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

- CFSRE's NPS Discovery program is funded in part by the National Institute of Justice (NIJ), Office of Justice Programs (OJP), U.S. Department of Justice (DOJ).
  - Award Number: 15PNIJ-22-GG-04434-MUMU
  - 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.

NIJ | National Institute of Justice

STRENGTHEN SCIENCE. ADVANCE JUSTICE.

2023 YEAR IN REVIEW ▸

cfsre | NPS DISCOVERY

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.

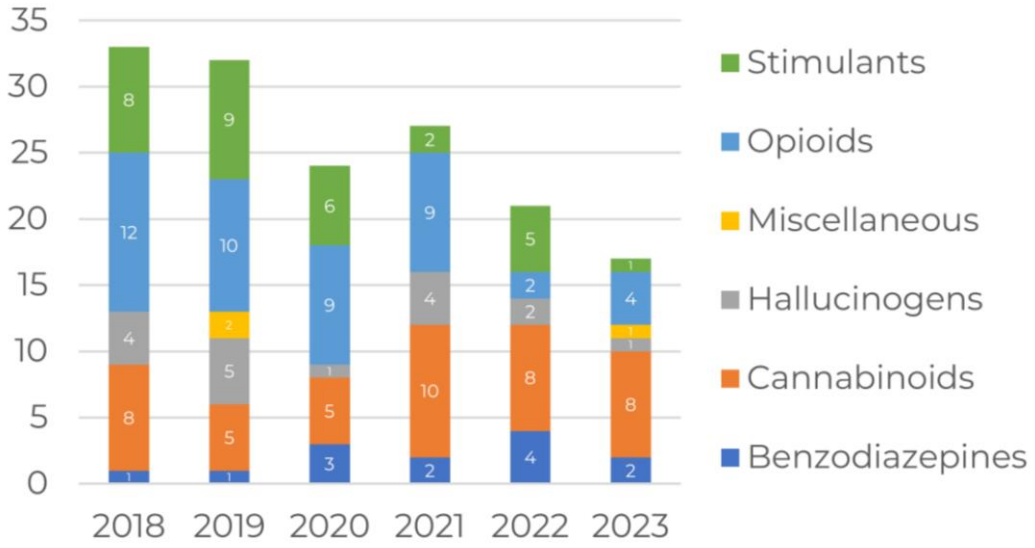


Figure 1: Newly discovered NPS reported for the first time since 2018.

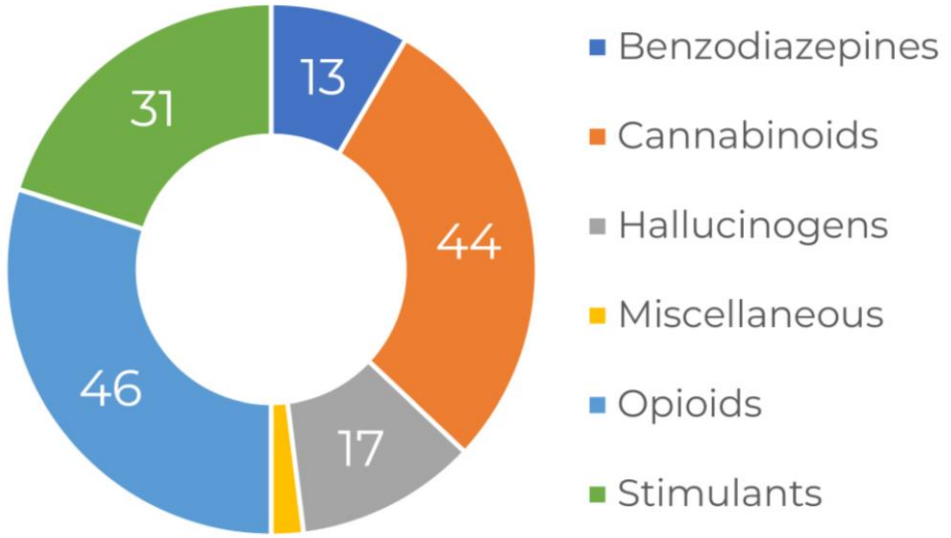


Figure 2: Breakdown by subclass of newly discovered NPS, 2018-2023.

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).

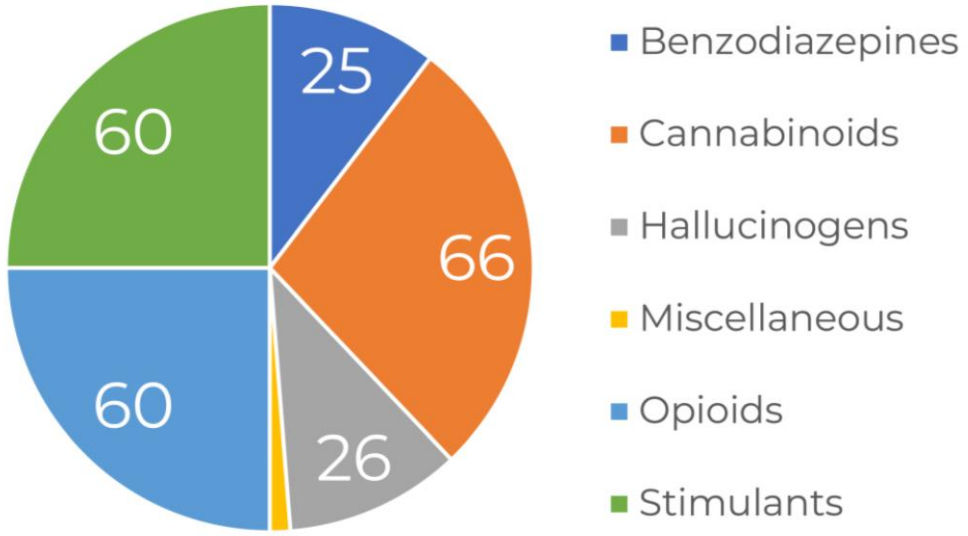


Figure 3: Breakdown by subclass of individual NPS detected, 2018-2023.

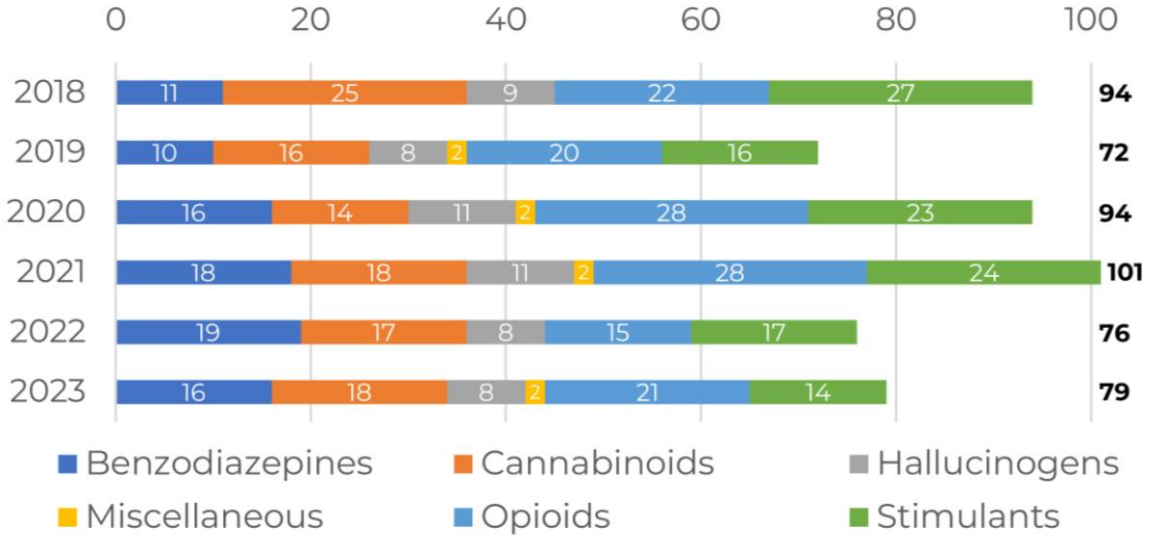


Figure 4: Individual NPS detected each year, cumulative since 2018.

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).

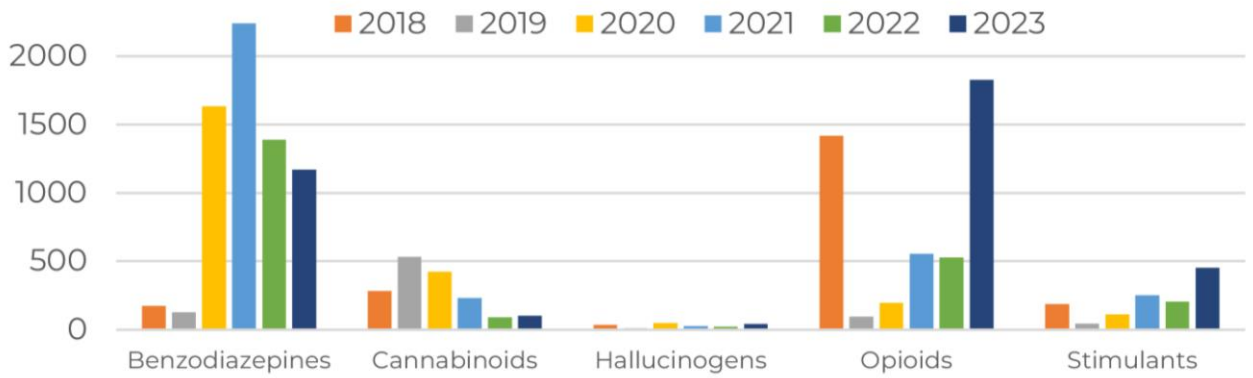


Figure 5: Total number of NPS detections by year among samples analyzed since 2018.

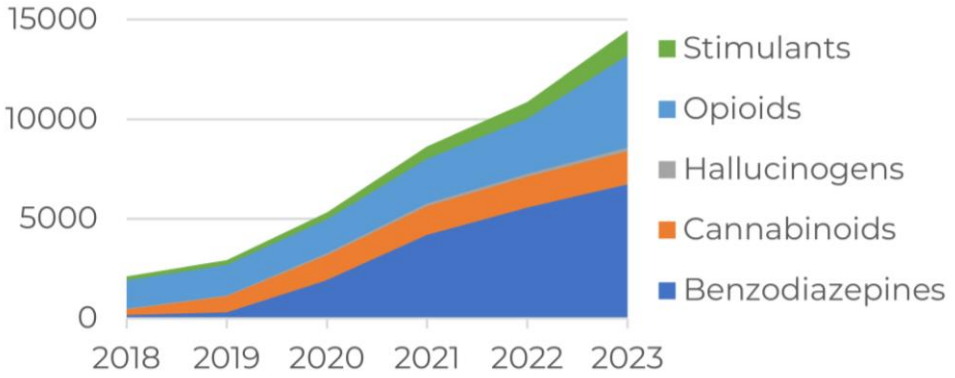
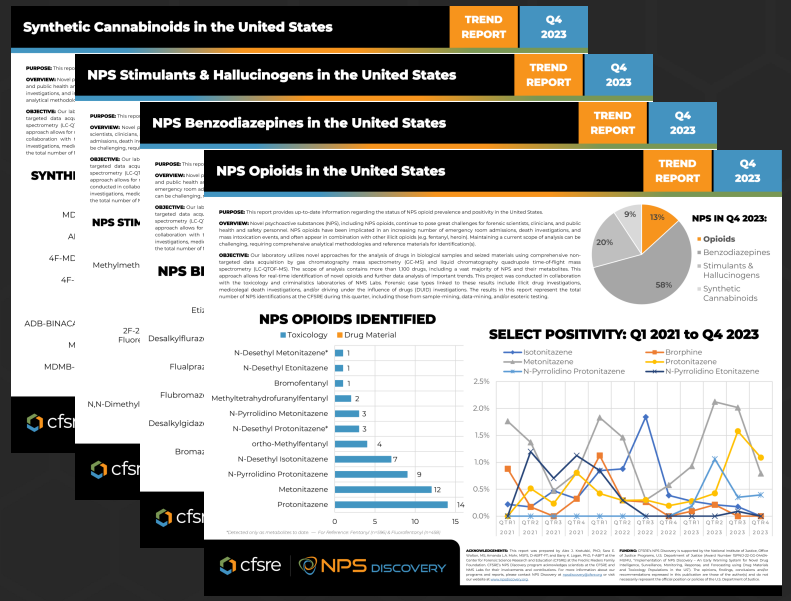


Figure 6: Cumulative number of total NPS detections since 2018.



Q4 2023 NPS TREND REPORTS ▲

cfsre | NPS DISCOVERY

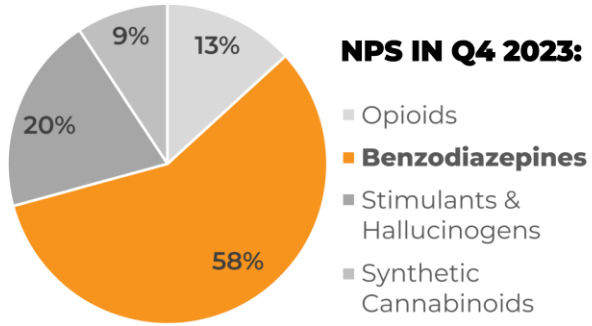
NPS Benzodiazepines in the United States

TREND REPORT | Q4 2023

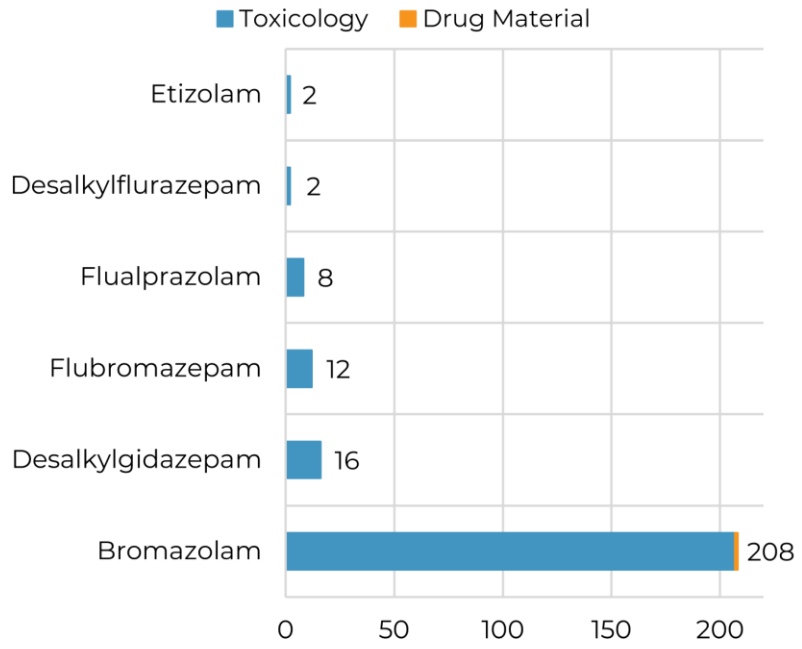
PURPOSE: This report provides up-to-date information regarding the status of NPS benzodiazepine prevalence and positivity in the United States.

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).

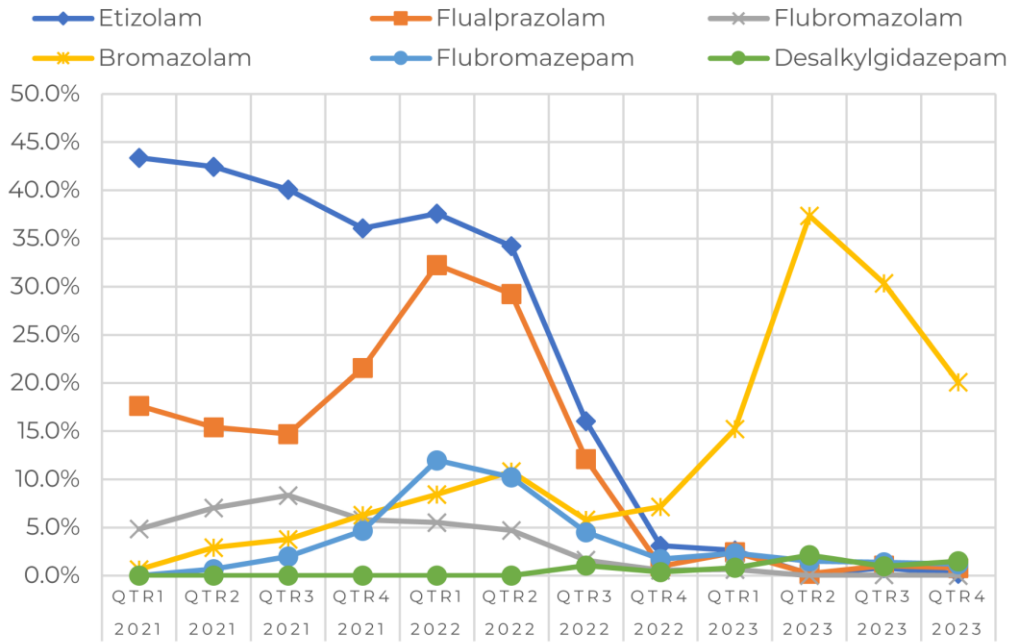
OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). 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



cfsre | NPS DISCOVERY

ACKNOWLEDGEMENTS: This report was prepared by Alex J. Krotulski, PhD; Sara E. Walton, MS; Amanda L.A. 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 15PNIJ-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.

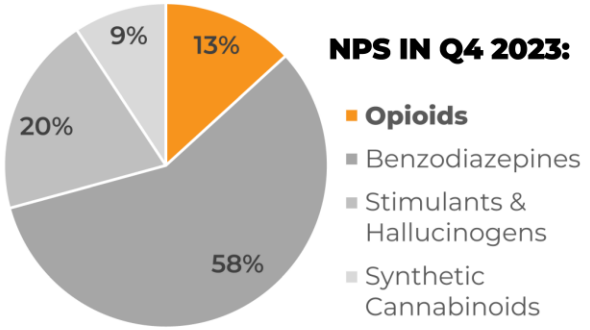
NPS Opioids in the United States

TREND REPORT | Q4 2023

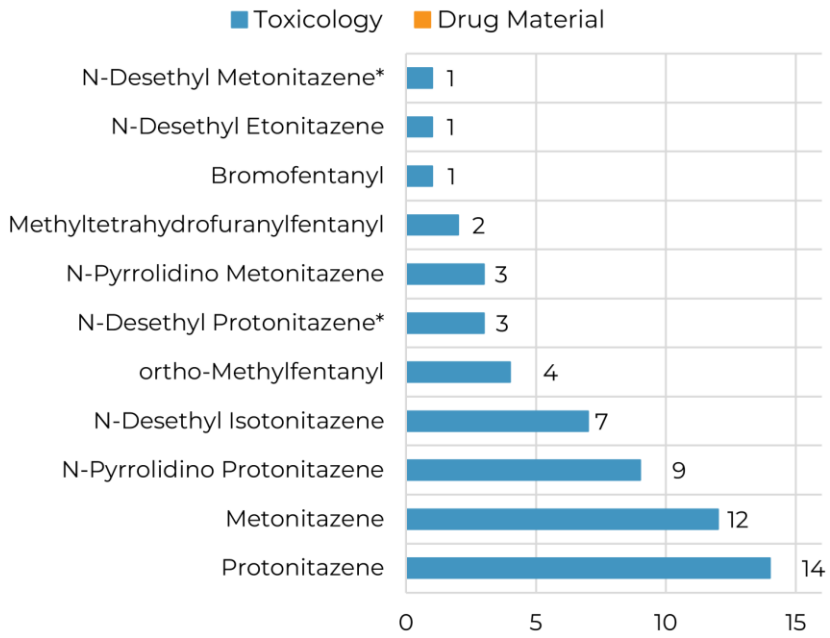
PURPOSE: This report provides up-to-date information regarding the status of NPS opioid prevalence and positivity in the United States.

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.

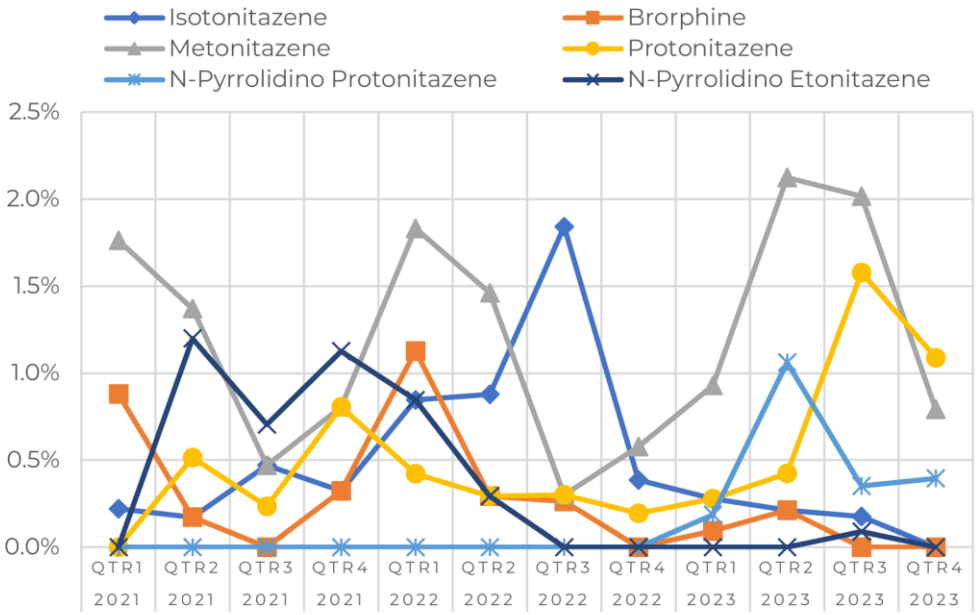


NPS OPIOIDS IDENTIFIED



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

SELECT POSITIVITY: Q1 2021 to Q4 2023



cfsre | NPS DISCOVERY

ACKNOWLEDGEMENTS: This report was prepared by Alex J. Krotulski, PhD; Sara E. Walton, MS; Amanda L.A. 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 15PNIJ-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.

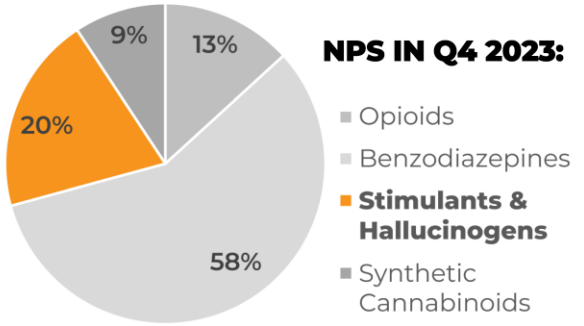
NPS Stimulants & Hallucinogens in the United States

TREND REPORT | Q4 2023

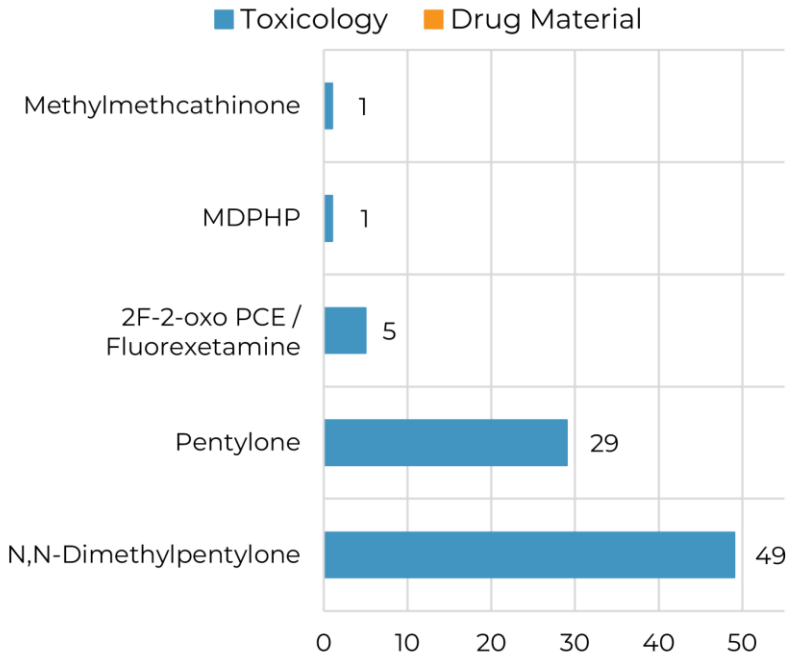
PURPOSE: This report provides up-to-date information regarding NPS stimulant & NPS hallucinogen prevalence and positivity in the United States.

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).

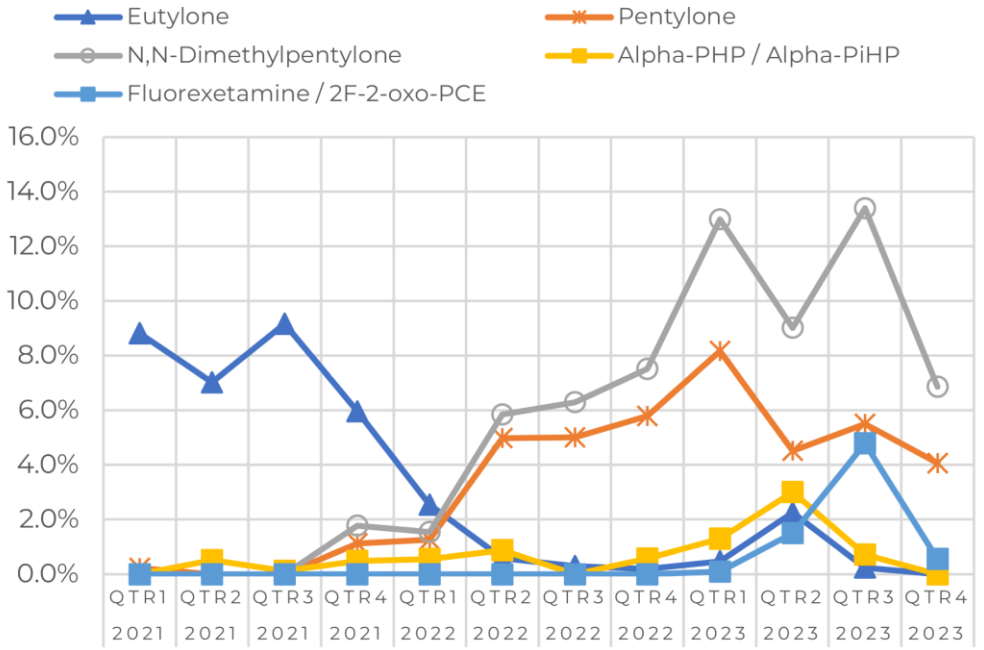
OBJECTIVE: Our laboratory utilizes novel approaches for the analysis of drugs in biological samples and seized materials using comprehensive non-targeted data acquisition by gas chromatography mass spectrometry (GC-MS) and liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). 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



cfsre | NPS DISCOVERY

ACKNOWLEDGEMENTS: This report was prepared by Alex J. Krotulski, PhD; Sara E. Walton, MS; Amanda L.A. 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 15PNIJ-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.

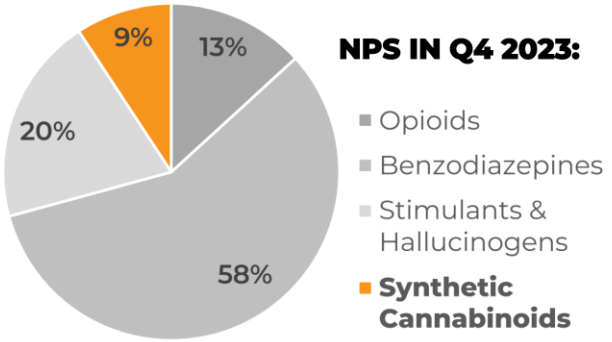
Synthetic Cannabinoids in the United States

TREND REPORT | Q4 2023

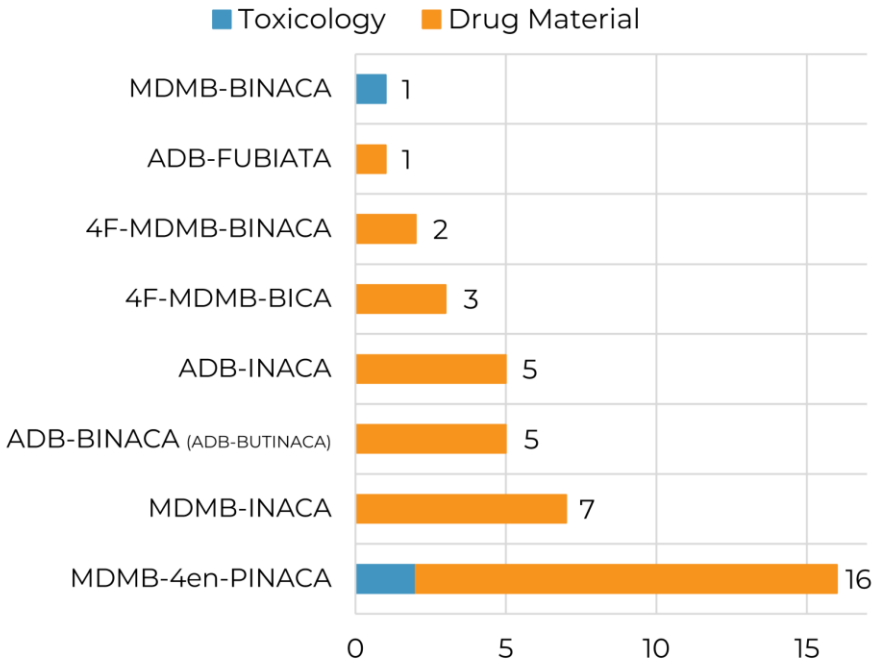
PURPOSE: This report provides up-to-date information regarding the status of synthetic cannabinoid prevalence and positivity in the United States.

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.

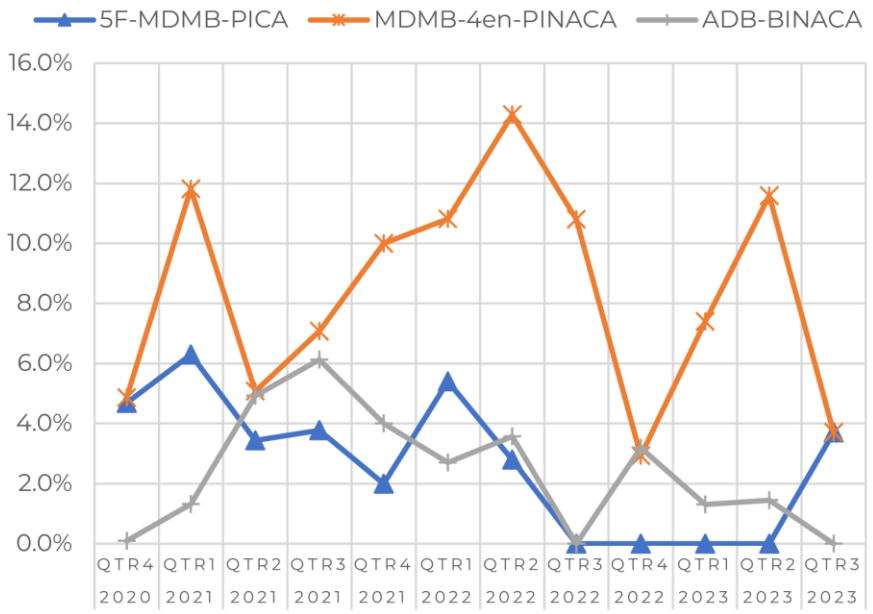


SYNTHETIC CANNABINOIDS IDENTIFIED



SELECT POSITIVITY: Q4 2020 to Q3 2023

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



cfsre | NPS DISCOVERY

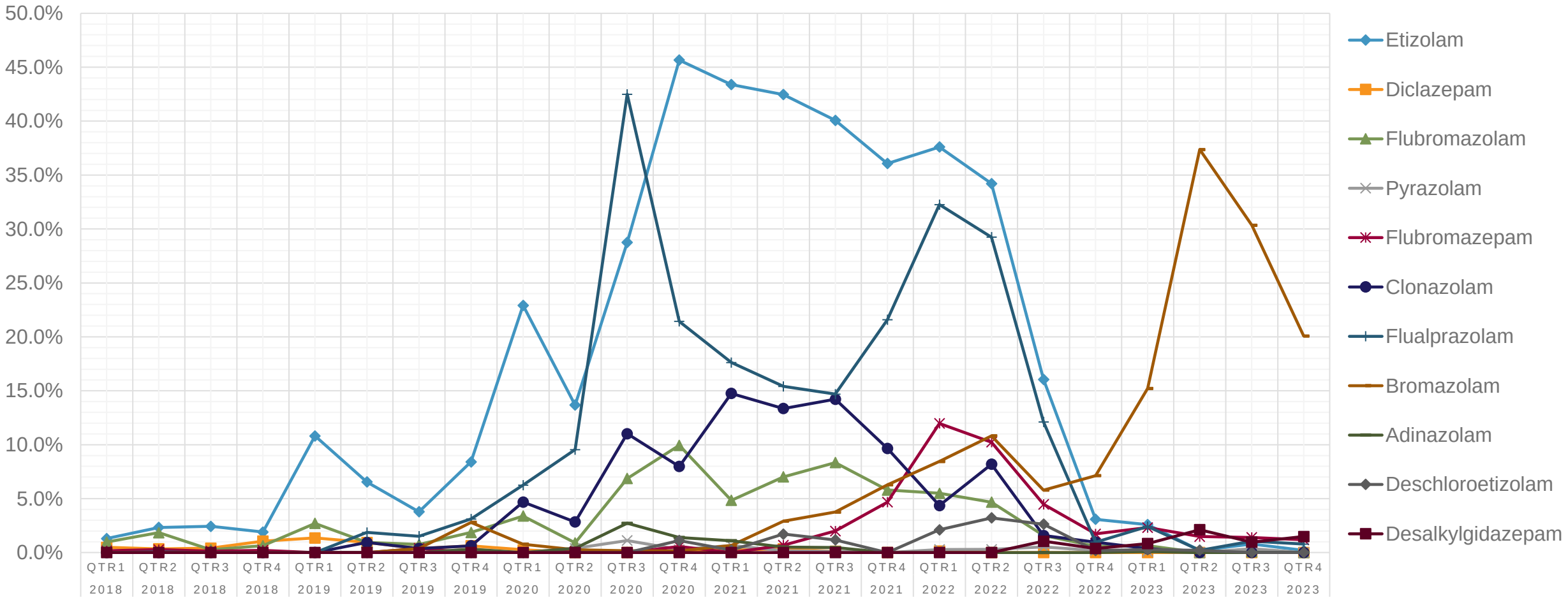
ACKNOWLEDGEMENTS: This report was prepared by Alex J. Krotulski, PhD; Sara E. Walton, MS; Amanda L.A. Mohr, MSFS, D-ABFT-FT; and Barry K. Logan, PhD, F-ABFT at the Center for Forensic Science Research and Education (CFSRE) at the Fredric Rieders Family Foundation. CFSRE's NPS Discovery program acknowledges 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 15PNIJ-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.

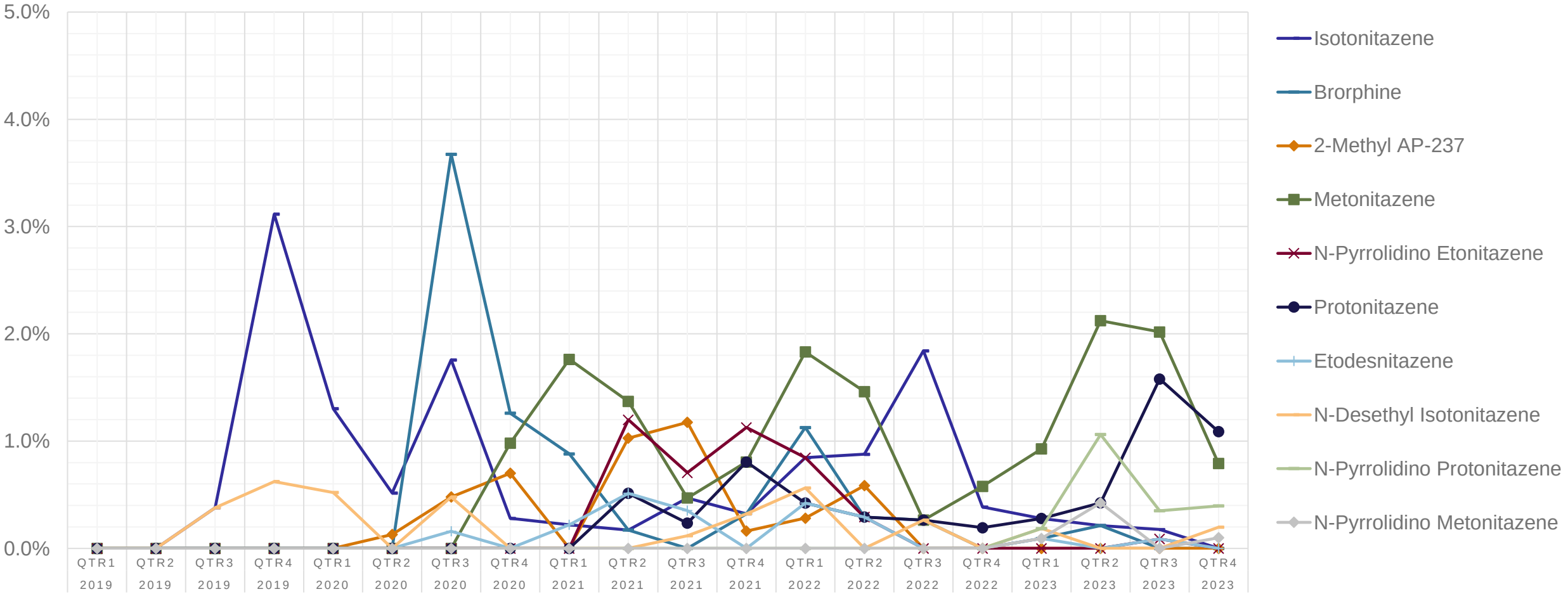
POSITIVITY PLOTS SINCE 2018

cfsre | NPS DISCOVERY

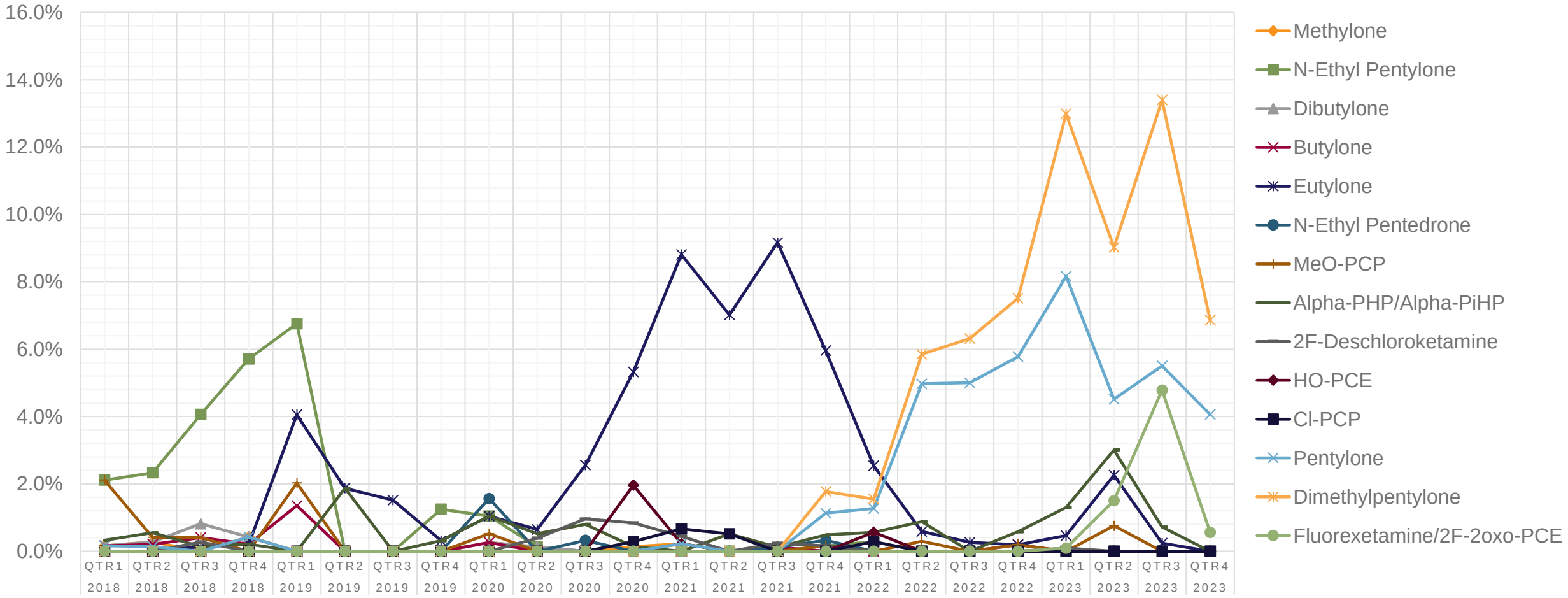
POSITIVITY PLOTS – NPS BENZODIAZEPINES



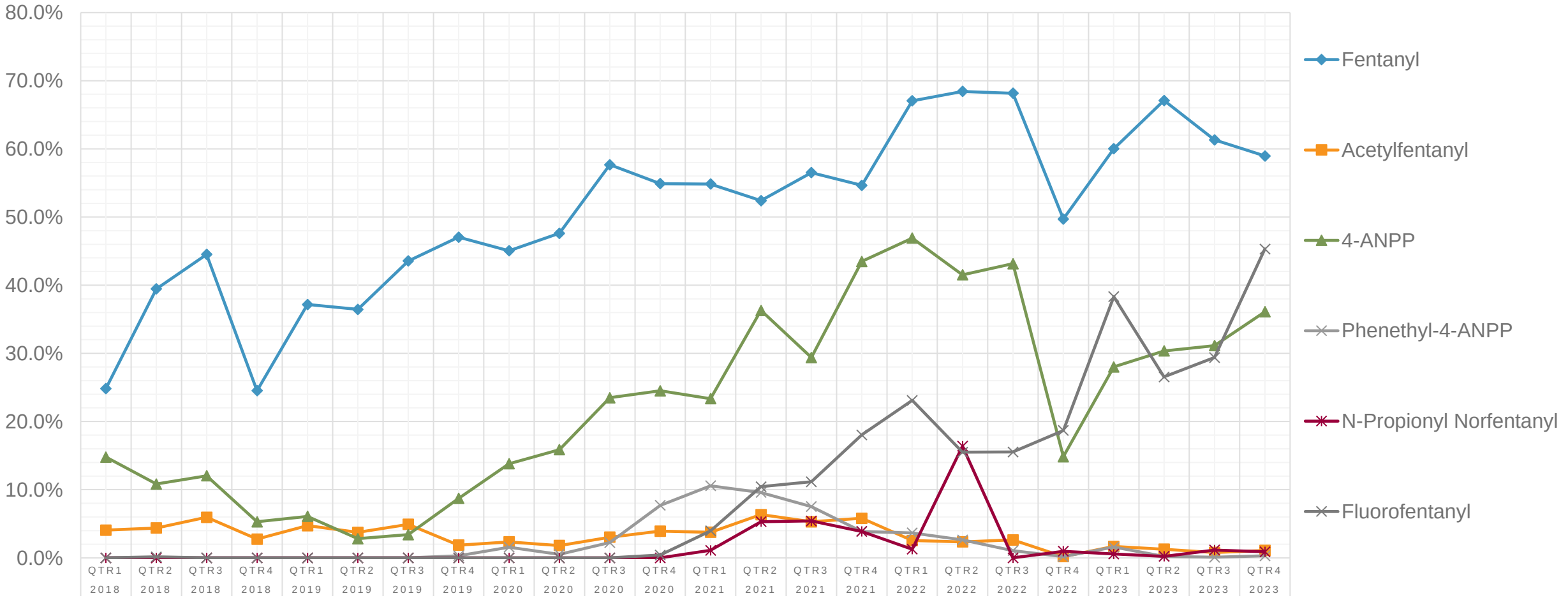
POSITIVITY PLOTS – NPS OPIOIDS (NEW GENERATION)



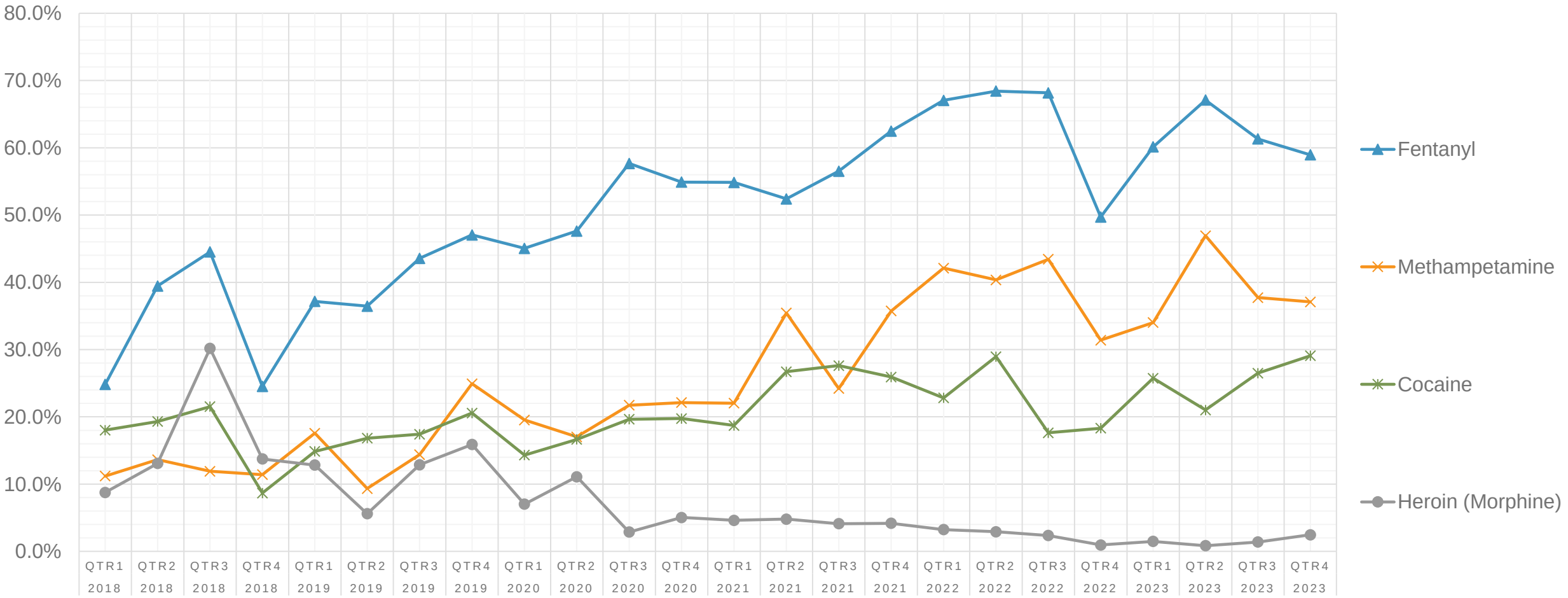
POSITIVITY PLOTS – NPS STIMULANTS & HALLUCINOGENS



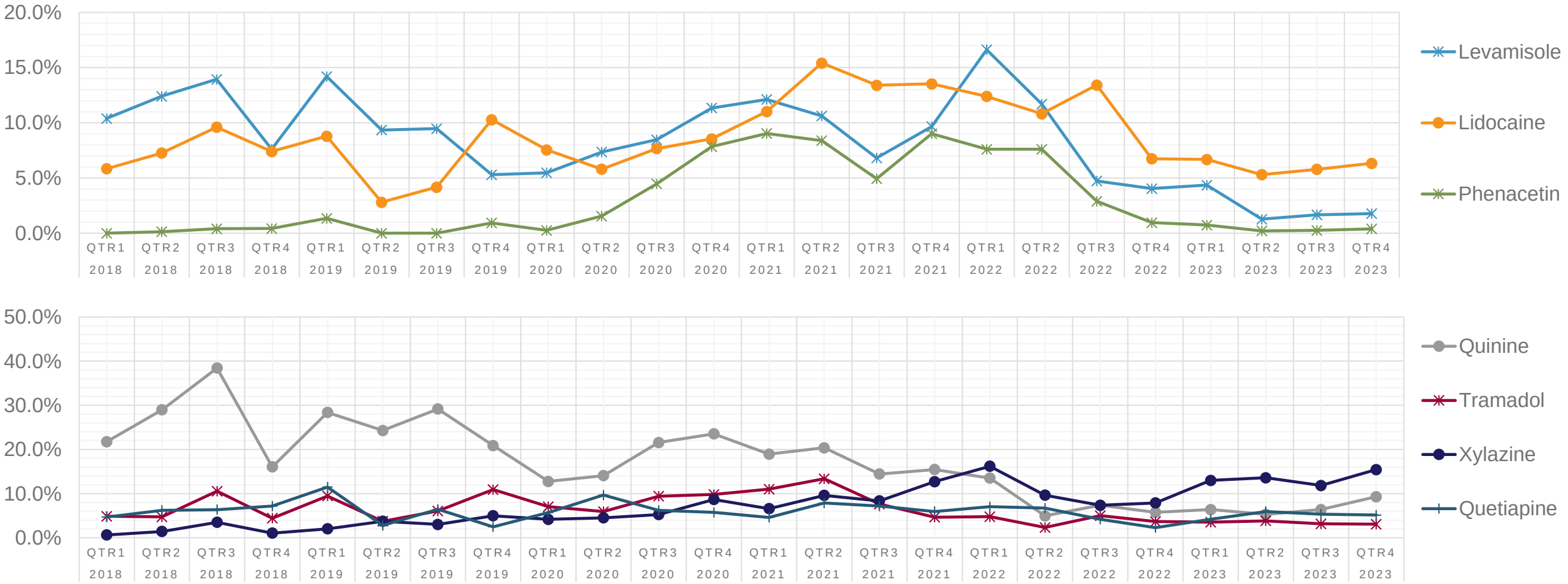
POSITIVITY PLOTS – FENTANYL, FLUOROFENTANYL, & MORE



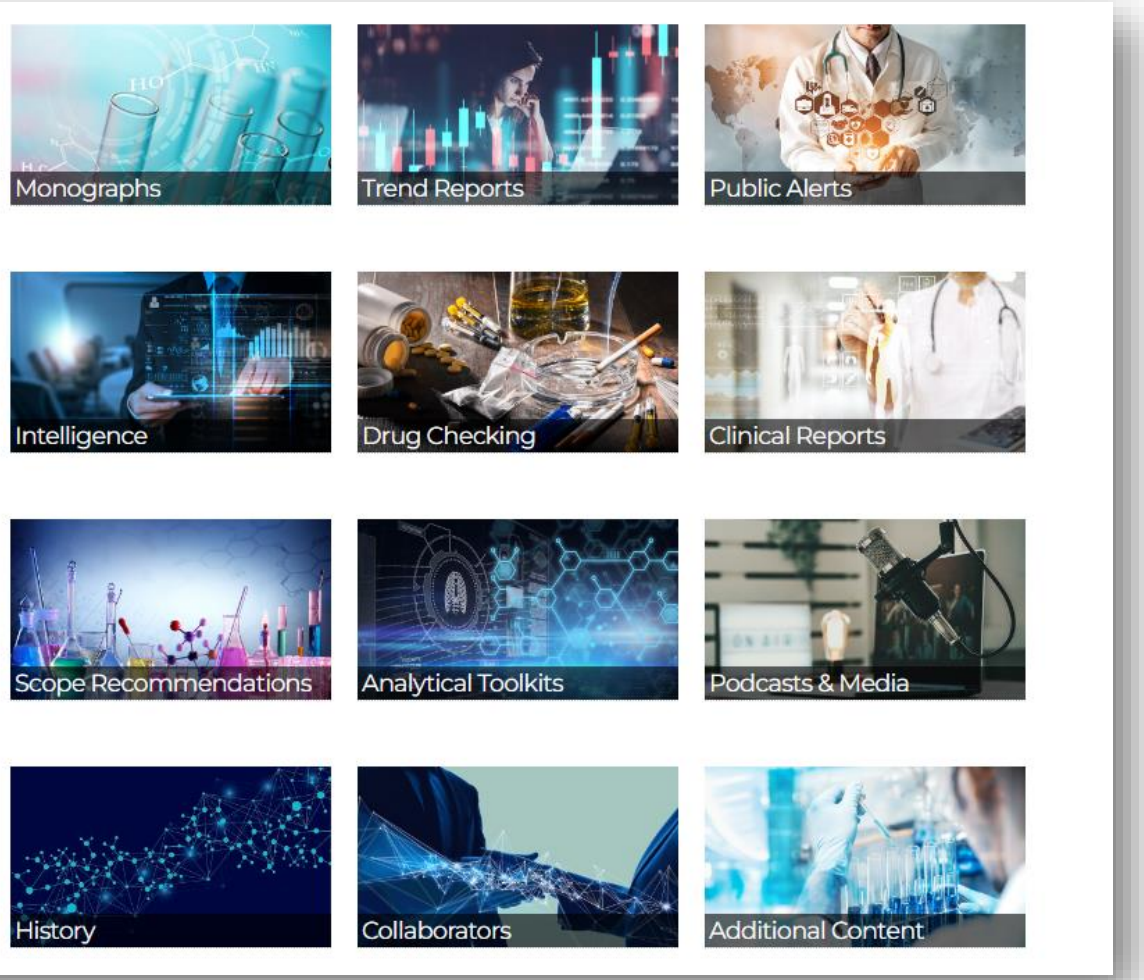
POSITIVITY PLOTS – TRADITIONAL DRUGS



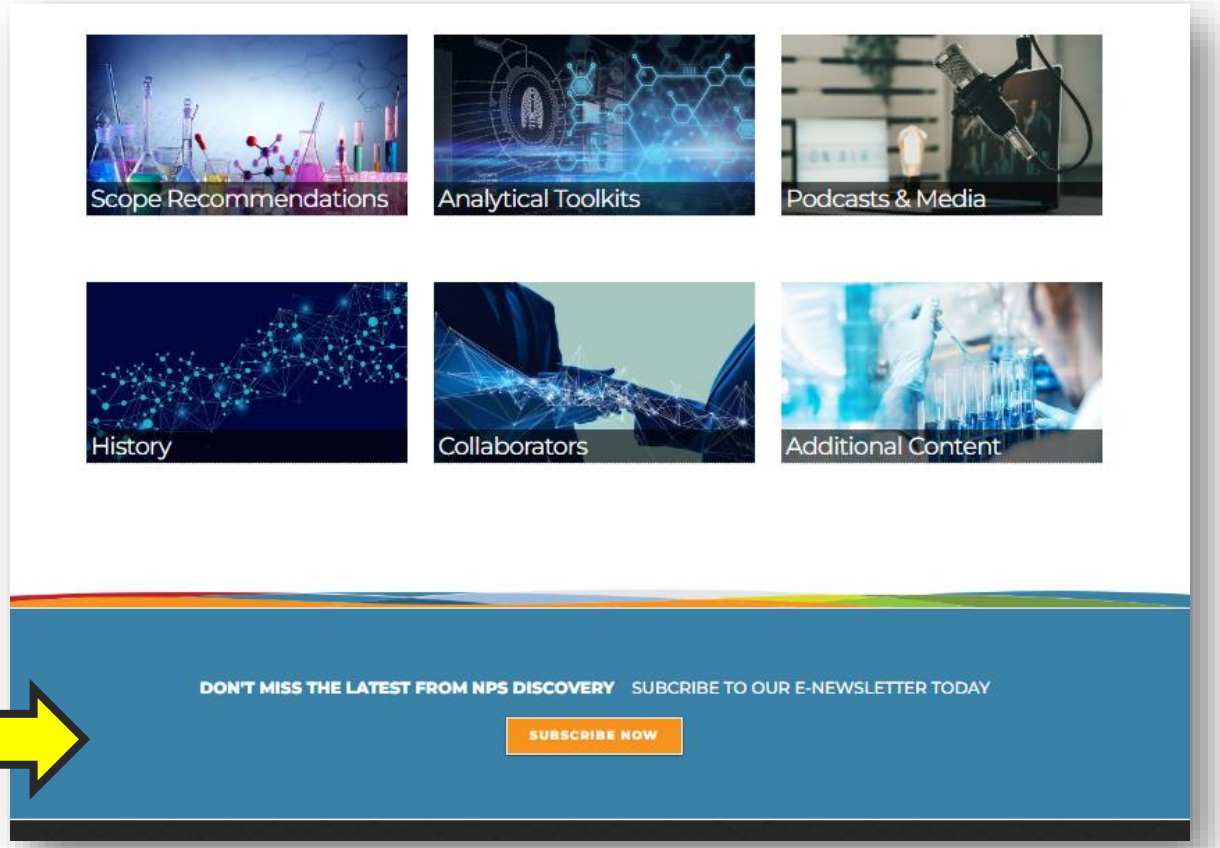
POSITIVITY PLOTS – ADULTERANTS

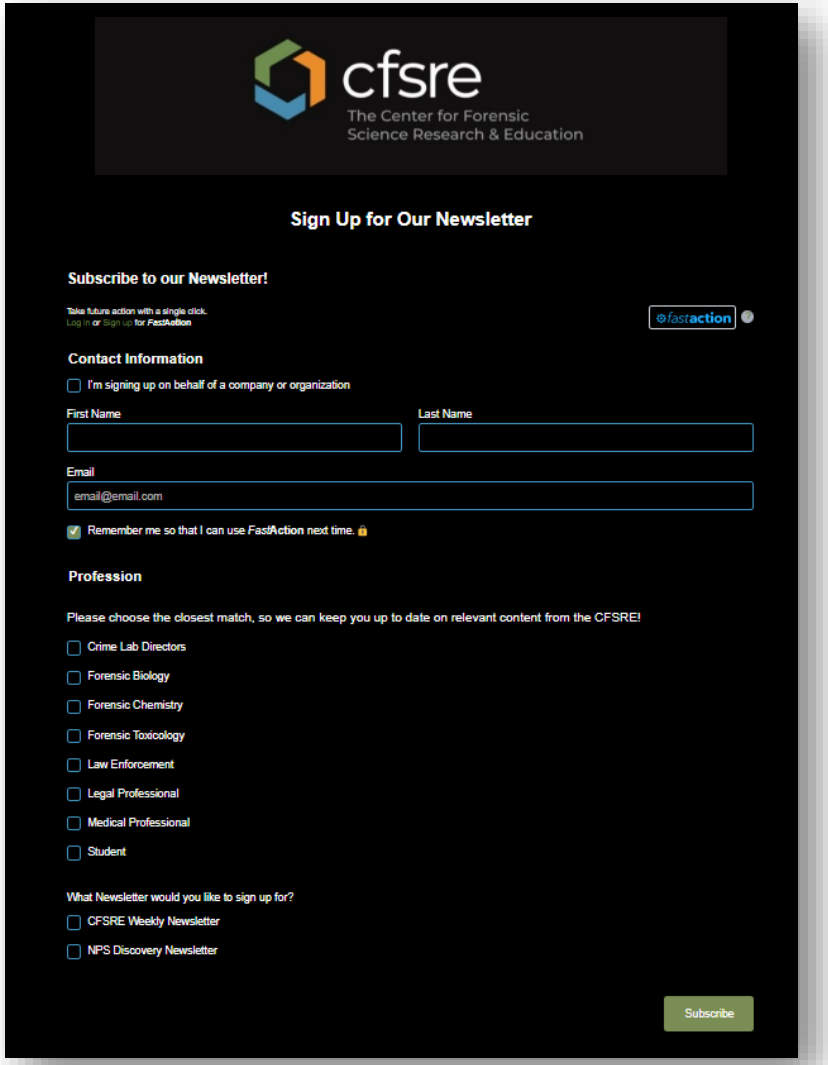


WEBSITE ▸ WWW.NPSDISCOVERY.ORG



JOIN OUR LISTSERV & NEWSLETTER





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:

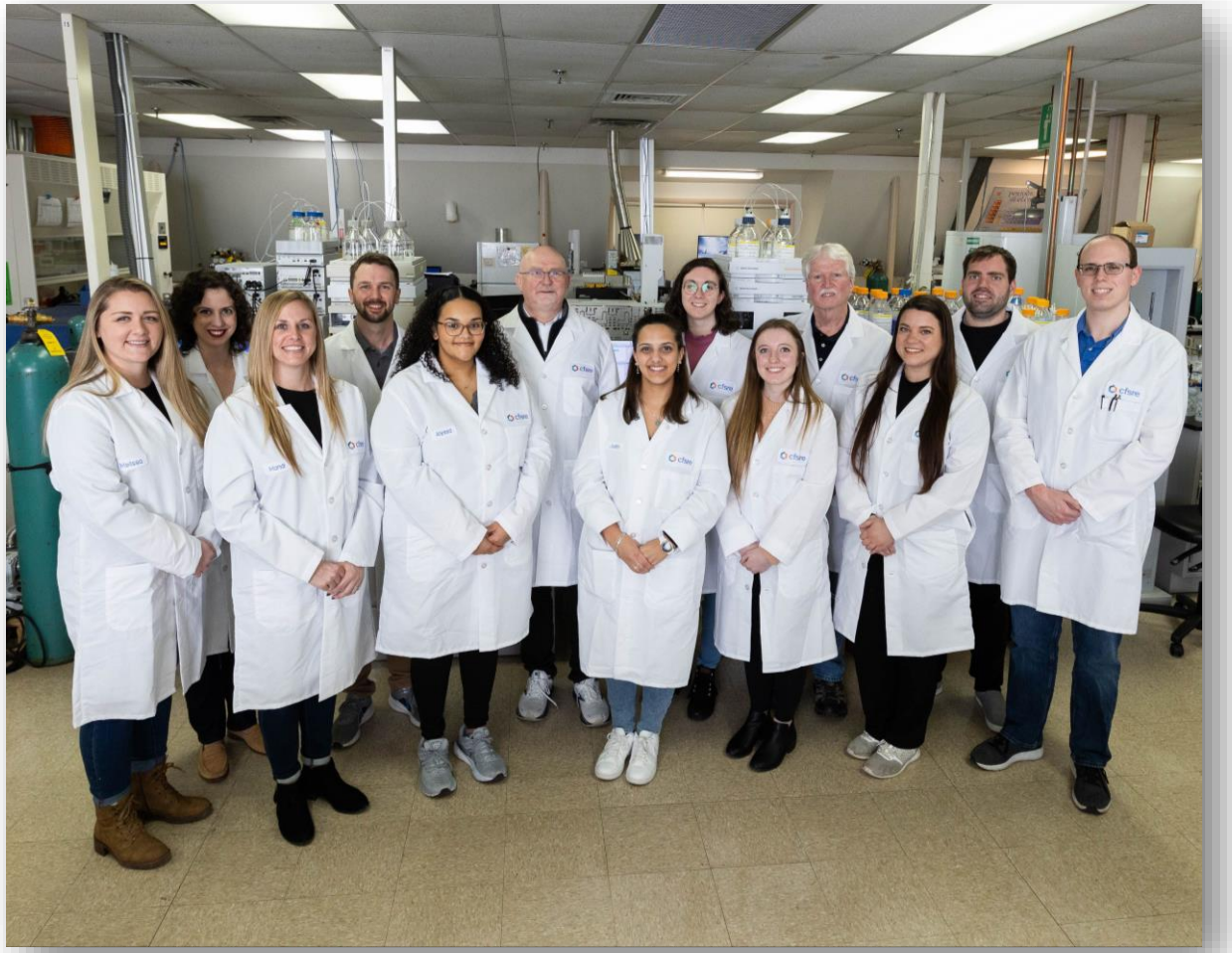
- Perform routine testing for all NPS subclasses, including opioids, benzodiazepines, stimulants, hallucinogens, and cannabinoids.
- Assist medical examiners and coroners with determining cause of death when prior toxicology testing is negative or inconclusive.
- Analysis by state-of-the-art instrumentation 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!

ACKNOWLEDGEMENTS

- **CFSRE Team**
  - Barry Logan
  - Alex Krotulski
  - Sara Walton
  - Josh DeBord
  - Mandi Mohr
  - Melissa Fogarty
  - Alyssa Reyes
  - Brianna Stang
  - Alexis Quinter
  - Max Denn
  - Many others!
- **NMS Labs**
  - Donna Papsun
- **Funding Agencies**
  - National Institute of Justice (NIJ)
- **Collaborators & Partners**
  - Forensic
  - Clinical
  - Medical Examiner
  - Coroner
  - Public Health



NIJ | National Institute of Justice
STRENGTHEN SCIENCE. ADVANCE JUSTICE.

cfsre | NPS DISCOVERY

cfsre | NPS DISCOVERY

THANK YOU! QUESTIONS?

Alex J. Krotulski, Ph.D.
Associate Director – CFSRE
Program Manager – NPS Discovery
alex.krotulski@cfsre.org