CFSRE's NPS Discovery – A No-Cost Resource for Tracking and Confirming the Presence of Novel Psychoactive Substances in Forensic Samples from Medicolegal Death Investigations

The National Association of Medical Examiners (NAME) 2023 Annual Meeting – October 15, 2023

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DISCLOSURES

- I have no conflicts of interest to disclose.
- I am a scientist and employee of FRFF / CFSRE, a 501(c)(3) non-profit research and educational facility.
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  - The opinions, findings, conclusions and/or recommendations expressed in this publication are those of the author(s) and do not necessarily represent the official position or policies of the U.S. Department of Justice.

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BACKGROUND

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WHAT ARE “NPS”?

- **Novel (or new) psychoactive substances (NPS) is a catch-all term that captures most drugs outside traditional and therapeutic categories, also referred to as “designer drugs”**
  - Newly synthesized or discovered
  - New to the drug supply
  - Used in a new way or manner
  - Altered toxicological effect profile
- **Five major subclasses of NPS**
  - Benzodiazepines
  - Opioids
  - Stimulants
  - Hallucinogens
  - Cannabinoids

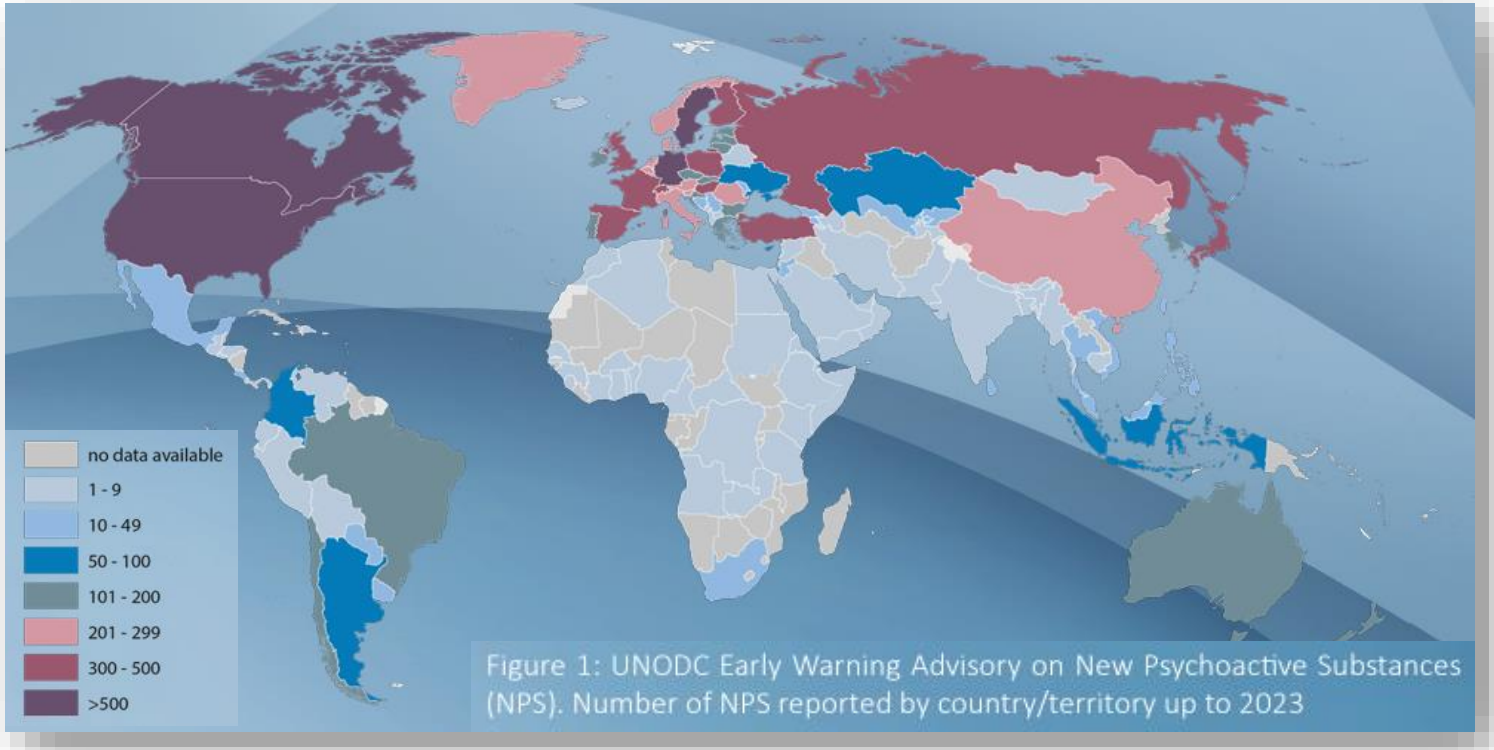


Figure 1: UNODC Early Warning Advisory on New Psychoactive Substances (NPS). Number of NPS reported by country/territory up to 2023

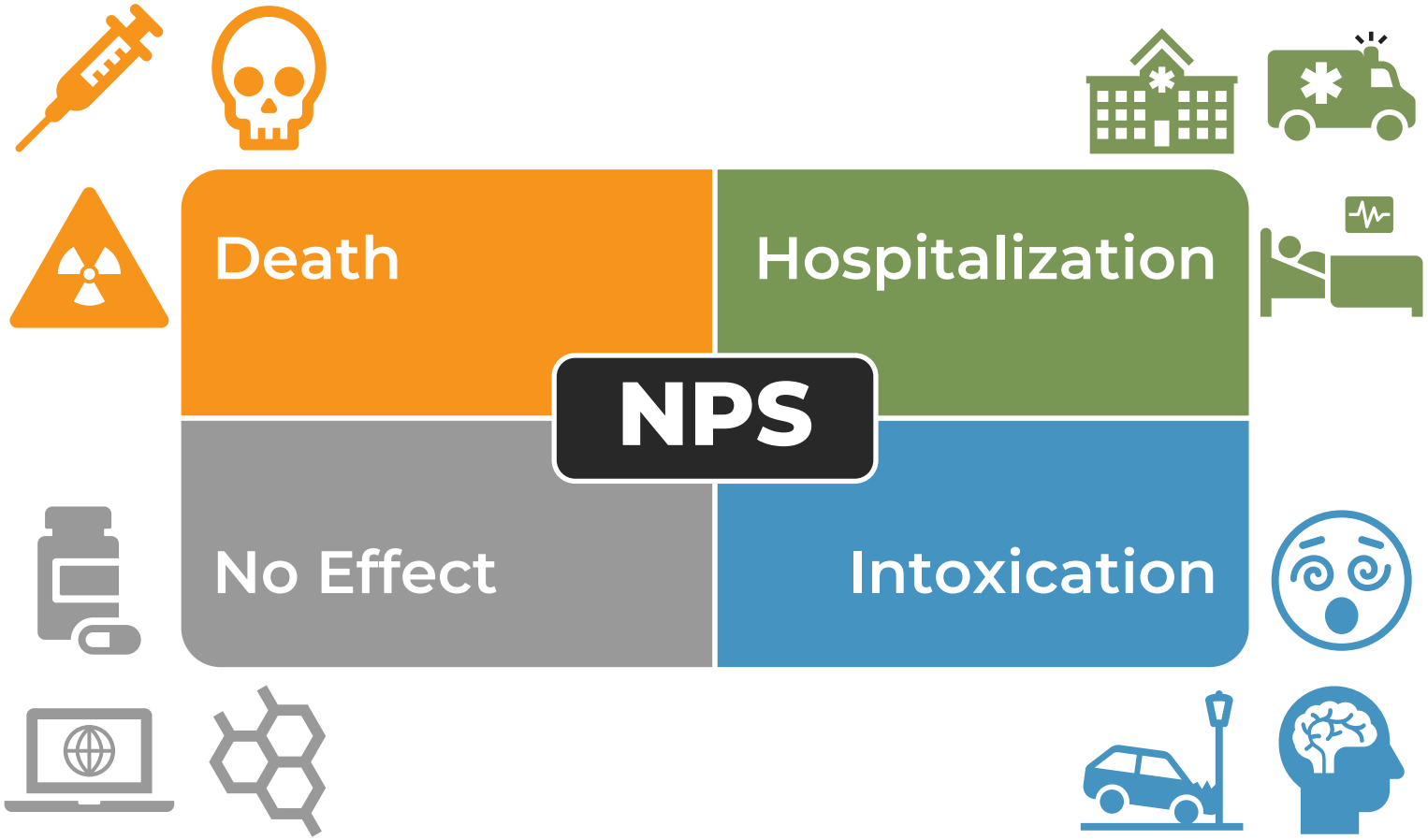
WHY ARE NPS POPULAR?

- **Consumers**
  - New highs / more desirable effects
  - Easier to source than tradition drugs
  - Legal status (or avoid illegal status)
  - Beat traditional drug tests

- **“Manufacturers” / Processers**
  - Cheaper alternatives
  - Desirable combined drug effects
  - Legal status (or avoid illegal status)

- **NPS are often unknown to consumer / processors**

WHERE DO NPS APPEAR?



DRUG EARLY WARNING SYSTEM

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DRUG EARLY WARNING SYSTEM (EWS)

- Drug early warning systems are a multidisciplinary network with aims to exchange information, identify emerging drugs and changes in drug markets, and assess risks
  - Have become an integral part of public health efforts
  - Primary goal – **reduce harms**
  - Several EWS exist internationally

- **In 2018, the CFSRE launched NPS Discovery**
  - Open-access drug early warning system
  - Combine aspects of surveillance, casework, and research
  - Analyze samples and generate data in-house
  - Develop a panel of high impact reports
  - Disseminate results and reports widely to stakeholders

COMPONENTS OF OUR DRUG EARLY WARNING SYSTEM

- **Access to sample populations & data sources**
  - Toxicology samples – forensic and clinical
  - Drug materials – various distribution points
  - Surveys and drug use information
  - Online sources – drug fora, gray market sites, etc.
- **Framework that defines drugs of interest**
  - NPS vs. traditional drugs vs. adulterants, etc.
- **Uniform reporting format and structure**
- **Research initiatives / research programs**

- **Dissemination avenues**
  - Scientific community
  - Public health and public safety
  - Drug consuming populations and general public
- **Scientific and health expertise**
  - Pharmacology
  - Toxicology
  - Medical treatment
- **Collaborations, cooperation, information sharing, and plan for action**
  - Drug control and scheduling actions

FORENSIC LABORATORY

- The Center for Forensic Science Research and Education (CFSRE)
  - 501(c)(3) non-profit research and educational facility
  - *Surveillance vs. Casework*

Waters Xevo® G2-S LC-QTOF-MS

Sciex X500R LC-QTOF-MS

Sciex TripleTOF® 5600+ LC-QTOF-MS

Agilent 6495 LC-QQQ-MS

Agilent 6430 LC-QQQ-MS

Waters TQS LC-QQQ-MS

Waters TQD LC-QQQ-MS

Agilent 5975 GC-MS

Agilent 5975 GC-MS

DATA AND TRENDS

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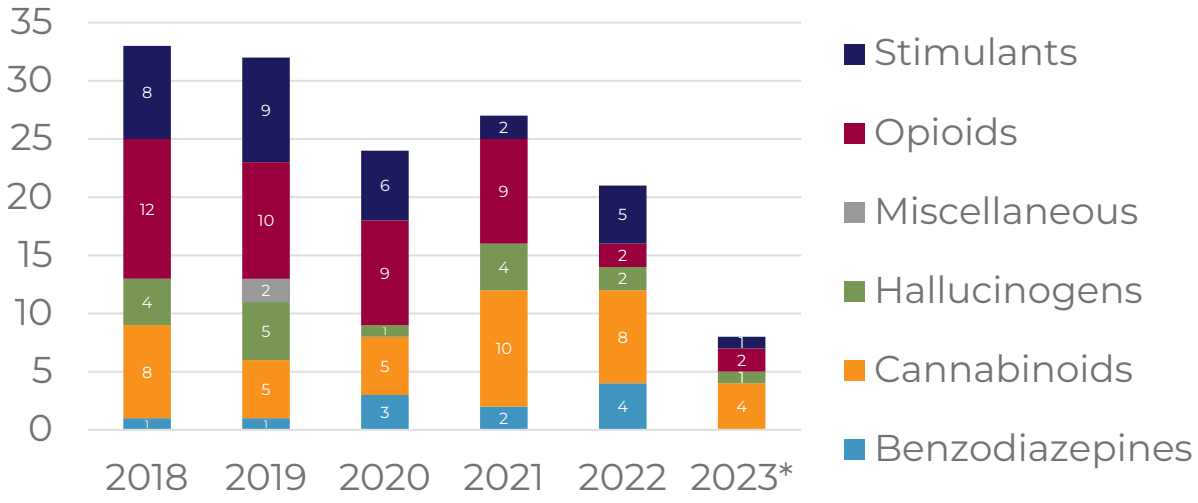
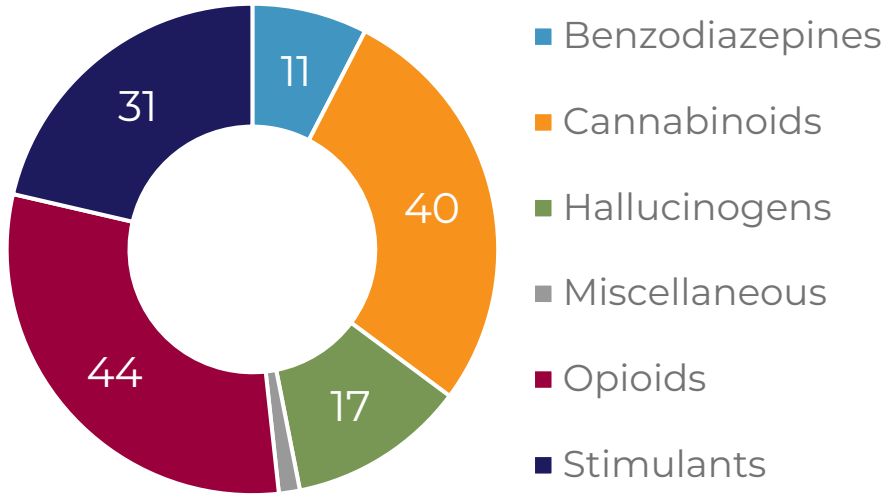
EMERGENCE OF NPS IN THE U.S.

- Since 2018, NPS Discovery has reported **145** newly discovered NPS (and counting)
- **NPS opioids** remain the largest subclass of newly emerging drugs encountered
- As of June 2023, NPS Discovery has reported **8** NPS for the first time this year





LANDSCAPE OF NPS IN THE U.S.

- Since 2018, NPS Discovery has identified **more than 225** NPS in forensic samples
- **NPS opioids**, **stimulants**, and **cannabinoids** represent the largest subclasses observed

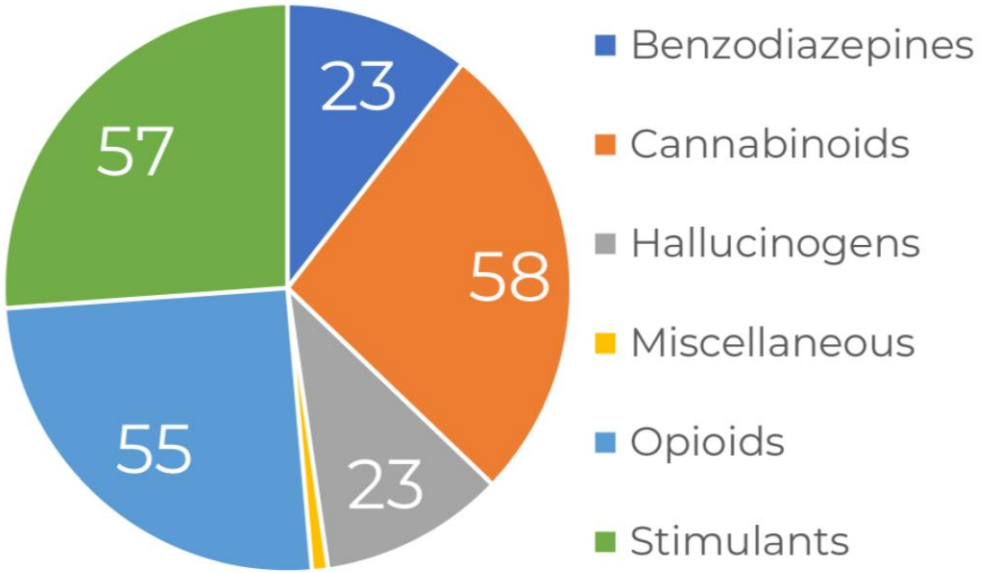


Figure 3: Breakdown by subclass of individual NPS detected, 2018-2022.

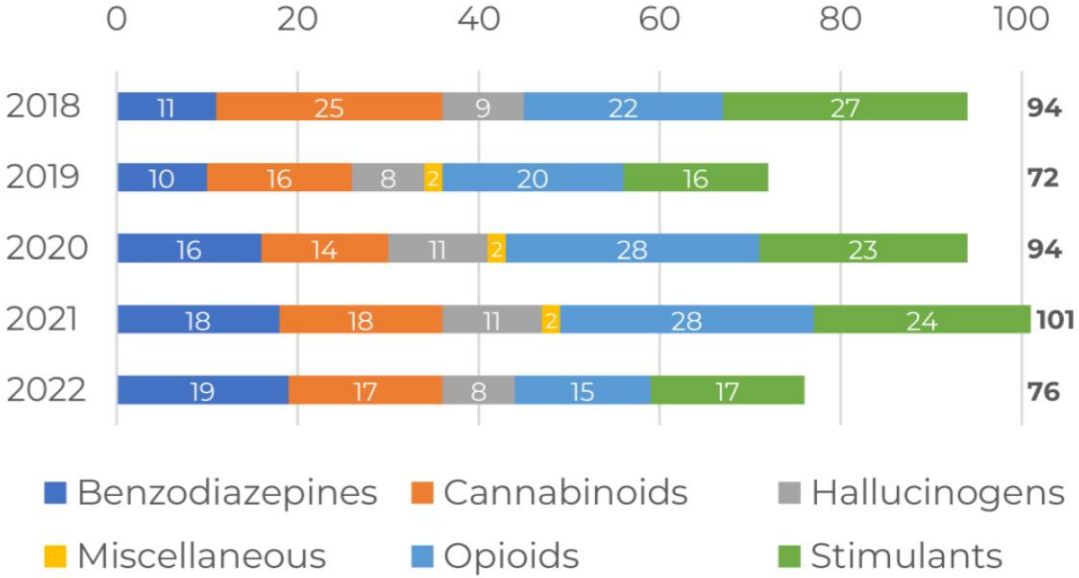


Figure 4: Individual NPS detected each year, cumulative since 2018.

PROLIFERATION OF NPS IN THE U.S.

- In 2022, NPS Discovery observed more than **2,200** total NPS detections
- A portion of more than **10,000** total NPS detections since 2018

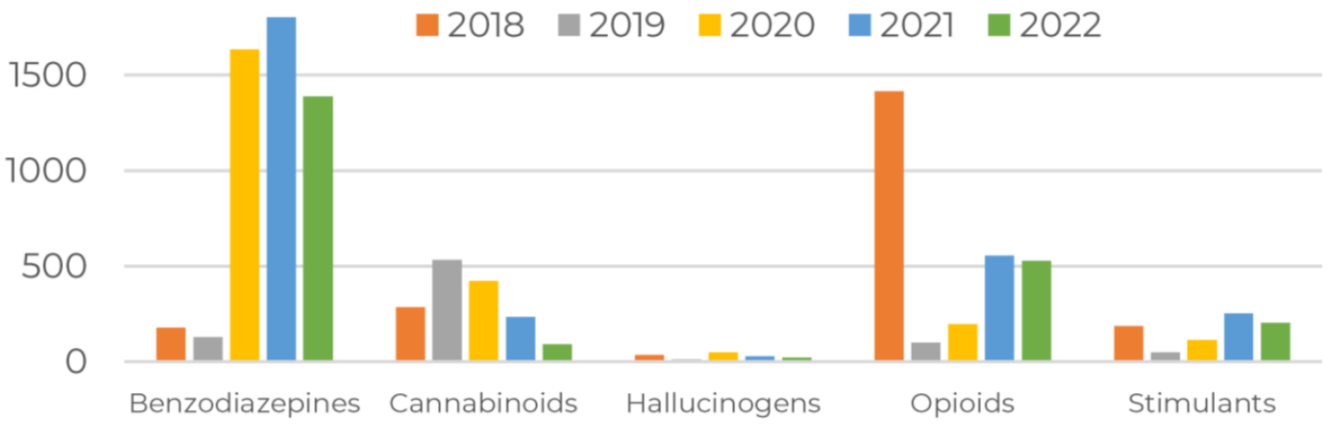


Figure 5: Total number of NPS detections among all samples analyzed since 2018.

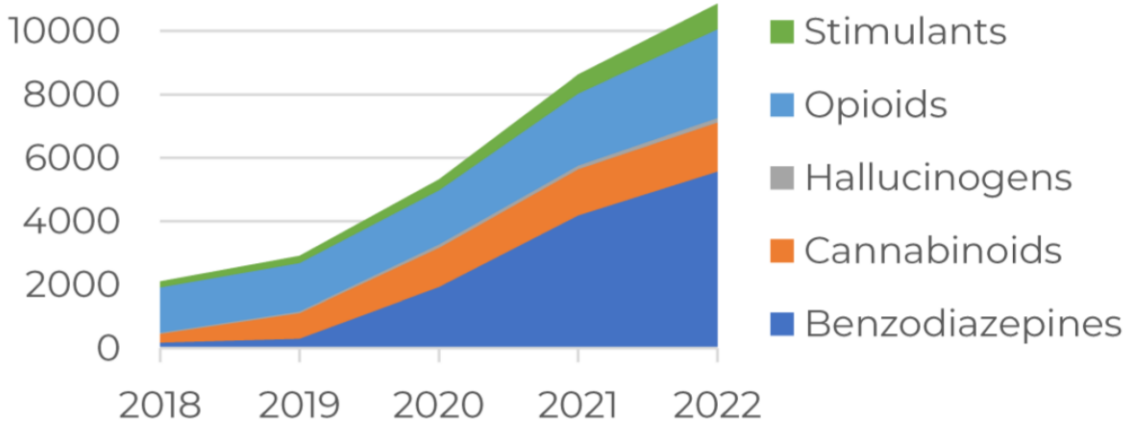


Figure 6: Cumulative number of NPS detections since 2018.

MOST POPULAR NPS TODAY

BENZODIAZEPINES

- **Bromazolam**
- Desalkylgidazepam
- Flubromazepam
- [Etizolam & Flualprazolam]

STIMULANTS & HALLUCINOGENS

- ***N,N*-Dimethylpentylone**
- Alpha-PHP / Alpha-PiHP
- Eutylone
- Fluorexetamine (2F- and 3F- analogues)

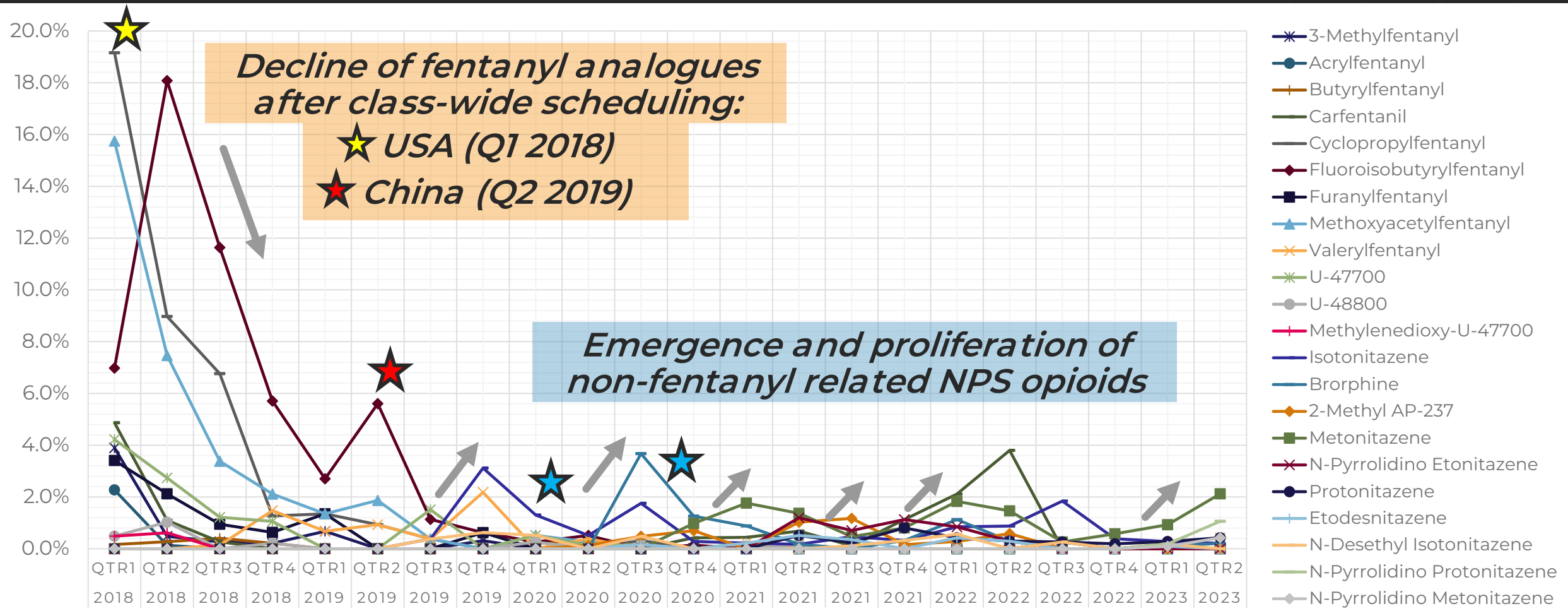
OPIOIDS

- [*para*-Fluorofentanyl]
- Metonitazene
- ***N*-Pyrrolidino Protonitazene**
- *Other Nitazene Analogues*

CANNABINOIDS

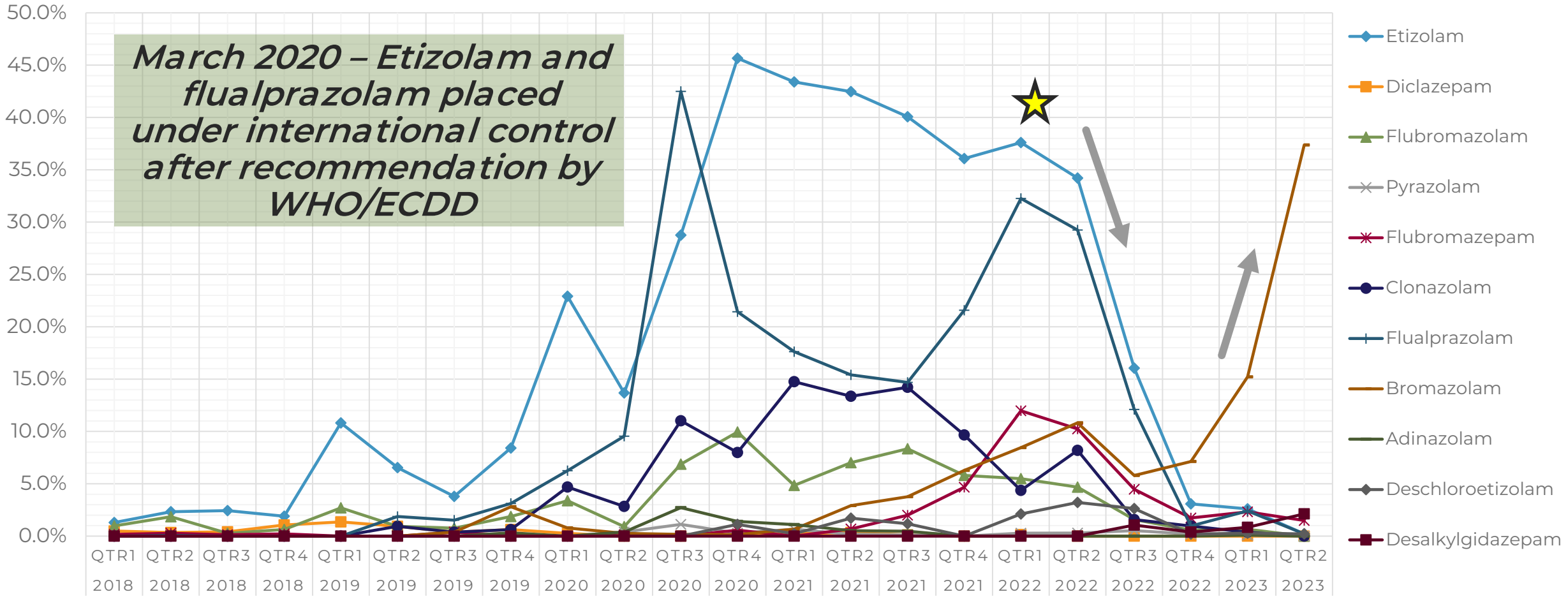
- **MDMB-4en-PINACA**
- ADB-BINACA / ADB-BUTINACA
- [*Others vary greatly by time / location*]
- [*Excludes semi-synthetic cannabinoids*]

EFFECTS OF DRUG SCHEDULING (NATIONAL)



Note: Fluorofentanyl Excluded

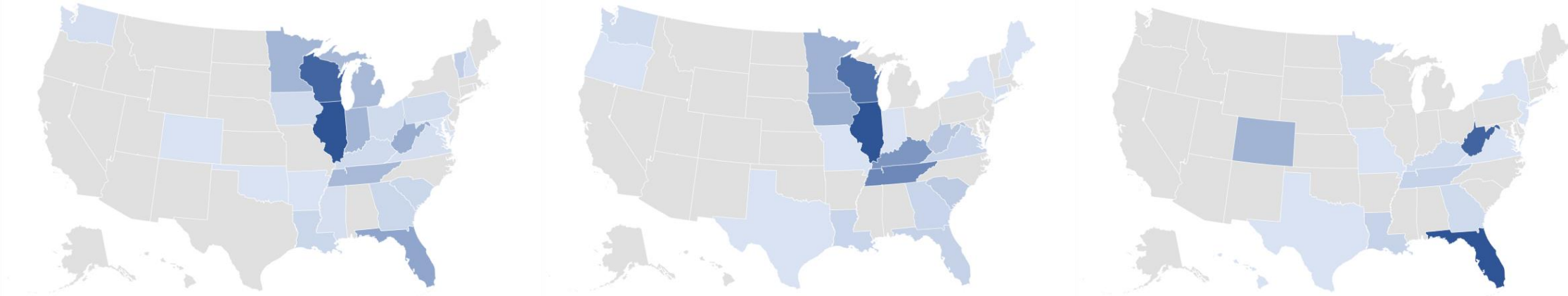
EFFECTS OF DRUG SCHEDULING (INTERNATIONAL)



NOTABLE NPS DRUG COMBINATIONS

- **Fentanyl & Bromazolam** (>75%)

- **Nitazene Analogues & NPS Benzodiazepines**
  - Isotonitazene (89%, L), Metonitazene (94%, C), N-Pyrrolidino Etonitazene (89%, R), etc.
  - Variety of NPS benzodiazepines
  - Geographical distribution:



CASE EXAMPLES

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CASE #1

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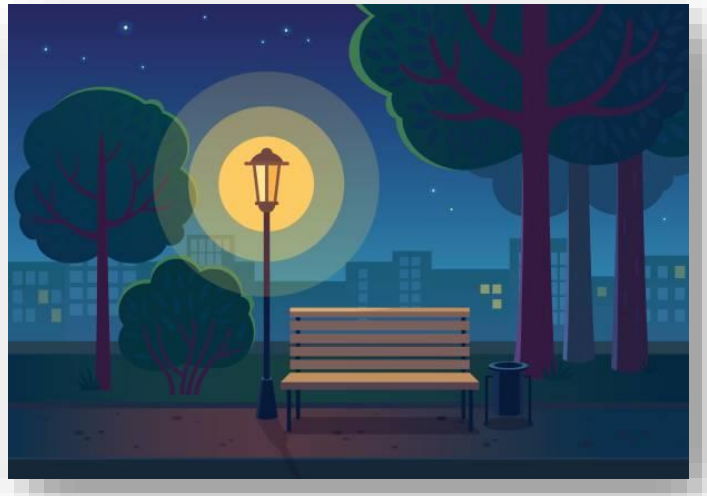
- Three individuals buy and use “cocaine”
- Become unresponsive and transported to hospital
  - One requires advanced life support – dies three days later



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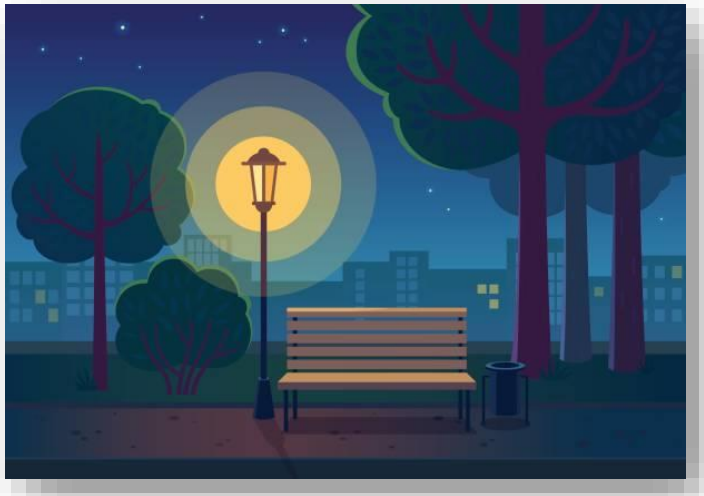
  - Forensic lab (urine): cocaine, methamphetamine, naloxone, fentanyl



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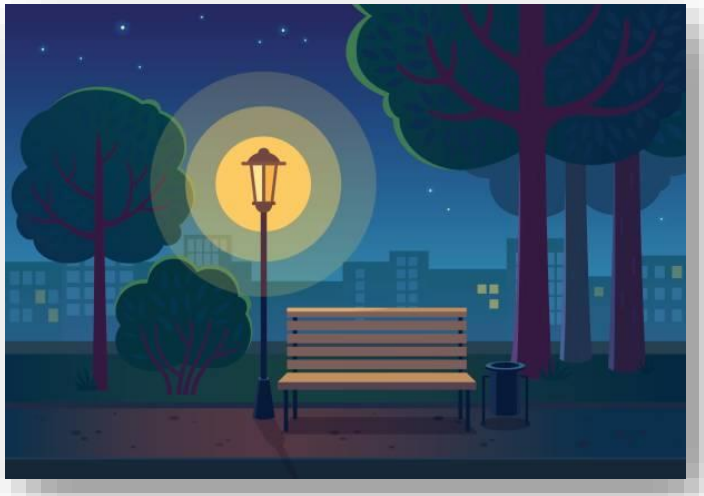
- **Further investigation required:**
  - Three powders submitted
  - Hospital blood and urine transferred



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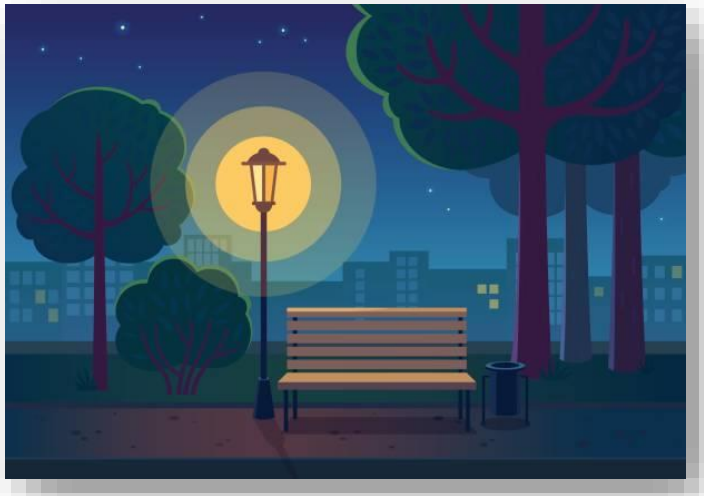
- **Etodesnitazene – blood (72 ng/mL)**



CASE #1

- **Case History:**
  - Three individuals ingested misrepresented “cocaine”
  - Two non-fatal overdoses, one fatal overdose
- **Drug Material Testing:**
  - Powder #3 → Etodesnitazene
- **Toxicology Testing:**
  - Blood & Urine → Etodesnitazene
- **Death Certification:**
  - Manner of Death – Accident
  - Cause of Death – Acute Etodesnitazene Intoxication

CASE #2

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CASE #2

- In-custody death – found unresponsive in cell
  - Location known for drug use
- Decedent found slumped forward on toilet
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- **Toxicology testing:**
  - Forensic lab: caffeine, naloxone and carbamazepine
- **Further investigation required:**
  - Blood transferred
- **Synthetic cannabinoid:**
  - MDMB-4en-PINACA and metabolite

NO-COST FORENSIC RESOURCE

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NO-COST FORENSIC TESTING

- CFSRE's NPS Discovery is funded by the **National Institute of Justice (NIJ) / Department of Justice (DOJ)** to assist medical examiner, coroners, toxicology labs, and other forensic agencies
  - Goal: Identify, confirm, and quantify (if necessary) the presence of emerging drugs in samples of interest
  - Scope: Toxicology samples (blood, urine, etc.) and drug materials (pills, powders, etc.)
  - ***Generally, not the first toxicology lab testing sample(s)

- **When to send samples to NPS Discovery:**
  - Signs point to opioid death but toxicology testing is negative
  - Drugs / paraphernalia found on scene, toxicology negative, NPS suggested
  - Naloxone administered but no opioids or drugs of interest detected


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TOXICOLOGY TESTING FOR EMERGING DRUGS & NOVEL PSYCHOACTIVE SUBSTANCES (NPS)

The **Center for Forensic Science Research and Education (CFSRE)** operates an open access drug early warning system called **NPS Discovery**. Through this initiative, with funding and support from the **Fredric Rieders Family Foundation** and the **National Institute of Justice**, the CFSRE is able to offer **no-cost** comprehensive forensic toxicology testing for emerging drugs and novel psychoactive substances (NPS), including qualitative and quantitative reporting.

BENEFITS OF TOXICOLOGY TESTING AT THE CFSRE:

- Perform routine testing for all NPS subclasses, including opioids, benzodiazepines, stimulants, hallucinogens, and cannabinoids.
- Assist medical examiners and coroners with determining cause of death when prior toxicology testing is negative or inconclusive.
- Analysis by state-of-the-art instrumentation and methodologies.
- Regularly updated, comprehensive in-house library database containing more than 1,000 drugs.
- Sample handling and analysis performed under chain of custody.
- Forensic quality data and individual reports generated per case.
- World-leading forensic toxicologists, chemists, and scientists.
- Laboratory follows forensic toxicology industry best practices.

TESTING CATALOG

- NPS Opioids — Fentanyl Analogues, Nitazene Analogues, U-Series, AP-Series, Other Novel Opioids
- NPS Benzodiazepines — Etizolam, Flualprazolam, Flubromazepam, Clonazolam, Bromazolam, Flubromazolam
- NPS Stimulants — Empathogens, Cathinones, Amphetamines, Phanethylamines, Pyrrolidines
- NPS Hallucinogens — Psychedelics, Dissociatives, PCP Analogues, Ketamine Analogues, LSD Analogues
- Synthetic Cannabinoids — Classical, Indoles, Indazoles, Miscellaneous, Newly Emergent, & Many More!

2016	2017	2018	2019	2020	2021	2022
U-47700 & Fluorofentanyl	N-Ethyl Pentylone	Cyclopropylfentanyl & Methoxyacetylfentanyl	Isotonitazene	MDMB-4en-PINACA	Metonitazene & Nitazene Analogues	ALM-Dimethylpentylone
Deadly outbreak investigation involving 20+ cases centralized in Midwestern states.	Investigation of deaths and impaired driving cases involving new stimulant drug linked to Ecstasy and Molly use.	Postmortem investigations involving new fentanyl analogues linked to 40+ deaths in Midwestern states and Florida.	First outbreak investigation in the U.S. involving 20+ deaths, primarily from Indiana and Illinois.	Investigation of 50+ cases involving deaths and hospitalizations from states in the South, Midwest, and Northeast.	Continued monitoring and investigations of 40+ deaths involving new nitazene analogues emerging in various regions across the U.S.	First outbreak investigations involving a new stimulant drug linked to 50+ cases, including deaths, primarily originating from Florida and Northeastern states.

CONTACT INFORMATION*

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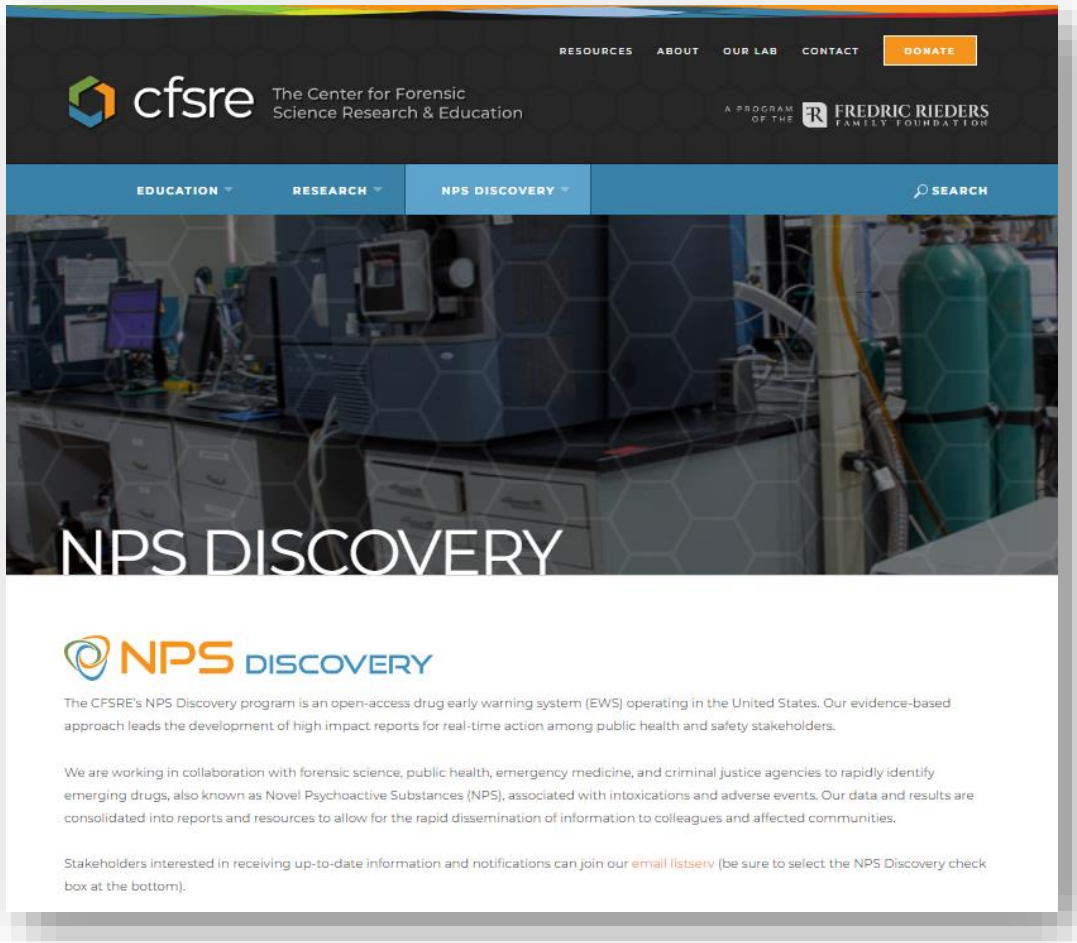
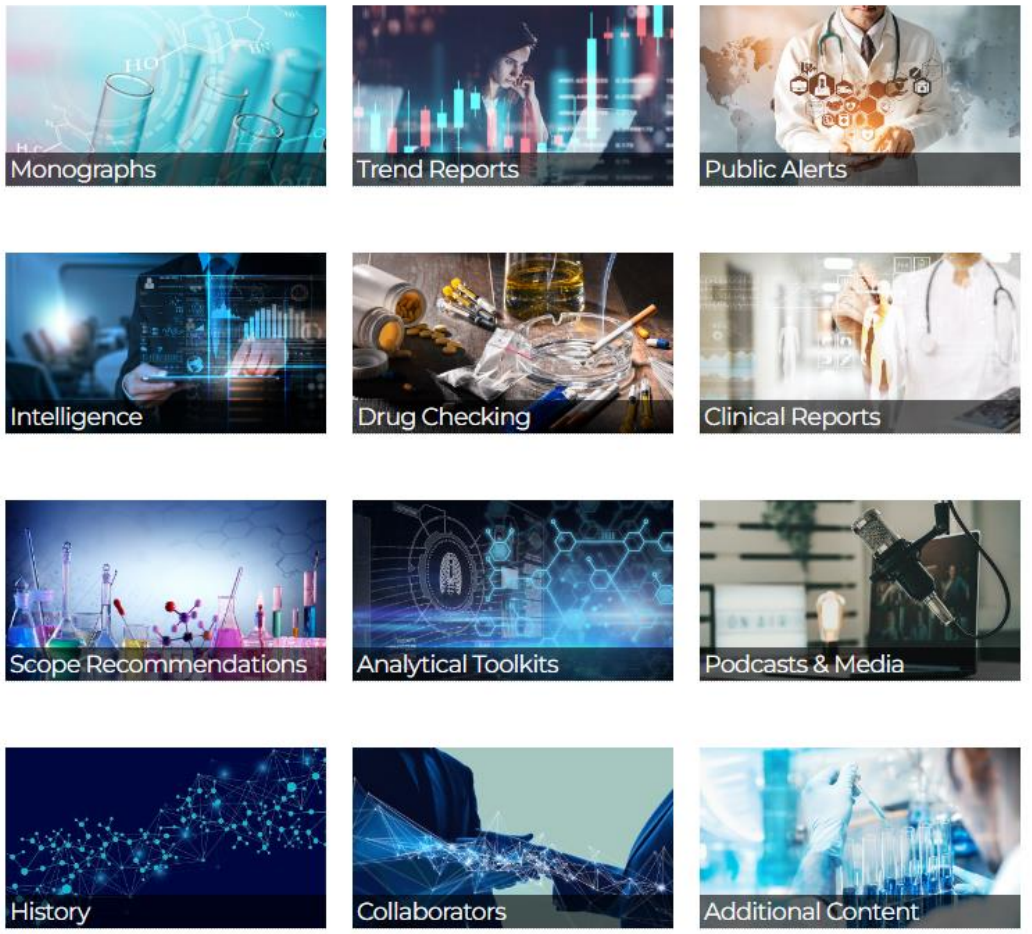
SHIPPING DETAILS

CFSRE / NPS Discovery (Second Floor)
2300 Stratford Avenue
Willow Grove, Pennsylvania 19090

*Correspondence required for approval prior to sample submission.

WEBSITE ▸ WWW.NPSDISCOVERY.ORG





CONCLUSIONS

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CONCLUSIONS

- **NPS continue to appear** in fatal overdose scenarios and in forensic samples and toxicology specimens
  - NPS as the cause of death / culprit for overdose
  - Polydrug cases with NPS alongside other drugs
  - NPS may be “along for the ride” (alternative MOD and/or COD)
- Extent of NPS impacts remains **unknown** and **under-reported**
- **Misrepresentation** and **adulteration** continue for NPS in North America, especially NPS opioids
  - Nitazene analogues sold as “dope”, “heroin”, or “fentanyl”
  - NPS added to fentanyl (e.g., increase potency of product)

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- **CFSRE Team**
  - Barry Logan
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  - Sara Walton
  - Josh DeBord
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  - Donna Papsun
- **Funding Agencies**
  - NIJ, CDC, NIH, etc.
- **Collaborators & Partners**
  - Forensic
  - Clinical
  - Medical Examiners
  - Coroners
  - Crime Labs
  - Etc.

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THANK YOU! QUESTIONS?

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