



Updated Trend Reports and Positivity Plots

NPS Discovery Webinar Series – Thursday January 11, 2024

Alex J. Krotulski, Ph.D. – Center for Forensic Science Research and Education (CFSRE)



FUNDING DISCLOSURE

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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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2023 YEAR IN REVIEW ▶

cfsre | **NPS DISCOVERY**

YEAR IN REVIEW 2023

Purpose: This report provides cumulative up-to-date statistics about the emergence and landscape of novel psychoactive substances (NPS) in the United States based on data developed by the Center for Forensic Science Research and Education (CFSRE)'s NPS Discovery program — a premier open-access drug early warning system utilizing an evidence-based approach to disseminate information for real-time public health and safety action.

Since 2018, NPS Discovery has reported **154** newly discovered NPS in the United States (Figure 1). **NPS opioids** remain the largest subclass (Figure 2). In 2023, NPS Discovery reported the discovery of **17** NPS for the first time.

Year	Stimulants	Opioids	Miscellaneous	Hallucinogens	Cannabinoids	Benzodiazepines
2018	1	1	1	1	1	1
2019	1	1	1	1	1	1
2020	1	1	1	1	1	1
2021	1	1	1	1	1	1
2022	1	1	1	1	1	1
2023	1	1	1	1	1	1

Subclass	Count
Stimulants	31
Opioids	46
Miscellaneous	13
Hallucinogens	17
Cannabinoids	44
Benzodiazepines	17

Figure 1: Newly discovered NPS reported for the first time since 2018. Figure 2: Breakdown by subclass of newly discovered NPS, 2018-2023.

Since 2018, NPS Discovery has identified **240** NPS in forensic samples (Figure 3). **NPS opioids, stimulants, and cannabinoids** represent the largest subclasses observed. In 2023, **79** total NPS were detected (Figure 4).

Subclass	Count
Stimulants	60
Opioids	60
Miscellaneous	25
Hallucinogens	26
Cannabinoids	66
Benzodiazepines	25

Year	Stimulants	Opioids	Miscellaneous	Hallucinogens	Cannabinoids	Benzodiazepines
2018	1	1	1	1	1	1
2019	1	1	1	1	1	1
2020	1	1	1	1	1	1
2021	1	1	1	1	1	1
2022	1	1	1	1	1	1
2023	1	1	1	1	1	1

Figure 3: Breakdown by subclass of individual NPS detected, 2018-2023. Figure 4: Individual NPS detected each year, cumulative since 2018.

In 2023, NPS Discovery observed more than **3,600** total NPS detections within examined sample populations (Figure 5), a portion of nearly **15,000** total NPS detections since our program launched in 2018 (Figure 6).

Year	Stimulants	Opioids	Miscellaneous	Hallucinogens	Cannabinoids	Benzodiazepines
2018	1	1	1	1	1	1
2019	1	1	1	1	1	1
2020	1	1	1	1	1	1
2021	1	1	1	1	1	1
2022	1	1	1	1	1	1
2023	1	1	1	1	1	1

Year	Total Detections
2018	1
2019	2
2020	3
2021	4
2022	5
2023	6

Figure 5: Total number of NPS detections by year among samples analyzed since 2018. Figure 6: Cumulative number of total NPS detections since 2018.

ACKNOWLEDGMENTS: This report was prepared at the Center for Forensic Science Research and Education (CFSRE) at the University of North Carolina at Charlotte. The authors would like to thank the following individuals for their contributions to this report: [List of names]

DISCLAIMER: The information contained in this report is for informational purposes only and does not constitute an endorsement or recommendation of any product, service, or organization. The authors and the Center for Forensic Science Research and Education (CFSRE) are not responsible for any actions taken based on the information provided in this report.

EMERGENCE OF NPS IN THE U.S.

- Since 2018, NPS Discovery has reported **154** newly discovered NPS in the United States (Figure 1). **NPS opioids** remain the largest subclass (Figure 2).
- In 2023, NPS Discovery reported the discovery of **17** NPS for the first time.

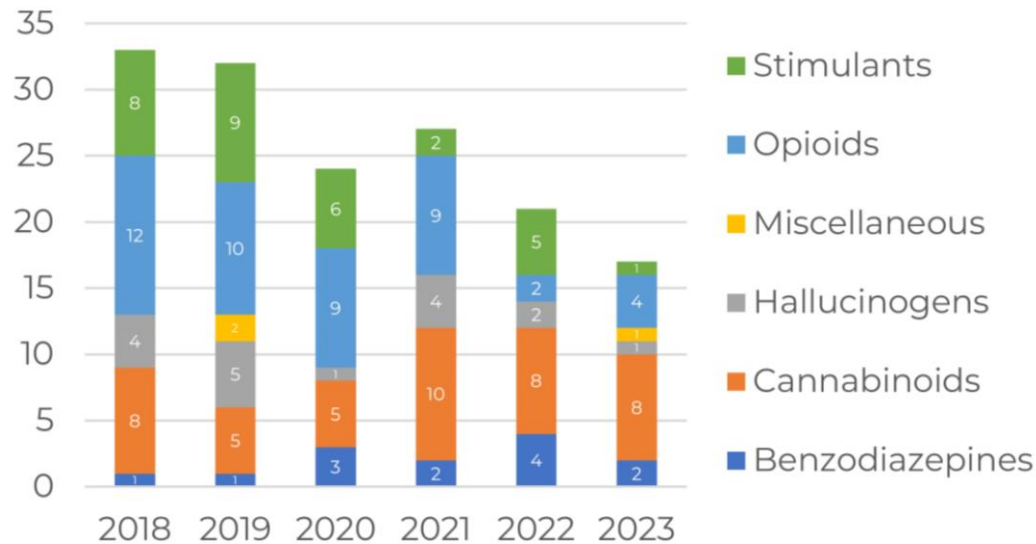


Figure 1: Newly discovered NPS reported for the first time since 2018.

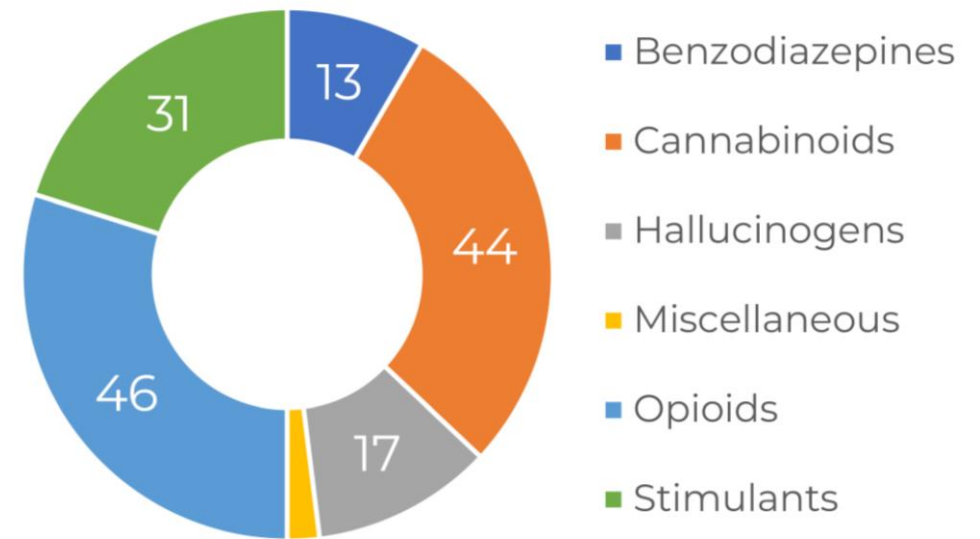


Figure 2: Breakdown by subclass of newly discovered NPS, 2018-2023.

LANDSCAPE OF NPS IN THE U.S.

- Since 2018, NPS Discovery has identified **240** NPS in forensic samples (Figure 3).
- **NPS opioids, stimulants, and cannabinoids** represent the largest subclasses.
- In 2023, **79** total NPS were detected (Figure 4).

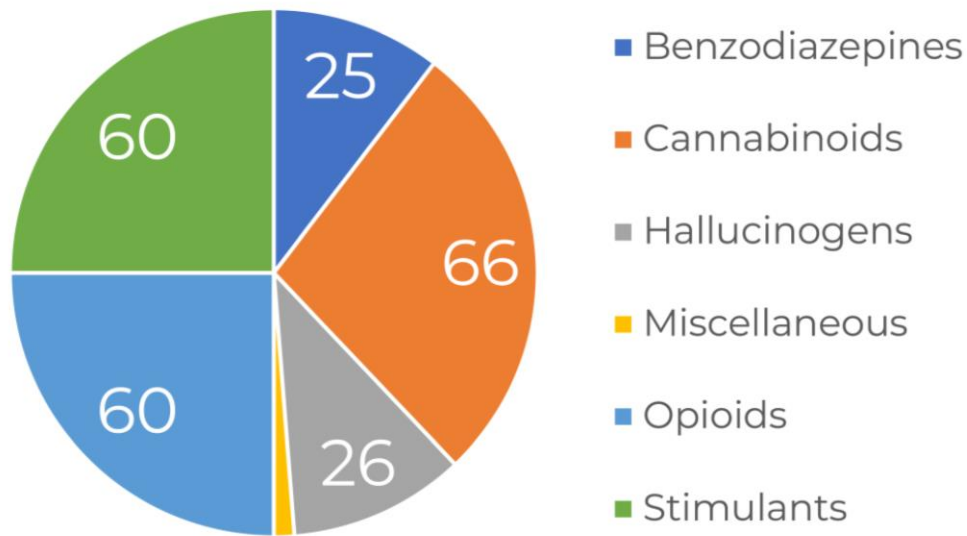


Figure 3: Breakdown by subclass of individual NPS detected, 2018-2023.

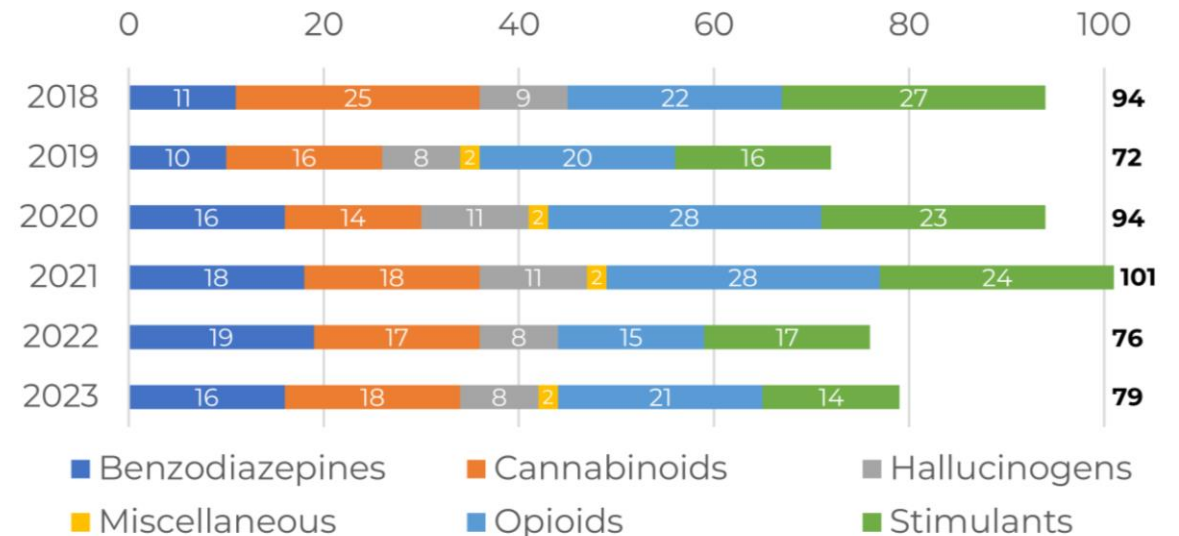


Figure 4: Individual NPS detected each year, cumulative since 2018.

MAGNITUDE OF NPS IN THE U.S.

- In 2023, NPS Discovery observed more than **3,600** total NPS detections within examined sample populations (Figure 5), a portion of nearly **15,000** total NPS detections since our program launched in 2018 (Figure 6).

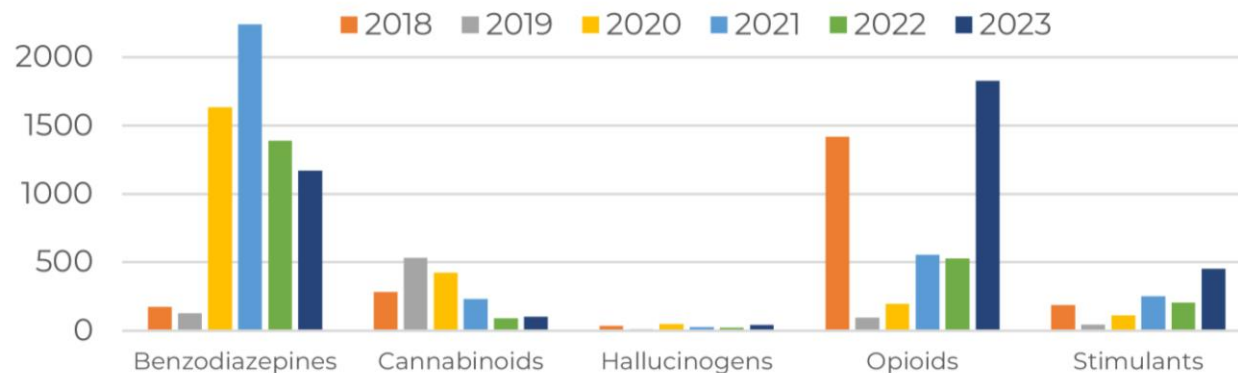


Figure 5: Total number of NPS detections by year among samples analyzed since 2018.

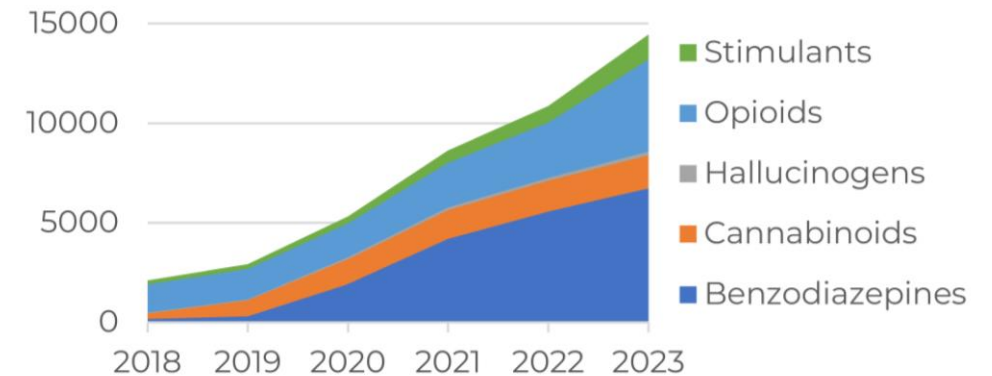


Figure 6: Cumulative number of total NPS detections since 2018.

Synthetic Cannabinoids in the United States

TREND REPORT Q4 2023

OBJECTIVE: This report provides up-to-date information regarding the status of NPS opioid prevalence and positivity in the United States.

OVERVIEW: Over the past quarter, NPS opioids have been included in an increasing number of emergency room admissions, death investigations, and mass toxicology events, and often appear in combination with other illicit substances (e.g., benzoyl fentanyl, heroin). Maintaining a current understanding of these substances is a challenging, ongoing process that requires continuous monitoring and laboratory testing.

OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/mass spectrometry (LC/MS/MS). The scope of analysis includes more than 1000 drugs, including a vast majority of NPS and their metabolites. This approach allows for the identification of novel opioids and further data analysis of reported trends. This report was conducted in collaboration with the toxicology and chemistry laboratories of NPS Labs, Federal case types listed in these results include: Risk, Drug Investigations, Medication Death Investigations, and/or along with the influence of drug OD/DI investigations. The results in this report represent the total number of NPS identifications at the CFSE during this quarter, including those from sample retesting, data mining, and/or retesting.

NPS IN Q4 2023:

- Opioids: 9%
- Stimulants & Hallucinogens: 13%
- Synthetic Cannabinoids: 58%

NPS Stimulants & Hallucinogens in the United States

TREND REPORT Q4 2023

OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/mass spectrometry (LC/MS/MS). The scope of analysis includes more than 1000 drugs, including a vast majority of NPS and their metabolites. This approach allows for the identification of novel stimulants and hallucinogens and further data analysis of reported trends. This report was conducted in collaboration with the toxicology and chemistry laboratories of NPS Labs, Federal case types listed in these results include: Risk, Drug Investigations, Medication Death Investigations, and/or along with the influence of drug OD/DI investigations. The results in this report represent the total number of NPS identifications at the CFSE during this quarter, including those from sample retesting, data mining, and/or retesting.

NPS IN Q4 2023:

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NPS Benzodiazepines in the United States

TREND REPORT Q4 2023

OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/mass spectrometry (LC/MS/MS). The scope of analysis includes more than 1000 drugs, including a vast majority of NPS and their metabolites. This approach allows for the identification of novel benzodiazepines and further data analysis of reported trends. This report was conducted in collaboration with the toxicology and chemistry laboratories of NPS Labs, Federal case types listed in these results include: Risk, Drug Investigations, Medication Death Investigations, and/or along with the influence of drug OD/DI investigations. The results in this report represent the total number of NPS identifications at the CFSE during this quarter, including those from sample retesting, data mining, and/or retesting.

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NPS Opioids in the United States

TREND REPORT Q4 2023

OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography/mass spectrometry (GC/MS) and liquid chromatography/mass spectrometry (LC/MS/MS). The scope of analysis includes more than 1000 drugs, including a vast majority of NPS and their metabolites. This approach allows for the identification of novel opioids and further data analysis of reported trends. This report was conducted in collaboration with the toxicology and chemistry laboratories of NPS Labs, Federal case types listed in these results include: Risk, Drug Investigations, Medication Death Investigations, and/or along with the influence of drug OD/DI investigations. The results in this report represent the total number of NPS identifications at the CFSE during this quarter, including those from sample retesting, data mining, and/or retesting.

NPS IN Q4 2023:

- Opioids: 9%
- Stimulants & Hallucinogens: 13%
- Synthetic Cannabinoids: 58%

NPS OPIOIDS IDENTIFIED

Substance	Toxicology	Drug Material
Desalkylfentanyl	1	1
N-Desethyl Etomidate	1	1
Bromofentanyl	1	1
Flubromab	2	2
N-Pyrrolidino Metonitazene	3	3
Desalkylgildaz	3	3
ortho-Methylfentanyl	4	4
N-Desethyl Isotonitazene	7	7
N-Pyrrolidino Protonitazene	9	9
Metonitazene	12	12
Protonitazene	14	14

SELECT POSITIVITY: Q1 2021 to Q4 2023

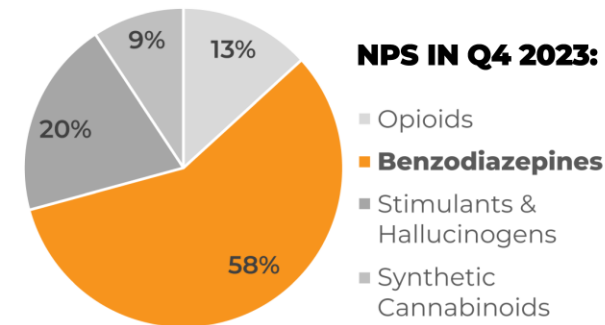


Q4 2023 NPS TREND REPORTS ▲

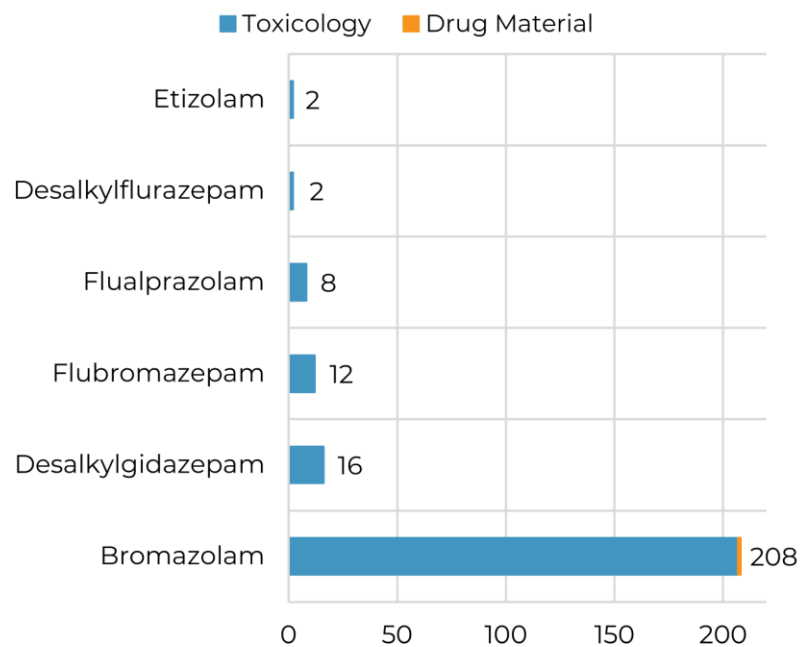
PURPOSE: This report provides up-to-date information regarding the status of NPS benzodiazepine prevalence and positivity in the United States.

OVERVIEW: Novel psychoactive substances (NPS), including NPS benzodiazepines, continue to pose great challenges for forensic scientists, clinicians, and public health and safety personnel. NPS benzodiazepines have been implicated in an increasing number of adverse health events, marked by emergency room admissions and death investigations, especially when ingested in combination with opioids. Maintaining a current scope of analysis can be challenging, requiring comprehensive analytical methodologies and reference materials for identification(s).

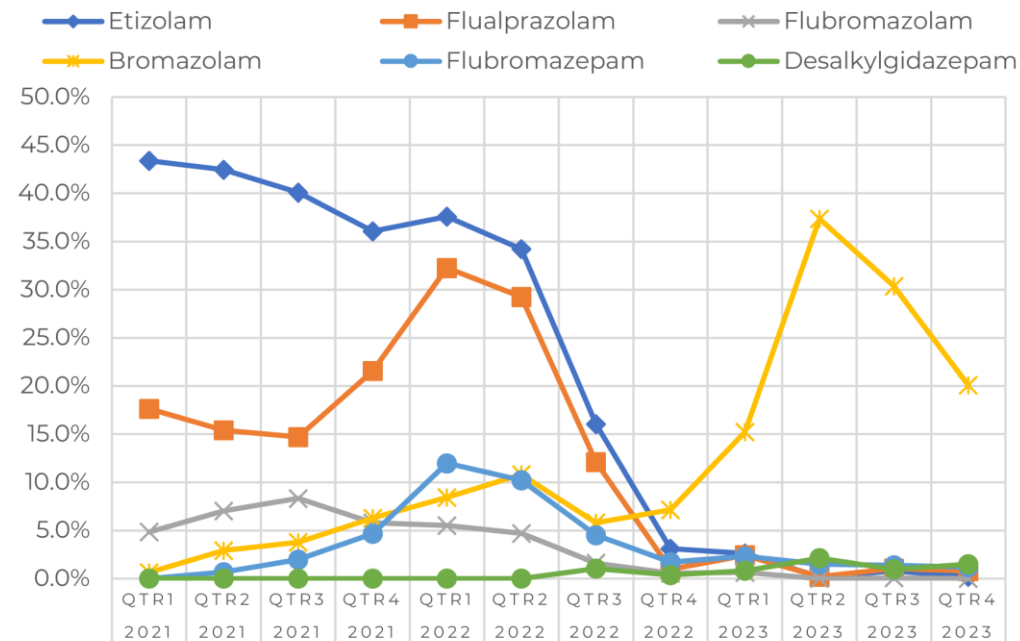
OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). The scope of analysis contains more than 1,100 drugs, including a vast majority of NPS and their metabolites. This approach allows for real-time identification of new benzodiazepines and further data analysis of important trends. This project was conducted in collaboration with the toxicology and criminalistics laboratories of NMS Labs. Forensic case types linked to these results include illicit drug investigations, medicolegal death investigations, and/or driving under the influence of drugs (DUID) investigations. The results in this report represent the total number of NPS identifications at the CFSRE during this quarter, including those from sample-mining, data-mining, and/or esoteric testing.



NPS BENZODIAZEPINES IDENTIFIED



SELECT POSITIVITY: Q1 2021 to Q4 2023



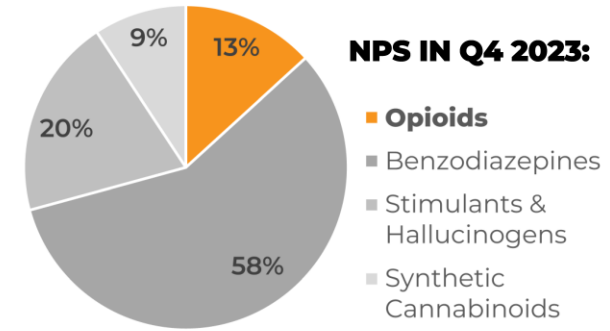
ACKNOWLEDGEMENTS: This report was prepared by Alex J. Krotulski, PhD; Sara E. Walton, MS; Amanda LA. Mohr, MSFS, D-ABFT-FT; and Barry K. Logan, PhD, F-ABFT at the Center for Forensic Science Research and Education (CFSRE) at the Fredric Rieders Family Foundation. CFSRE's NPS Discovery program acknowledges scientists at the CFSRE and NMS Labs for their involvements and contributions. For more information about our programs and reports, please contact NPS Discovery at npsdiscovery@cfsre.org or visit our website at www.npsdiscovery.org.

FUNDING: CFSRE's NPS Discovery is supported by the National Institute of Justice, Office of Justice Programs, U.S. Department of Justice (Award Number 15PNJ-22-GG-04434-MUMU, "Implementation of NPS Discovery - An Early Warning System for Novel Drug Intelligence, Surveillance, Monitoring, Response, and Forecasting using Drug Materials and Toxicology Populations in the US"). 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.

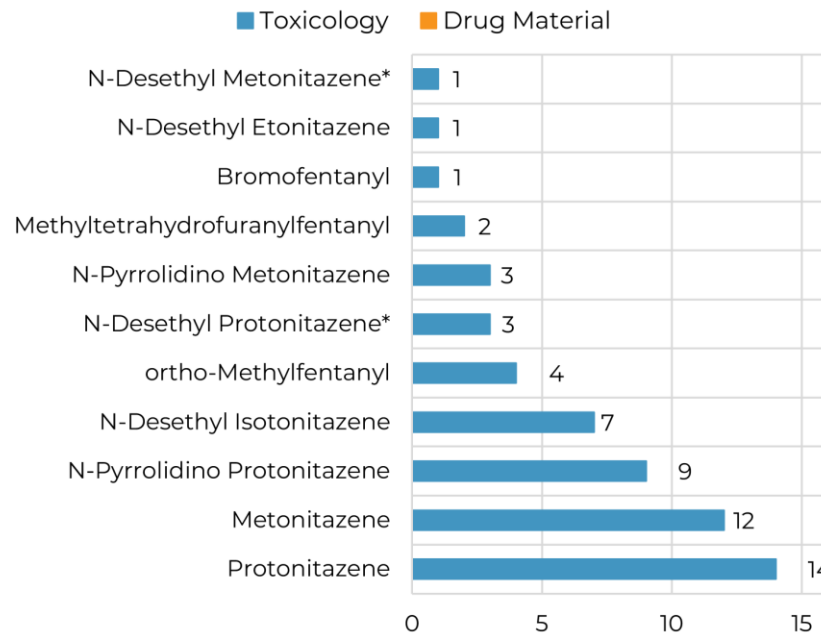
PURPOSE: This report provides up-to-date information regarding the status of NPS opioid prevalence and positivity in the United States.

OVERVIEW: Novel psychoactive substances (NPS), including NPS opioids, continue to pose great challenges for forensic scientists, clinicians, and public health and safety personnel. NPS opioids have been implicated in an increasing number of emergency room admissions, death investigations, and mass intoxication events, and often appear in combination with other illicit opioids (e.g. fentanyl, heroin). Maintaining a current scope of analysis can be challenging, requiring comprehensive analytical methodologies and reference materials for identification(s).

OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). The scope of analysis contains more than 1,100 drugs, including a vast majority of NPS and their metabolites. This approach allows for real-time identification of novel opioids and further data analysis of important trends. This project was conducted in collaboration with the toxicology and criminalistics laboratories of NMS Labs. Forensic case types linked to these results include illicit drug investigations, medicolegal death investigations, and/or driving under the influence of drugs (DUID) investigations. The results in this report represent the total number of NPS identifications at the CFSRE during this quarter, including those from sample-mining, data-mining, and/or esoteric testing.

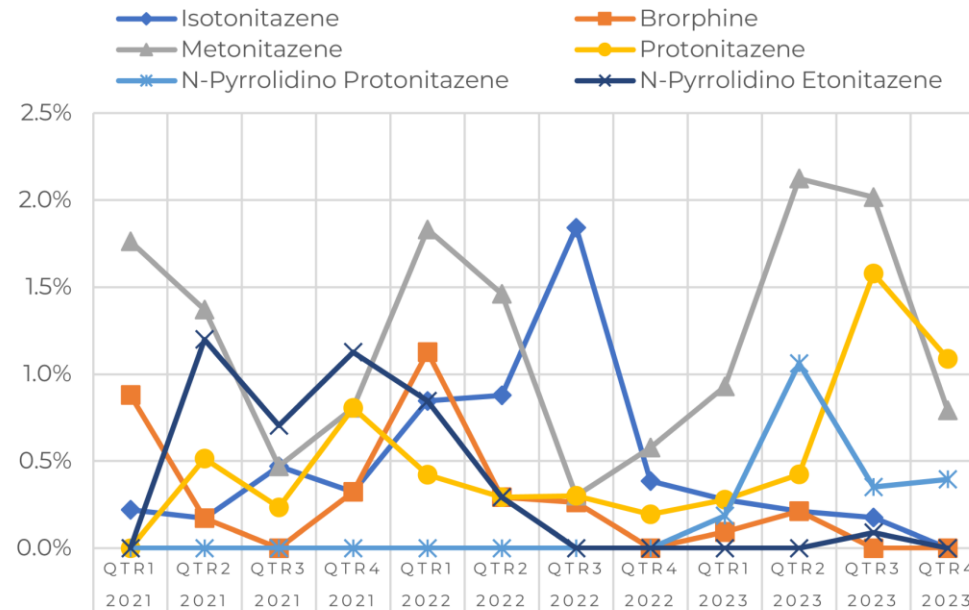


NPS OPIOIDS IDENTIFIED



*Detected only as metabolites to date. — For Reference: Fentanyl (n=596) & Fluorofentanyl (n=458)

SELECT POSITIVITY: Q1 2021 to Q4 2023



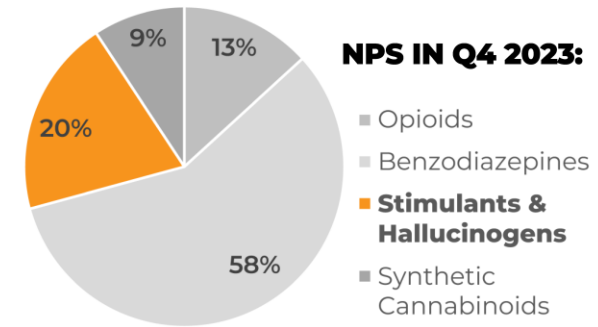
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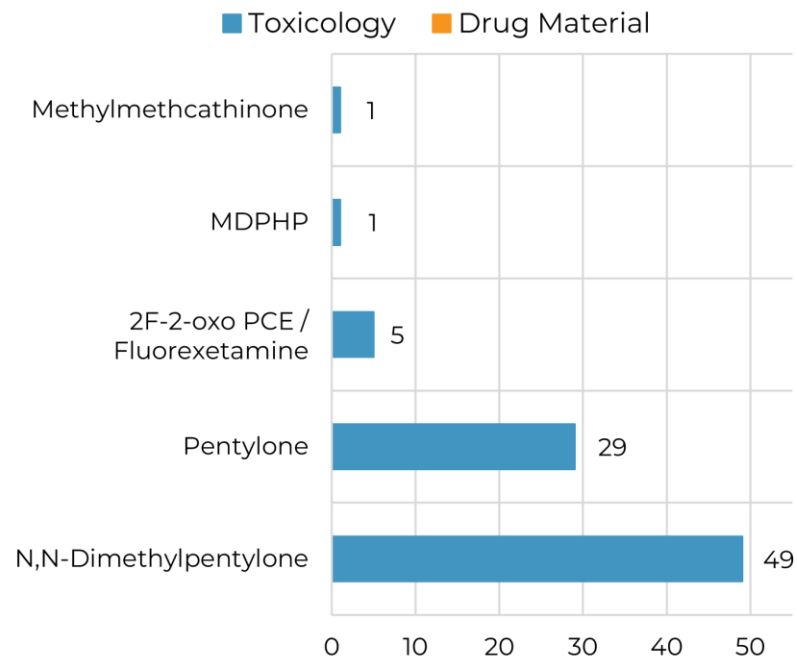
PURPOSE: This report provides up-to-date information regarding NPS stimulant & NPS hallucinogen prevalence and positivity in the United States.

OVERVIEW: Novel psychoactive substances (NPS), including NPS stimulants and NPS hallucinogens, continue to pose great challenges for forensic scientists, clinicians, and public health and safety personnel. Both NPS stimulants and NPS hallucinogens have been implicated in emergency room admissions, death investigations, and/or intoxication events associated with night clubs and music festivals. Maintaining a current scope of analysis can be challenging, requiring comprehensive analytical methodologies and reference materials for identification(s).

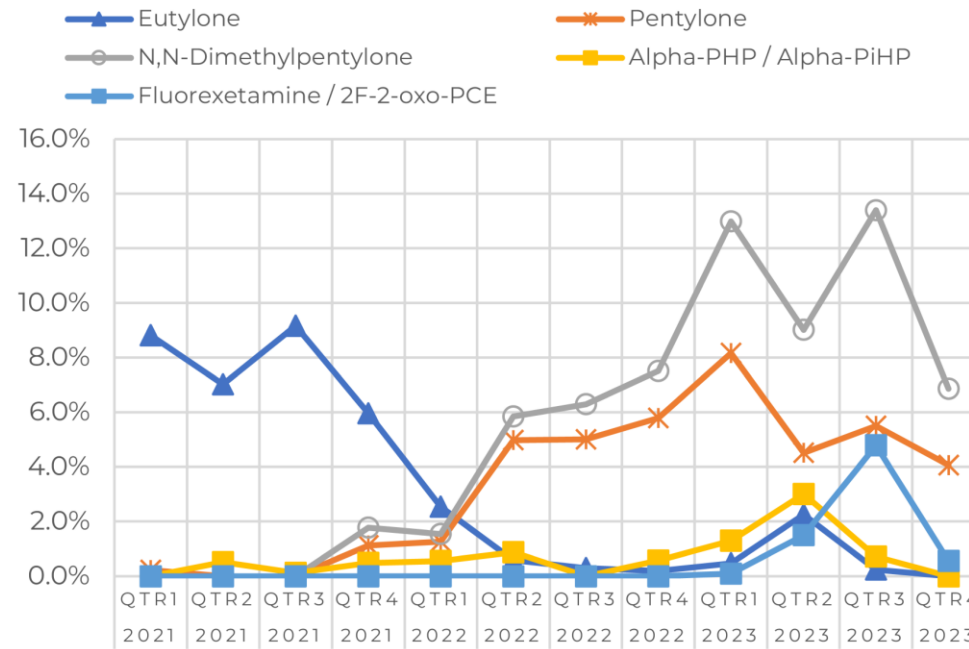
OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). The scope of analysis contains more than 1,100 drugs, including a vast majority of NPS and their metabolites. This approach allows for real-time identification of emerging stimulants and hallucinogens, and further data analysis of important trends. This project was conducted in collaboration with the toxicology and criminalistics laboratories of NMS Labs. Forensic case types linked to these results include illicit drug investigations, medicolegal death investigations, and/or driving under the influence of drugs (DUID) investigations. The results in this report represent the total number of NPS identifications at the CFSRE during this quarter, including those from sample-mining, data-mining, and/or esoteric testing.



NPS STIMULANTS & HALLUCINOGENS IDENTIFIED



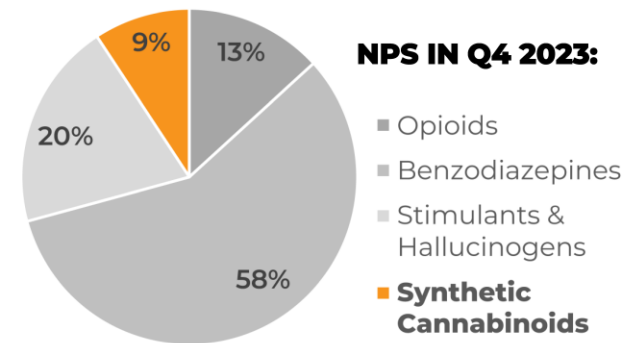
SELECT POSITIVITY: Q1 2021 to Q4 2023



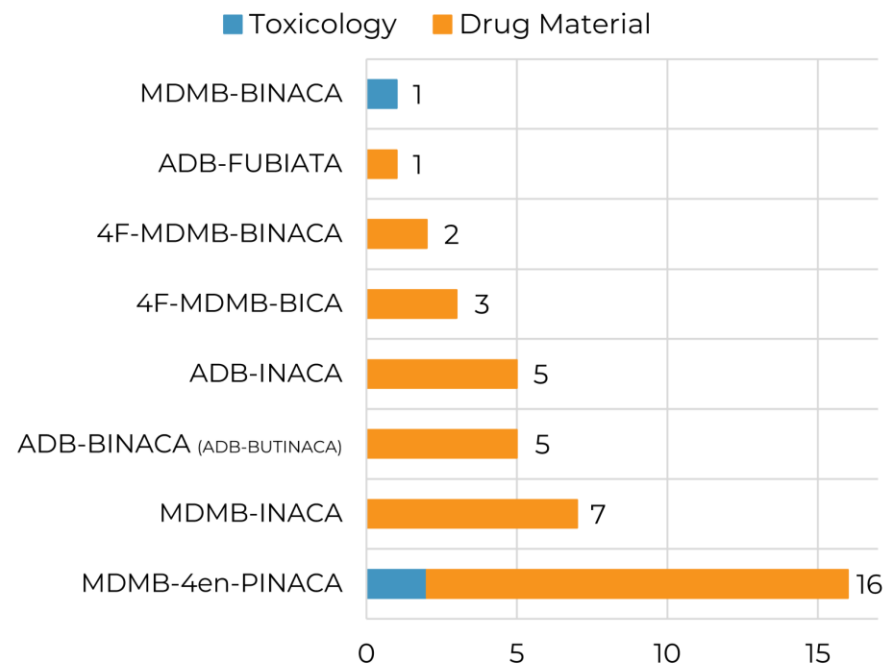
PURPOSE: This report provides up-to-date information regarding the status of synthetic cannabinoid prevalence and positivity in the United States.

OVERVIEW: Novel psychoactive substances (NPS), including synthetic cannabinoids, continue to pose great challenges for forensic scientists, clinicians, and public health and safety personnel. Synthetic cannabinoids have been implicated in an increasing number of emergency room admissions, death investigations, and intoxication events in corrections populations. Maintaining a current scope of analysis can be challenging, requiring comprehensive analytical methodologies and reference materials for identification(s).

OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). The scope of analysis contains more than 1,100 drugs, including a vast majority of NPS and their metabolites. This approach allows for real-time identification of novel synthetic cannabinoids and further data analysis of important trends. This project was conducted in collaboration with the toxicology and criminalistics laboratories of NMS Labs. Forensic case types linked to these results include illicit drug investigations, medicolegal death investigations, and/or driving under the influence of drugs (DUID) investigations. The results in this report represent the total number of NPS identifications at the CFSRE during this quarter, including those from sample-mining, data-mining, and/or esoteric testing.

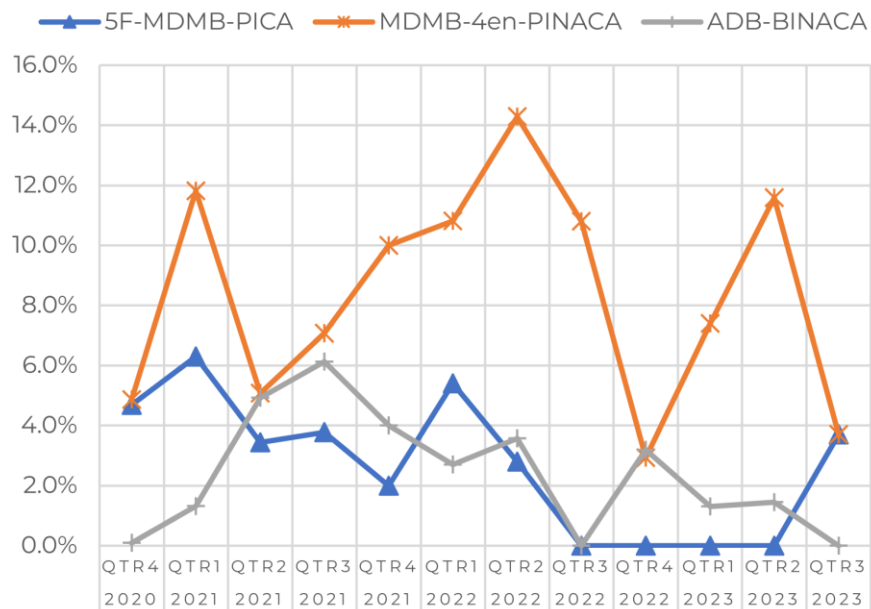


SYNTHETIC CANNABINOIDS IDENTIFIED



SELECT POSITIVITY: Q4 2020 to Q3 2023

Positivity plot does not include Q4 2023 due to low volume and positivity in toxicology samples.

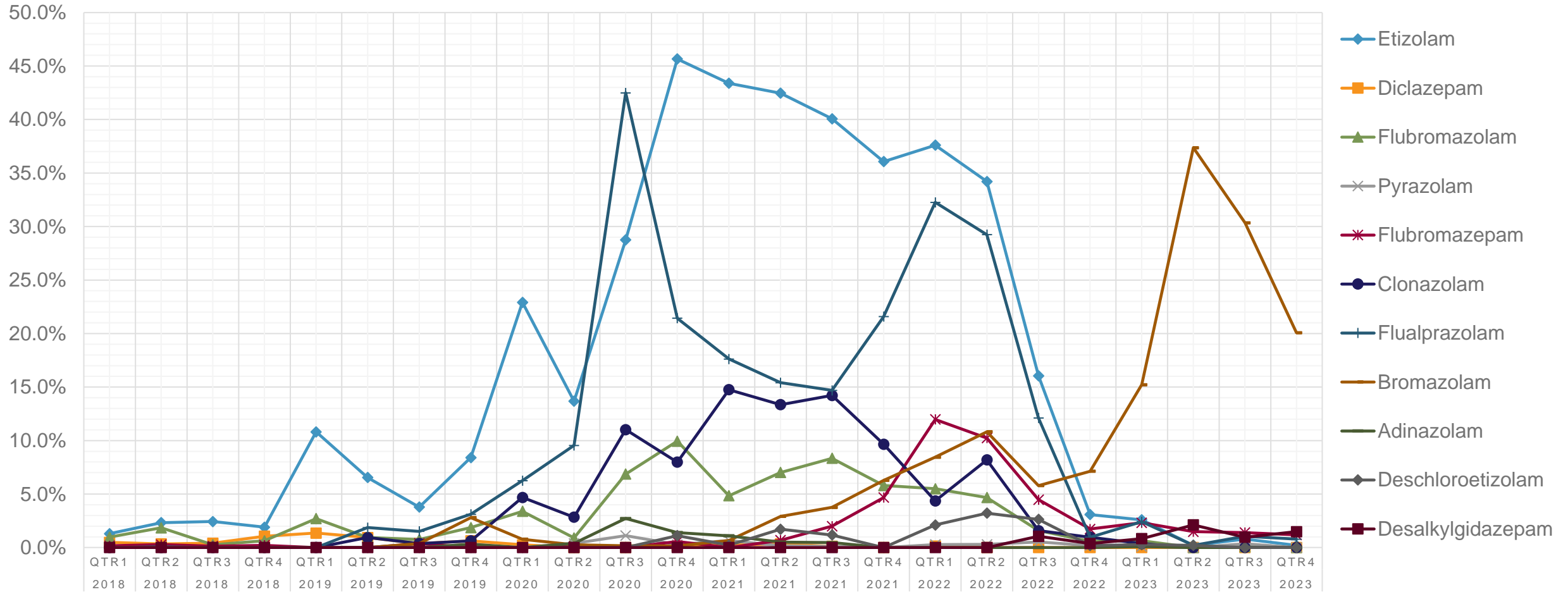




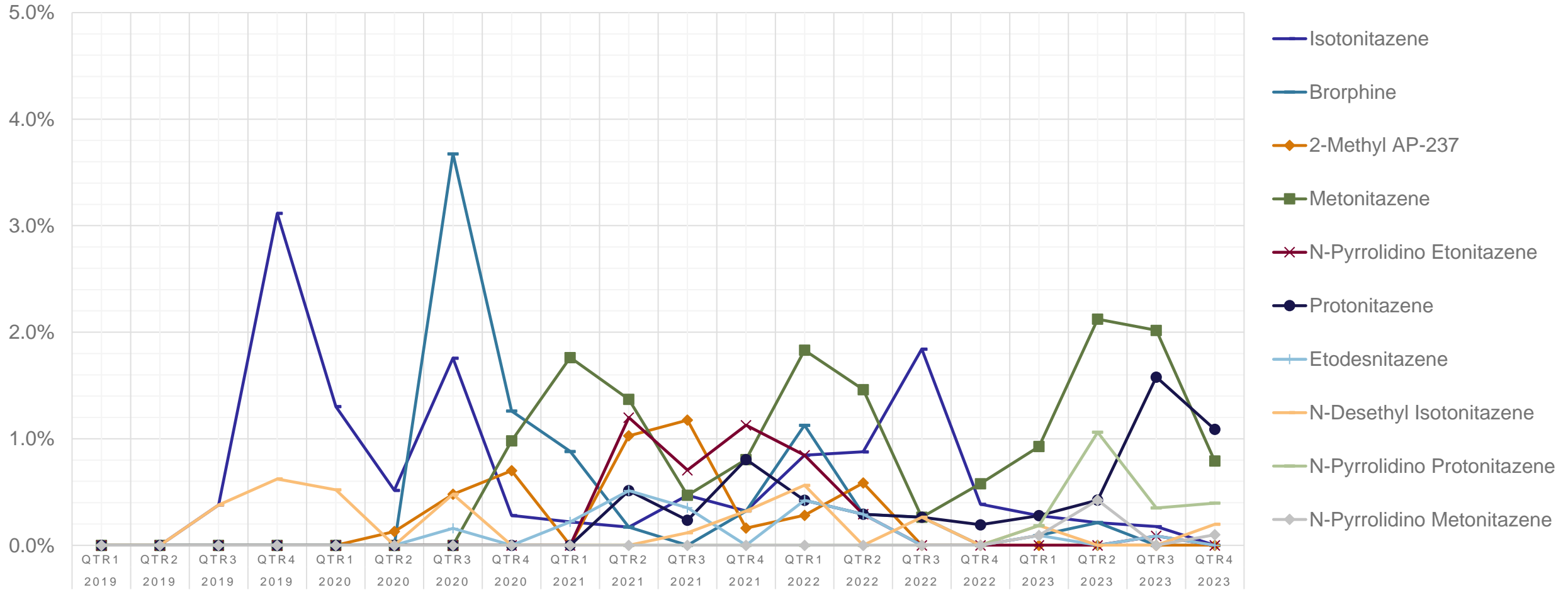
POSITIVITY PLOTS SINCE 2018



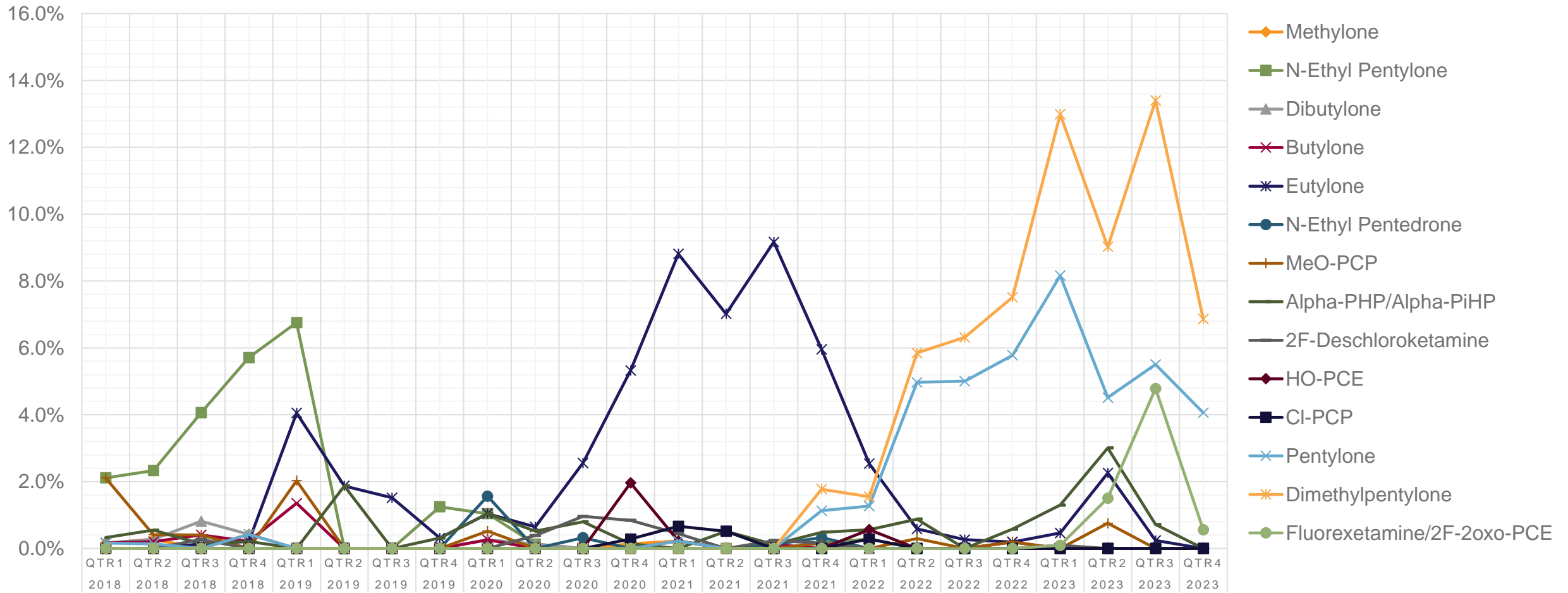
POSITIVITY PLOTS – NPS BENZODIAZEPINES



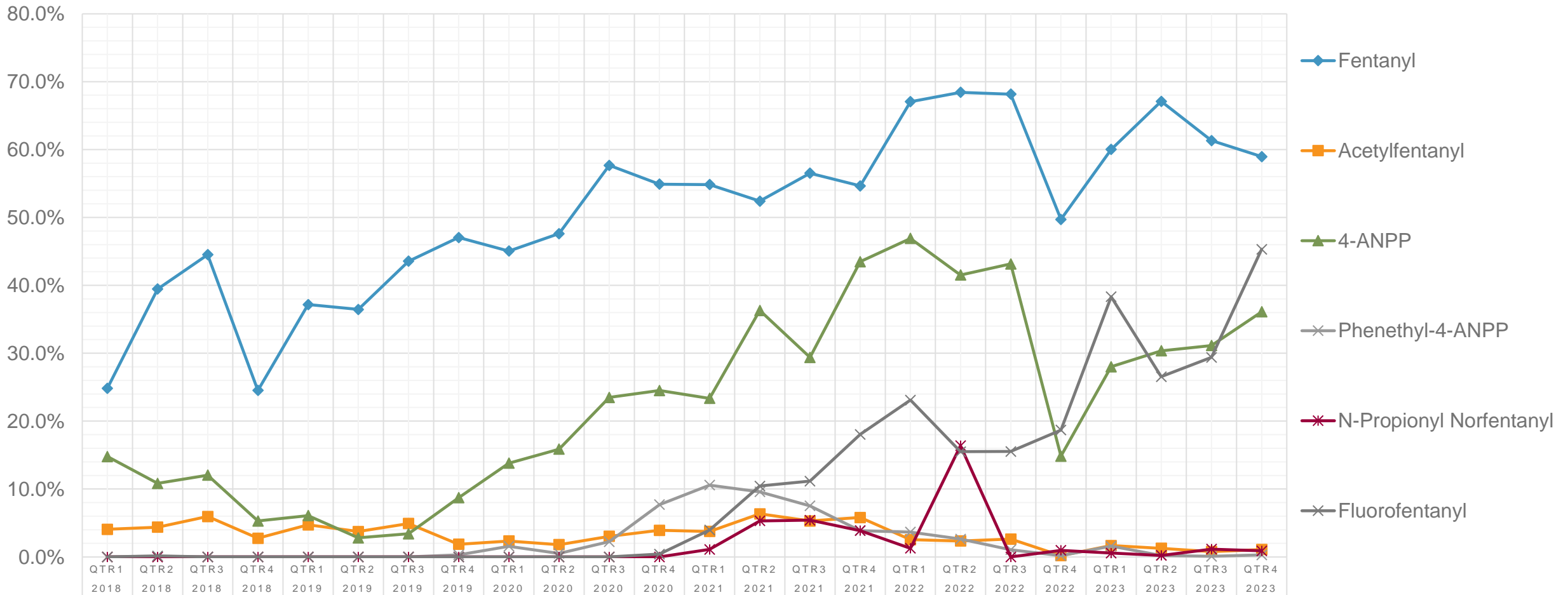
POSITIVITY PLOTS – NPS OPIOIDS (NEW GENERATION)



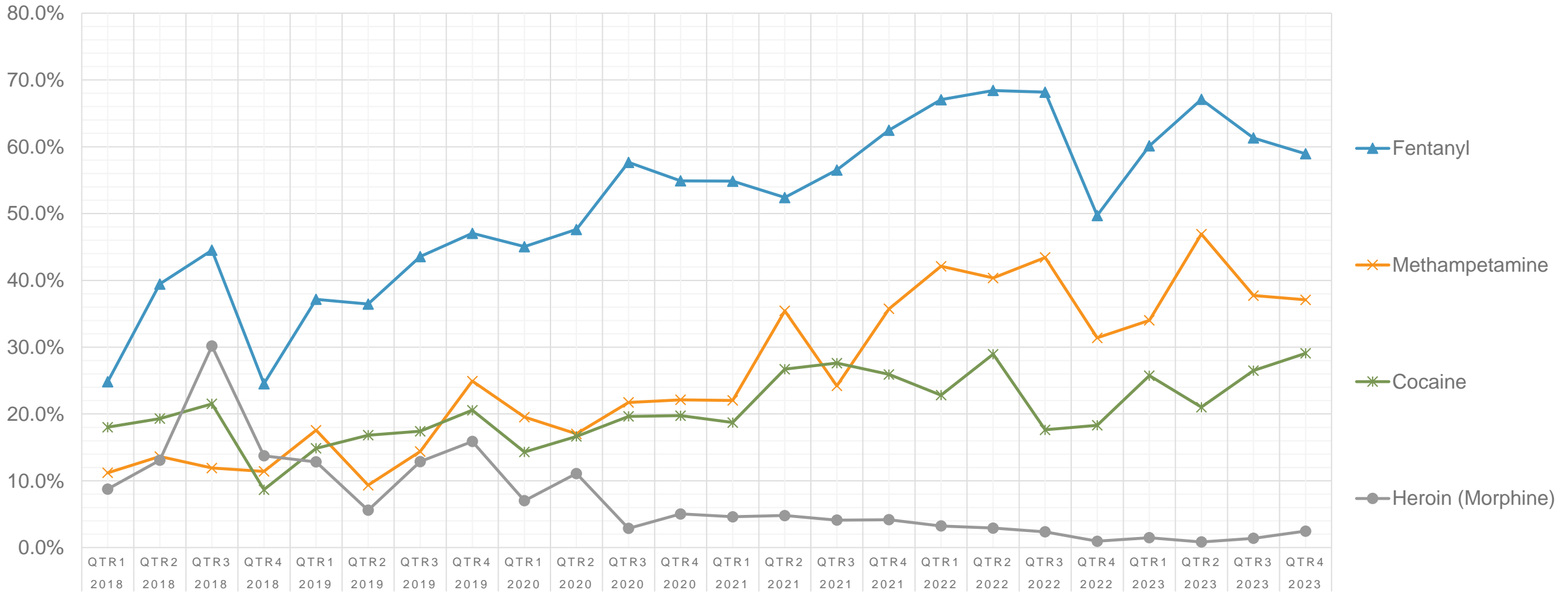
POSITIVITY PLOTS – NPS STIMULANTS & HALLUCINOGENS



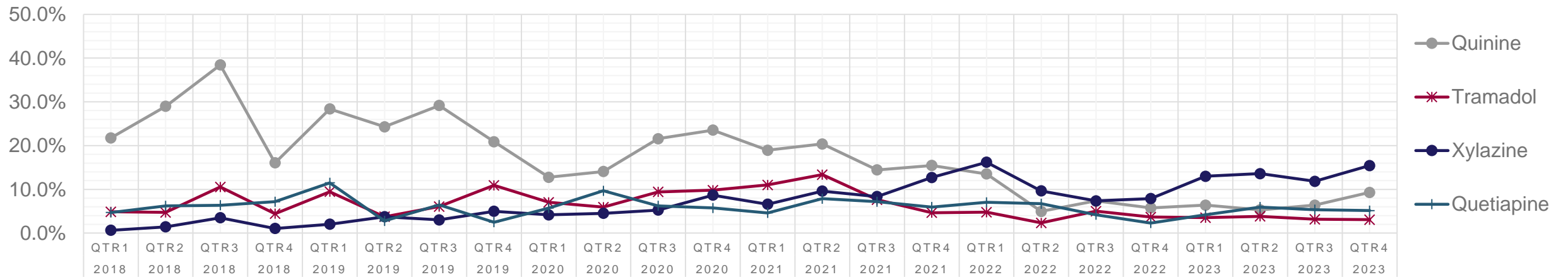
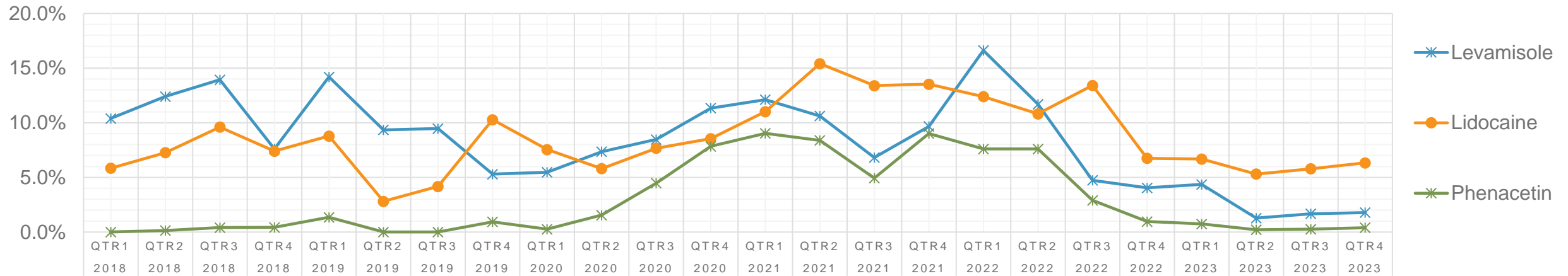
POSITIVITY PLOTS – FENTANYL, FLUOROFENTANYL, & MORE



POSITIVITY PLOTS – TRADITIONAL DRUGS



POSITIVITY PLOTS – ADULTERANTS



WEBSITE ► WWW.NPSDISCOVERY.ORG



The screenshot shows the homepage of the NPS Discovery website. At the top, there is a navigation bar with links for RESOURCES, ABOUT, OUR LAB, CONTACT, and a DONATE button. The main header features the cfsre logo and the text "The Center for Forensic Science Research & Education" and "A PROGRAM OF THE FREDRIC RIEDERS FAMILY FOUNDATION". Below the navigation bar, there are tabs for EDUCATION, RESEARCH, and NPS DISCOVERY, along with a SEARCH button. The main content area has a large image of a laboratory with the text "NPS DISCOVERY" overlaid. Below this, there is a sub-header "NPS DISCOVERY" and a paragraph describing the program as an open-access drug early warning system (EWS). A second paragraph explains the program's goal to identify emerging drugs (NPS) and disseminate information. A third paragraph provides information about an email listserve.

RESOURCES ABOUT OUR LAB CONTACT DONATE

cfsre The Center for Forensic Science Research & Education

A PROGRAM OF THE FREDRIC RIEDERS FAMILY FOUNDATION

EDUCATION RESEARCH NPS DISCOVERY SEARCH

NPS DISCOVERY

NPS DISCOVERY

The CFSRE's NPS Discovery program is an open-access drug early warning system (EWS) operating in the United States. Our evidence-based approach leads the development of high impact reports for real-time action among public health and safety stakeholders.

We are working in collaboration with forensic science, public health, emergency medicine, and criminal justice agencies to rapidly identify emerging drugs, also known as Novel Psychoactive Substances (NPS), associated with intoxications and adverse events. Our data and results are consolidated into reports and resources to allow for the rapid dissemination of information to colleagues and affected communities.

Stakeholders interested in receiving up-to-date information and notifications can join our [email listserve](#) (be sure to select the NPS Discovery check box at the bottom).




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- Forensic Biology
- Forensic Chemistry
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- Law Enforcement
- Legal Professional
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- CFSRE Weekly Newsletter
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COLLABORATE WITH OUR TEAM

- We accept toxicology samples and drug materials for NPS testing
- Contact Alex Krotulski for more information ► alex.krotulski@cfsre.org

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, Phenethylamines, Pyrrolidines

NPS Hallucinogens

Psychedelics, Dissociatives, PCP Analogues, Ketamine Analogues, LSD Analogues

Synthetic Cannabinoids

Classical, Indoles, Indazoles, Miscellaneous, Newly Emergent, & Many More!

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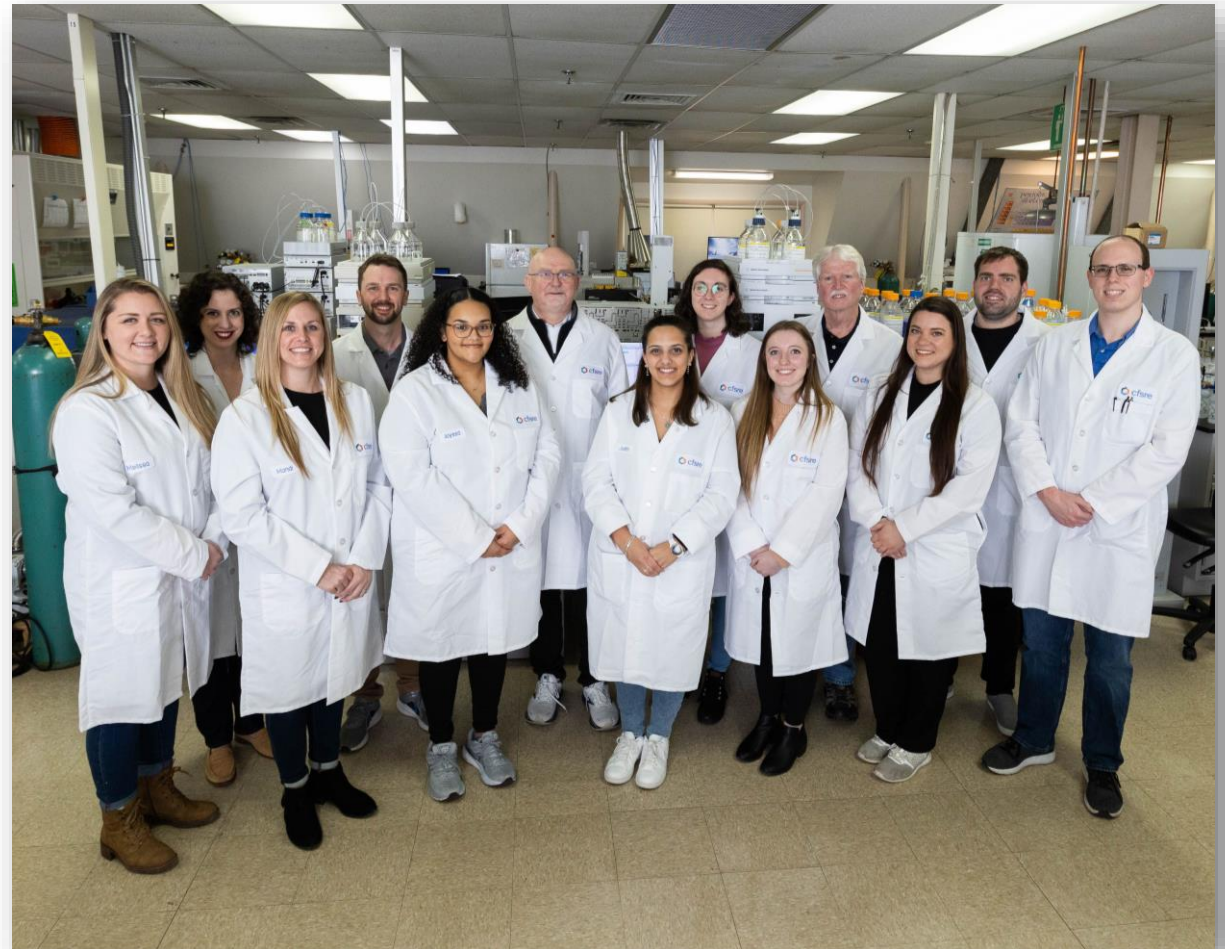
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- Forensic
- Clinical
- Medical Examiner
- Coroner
- Public Health



NIJ | National Institute of Justice
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NPS DISCOVERY

THANK YOU! **QUESTIONS?**



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