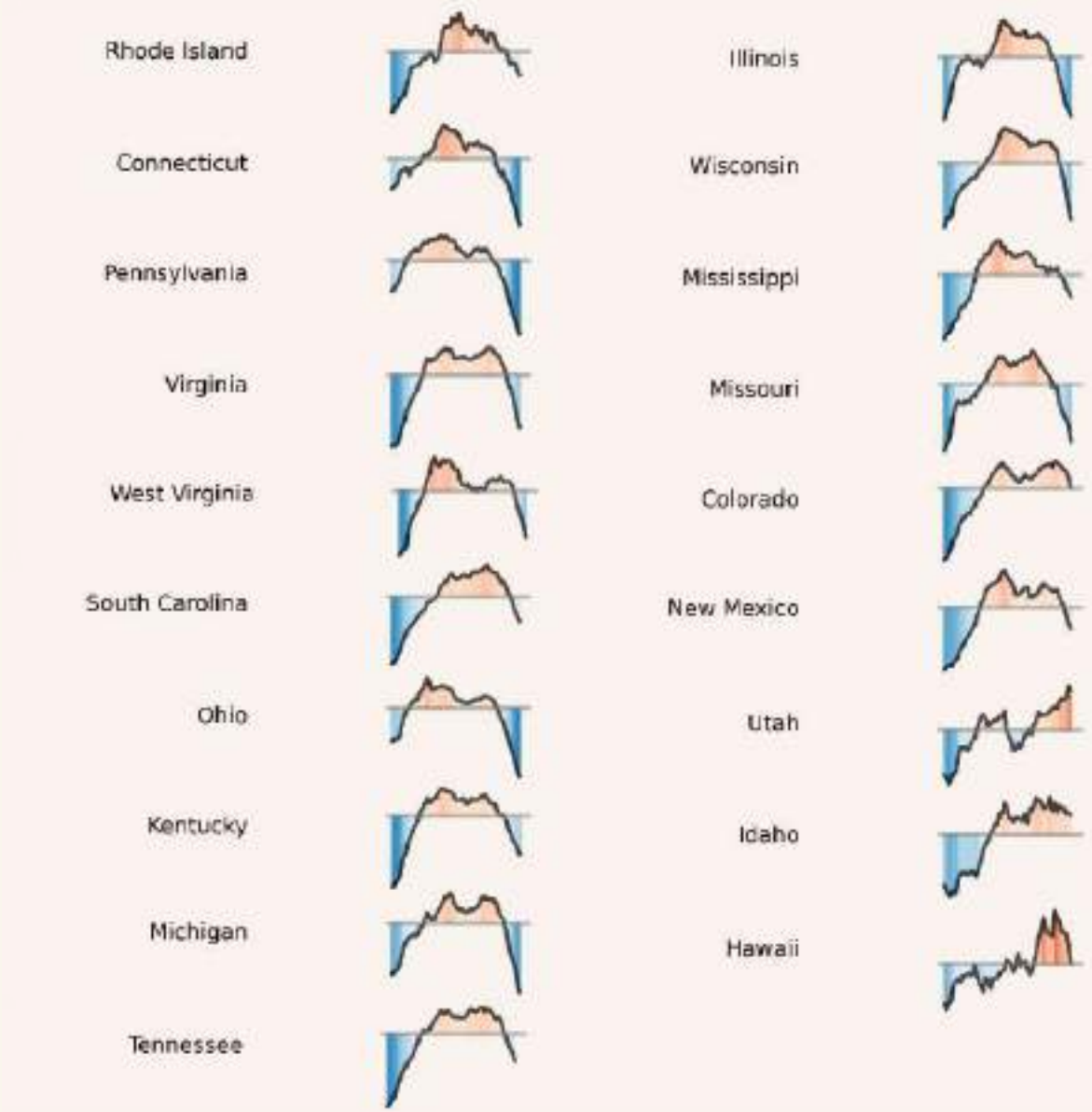
How to read our visualization of provisional overdose mortality from CDC.



A-shape


Maine
New York State
District of Columbia
North Carolina
Florida
Indiana
Alabama
Arkansas
Oklahoma
Texas
Oregon
Washington
Alaska

M-shape

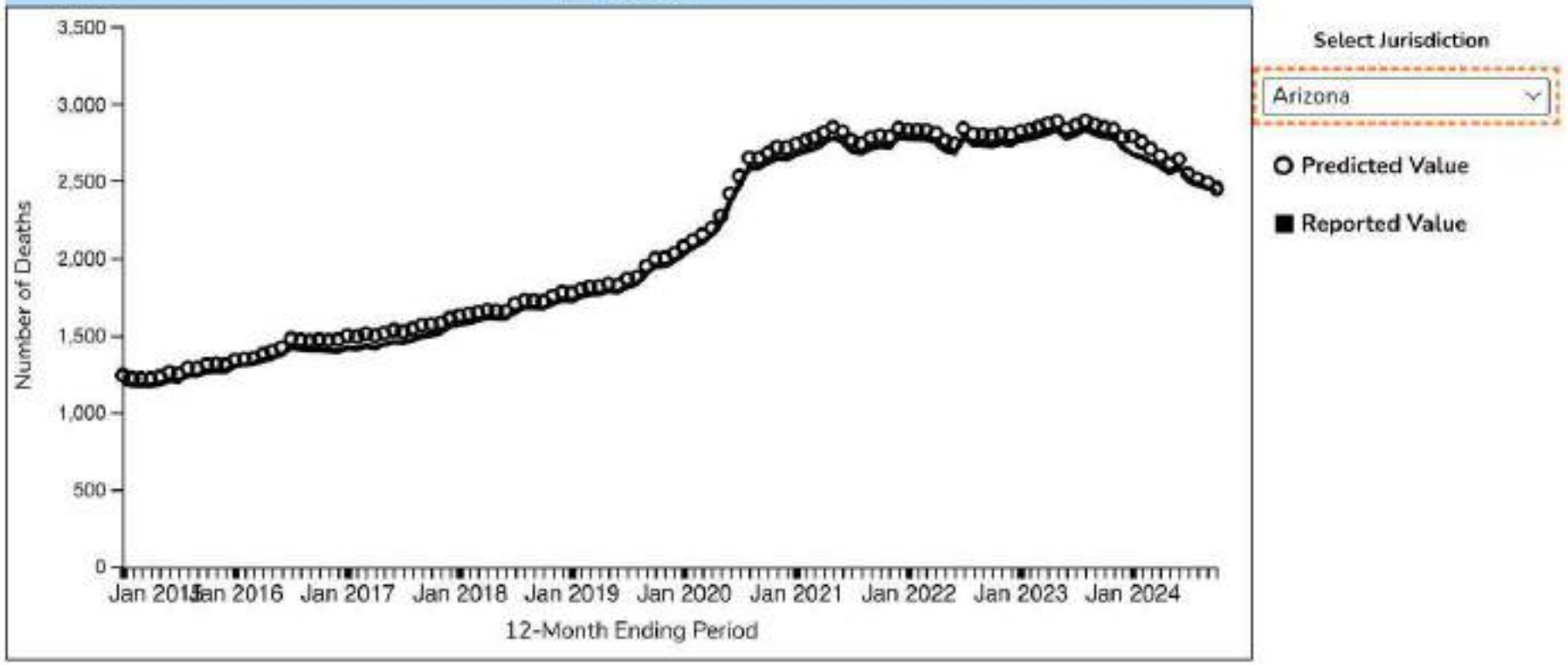

Rhode Island
Connecticut
Pennsylvania
Virginia
West Virginia
South Carolina
Ohio
Kentucky
Michigan
Tennessee
Illinois
Wisconsin
Mississippi
Missouri
Colorado
New Mexico
Utah
Idaho
Hawaii

Arizona

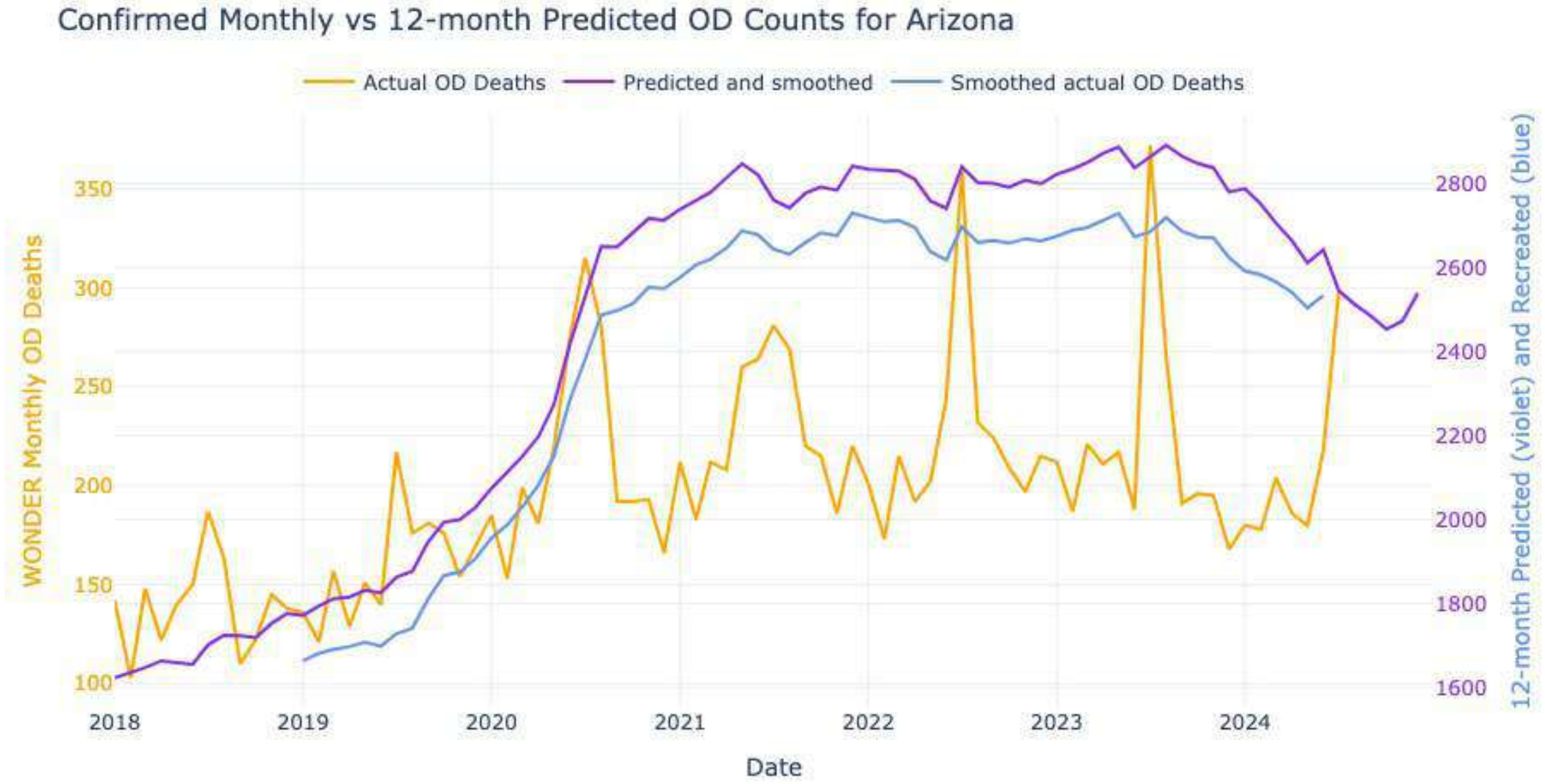
12 Month-ending Provisional Number and Percent Change of Drug Overdose Deaths

Based on data available for analysis on: March 2, 2025

Figure 1a. 12 Month-ending Provisional Counts of Drug Overdose Deaths: Arizona



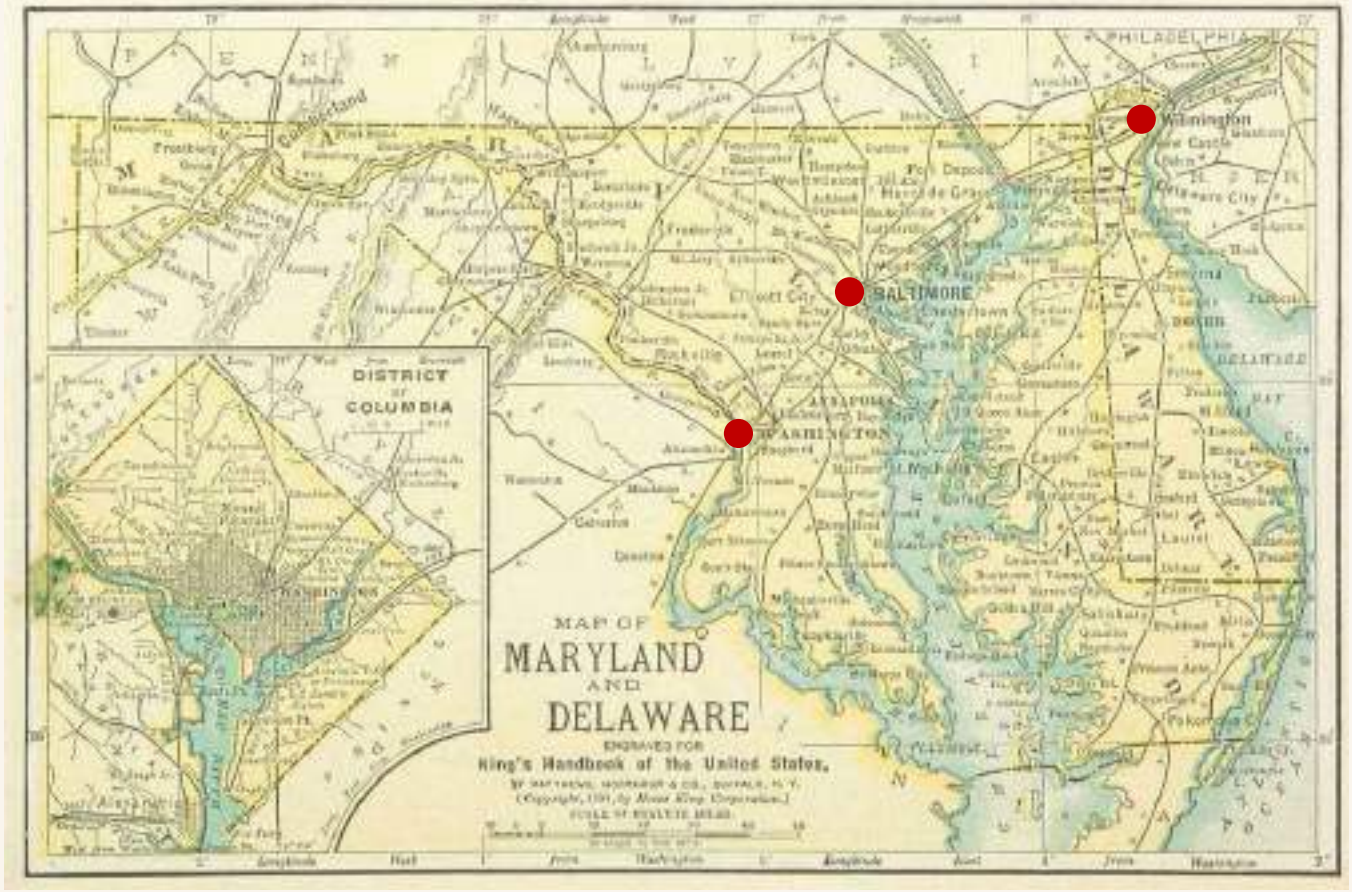
Source: CDC Provisional Overdose Death Counts



Source: UNC Opioid Data Lab, using CDC Provisional and WONDER mortality data

How much does geography matter?

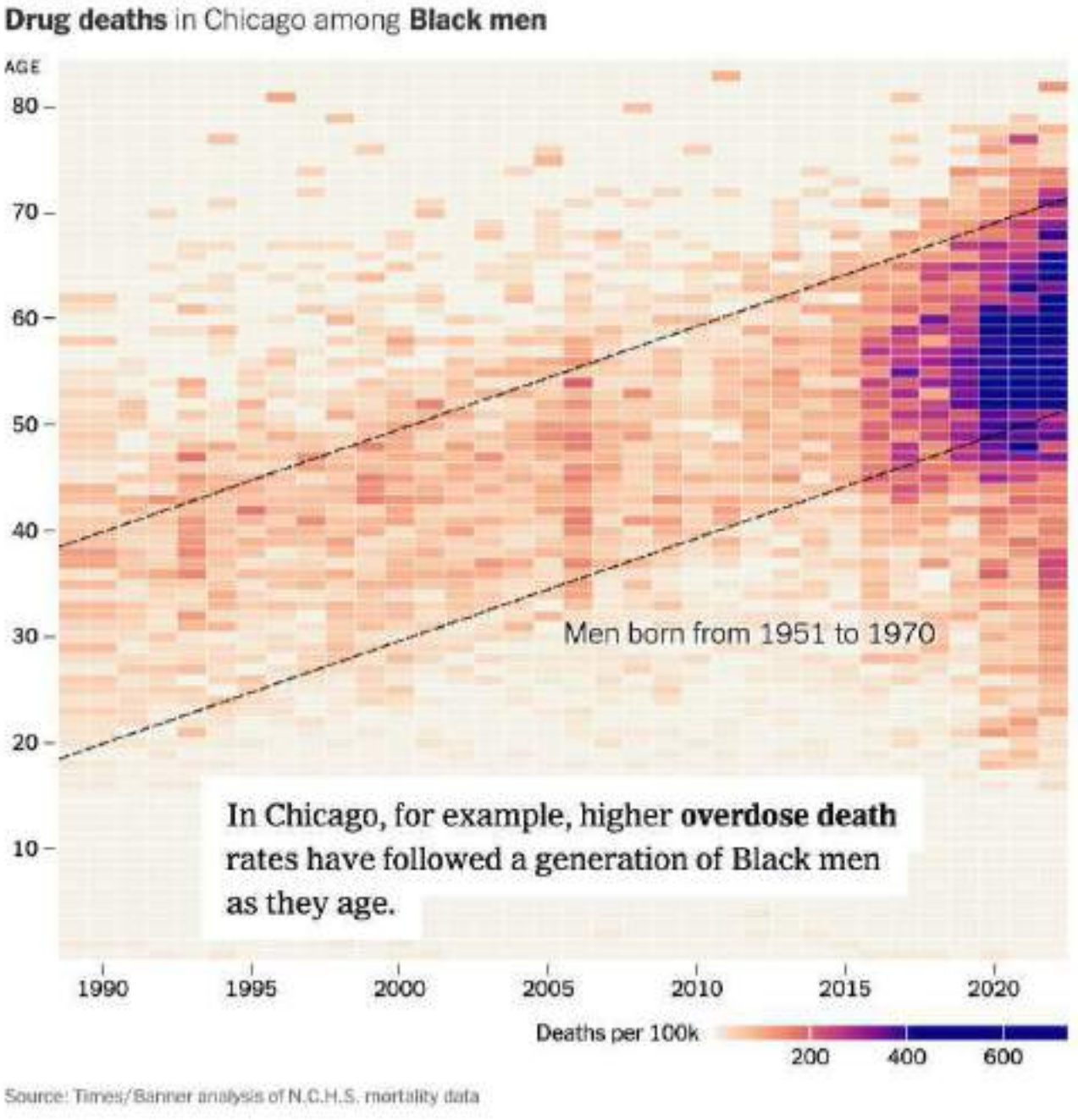
Can drug supply or geography explain declines?



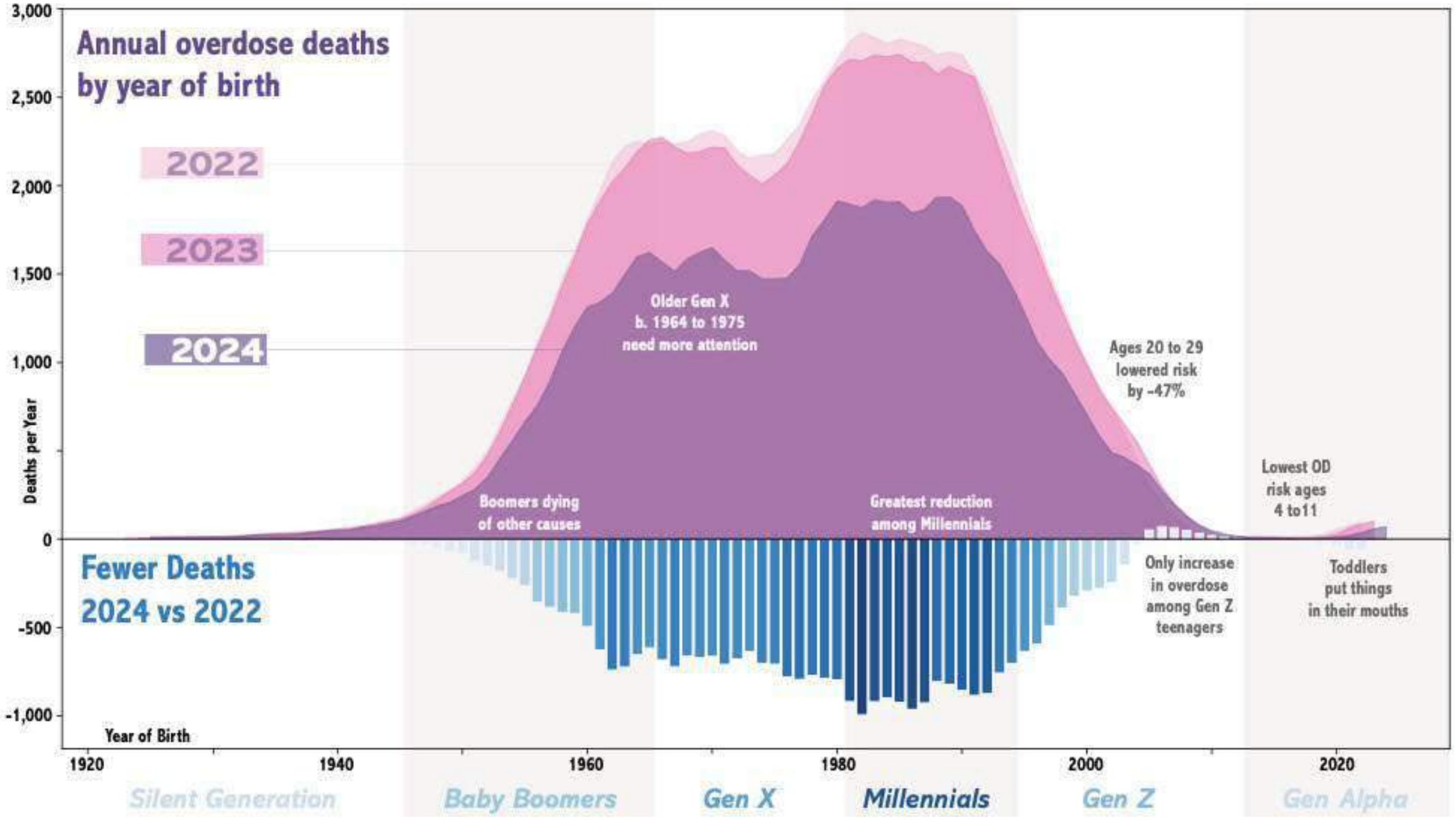
2020 2025

Generational Effects

Generational Impacts



Source: NY Times.
Josh Katz, Margot Sanger-Katz, Nick Thieme
Published Dec. 20, 2024



Source: CDC WONDER, processed and analyzed by UNC Opioid Data Lab

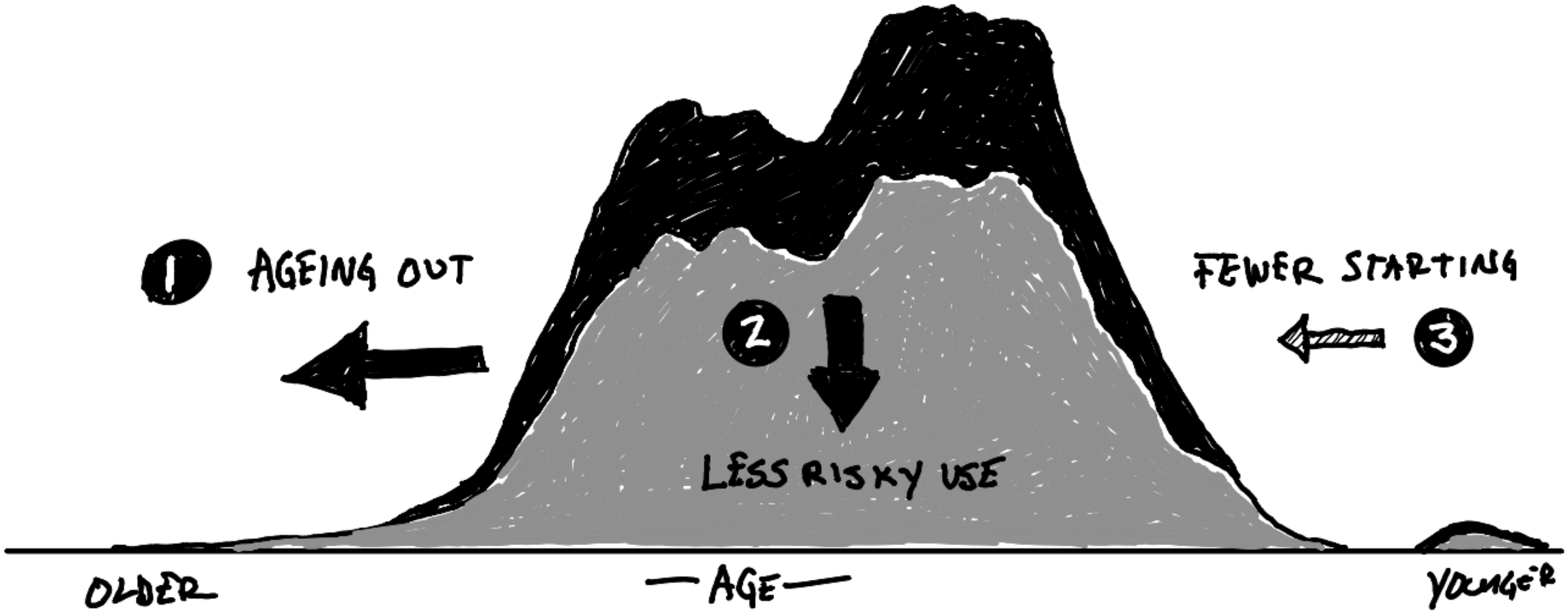

1
AGEING OUT
2
LESS RISKY USE
FEWER STARTING
3
OLDER
AGE
YOUNGER

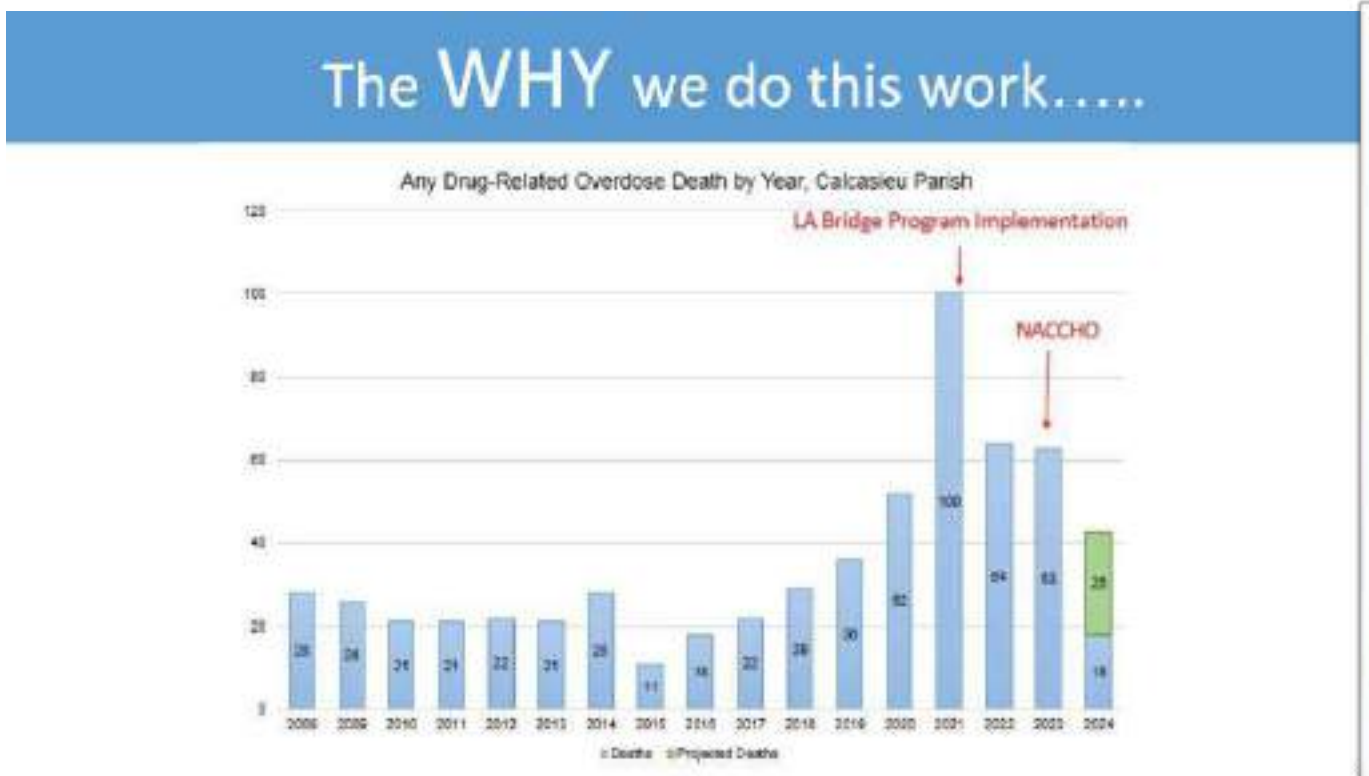
TABLE 1— Estimates of Counts and Percentages of Children Aged Younger Than 18 Years in 2019 Who Had Lost Various Relatives to Overdose Deaths During Their Lifetimes, Overall and by Age Group: United States

	Estimated No. of Children, Thousands (% of Population in Age Group)
Total US population aged < 18 y	77 295.0
Total who experienced kin loss to overdose death	1 421.8 (1.8)
Total who lost ≥ 1 of following to overdose death[a]	
Parents	317.2 (0.4)
Siblings	14.7 (< 0.1)
Grandparents	476.8 (0.6)
Aunts and uncles	536.0 (0.7)
Cousins	89.2 (0.1)

Source: Verdery et al. *Am J of Public Health 2024*

Invisible Work

Lake Charles, Louisianna: Buprenorphine dispensing in hospital emergency department



St. Louis, Missouri: Naloxone distro

UMSL | Addiction Science Team
University of Missouri–St. Louis

KEY TAKEAWAYS

Overdose deaths across Missouri
decreased by 23%
in the first six months of 2024
compared to the first six months of 2023.

- **Each Missouri region experienced a decrease** in the number of overdose deaths in 2024, with the St. Louis Metro Region showing the highest decrease (-32%).
- Fewer individuals died in the first six months of 2024 **across all drug types.**
  - The proportion of deaths involving an opioid decreased by almost 10%. The likelihood fentanyl was involved among these opioid-involved deaths also slightly decreased.
- The total number of **overdose deaths for Black Missourians decreased by 37%** statewide.
  - Most significantly, deaths among **Black residents in the St. Louis Metro Region decreased by almost half (46%).**

- For information on how to get naloxone visit: getmissourinaloxone.com
- To find linkage to SUD treatment visit: https://www.nomodeaths.org/get-treatment
- To see previous reports visit: https://www.mimhaddisci.org/missouri-overdose-data-2

Public health is working. Keep going!

1. **Use settlement funds wisely**
   This money was intended to support your mission.
2. **Be critical - not all interventions are created equal**
   Keep going with interventions that are proven to work.
3. **Ask who is being left behind**
   Improvements are not uniform.
4. **Get local information**
   Employ people with the most recent drug use experience.
5. **Address other drug-related harms**
   Skin wounds, hepatitis, endocarditis, etc. stem from unregulated drug supply.
6. **Properly resource medical examiners**
   The key to faster and higher quality data.

“Love is a research value.” – Louise Vincent

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Hand drawn by BRITTAIN PECK

Natalie
Shay
Jalice
Adams
Bridgette
Tushar
William
David
Paula
Dmitri
Allison
Shelby
Mirian
Meredith
Leslie
Ginger

Brandie

Illyana

LaMonda

Nabarun

Colin

Erin

Anuja
Erin N.
Elijah
Bryn
Zoë

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Trends, Analysis & Threats Webinar Series

UPCOMING CALLS

Wednesday, September 3 from 2PM-3PM
Wednesday, November 5 from 2PM-3PM
Wednesday, January 7 from 2PM-3PM

Feedback Requested

THANK YOU!