DOTS Reporting Program — Quarterly Report

CLINICAL | Q4 2023

cfsre NPS DISCOVERY | ACMT American College of Medical Toxicology | ToxIC Toxicology Investigators Consortium

PURPOSE: This report provides new information regarding comprehensive drug testing of toxicology specimens collected in clinical settings after suspected non-fatal opioid, stimulant, and other drug-related overdoses in cities across the United States (U.S.).

OVERVIEW: Drug use can lead to adverse events and overdose scenarios where individuals present to emergency departments (ED) for clinical evaluation and/or treatment. The culprit can be traditional drugs (e.g., heroin, fentanyl, cocaine, methamphetamine) or novel psychoactive substances (NPS); however, proper drug testing methodologies must be used for accurate identification and characterization. Street-level drug preparations may contain undeclared or unwanted substances (e.g., toxic adulterants, NPS) which can potentiate effects or lead to adverse reactions and unmasking scenarios. Understanding emerging drug trends and testing results can help direct new or revised approaches to clinical treatment and harm reduction.

OBJECTIVE: A partnership between the American College of Medical Toxicology (ACMT) and the Center for Forensic Science Research and Education (CFSRE) was established to comprehensively assess the role and prevalence of drugs, adulterants, NPS, and other relevant substances among suspected overdose events in the U.S.

SAMPLE SOURCE: Patients presented to EDs within the Toxicology Investigators Consortium (ToxIC) Drug Overdose Toxico-Surveillance (DOTS) Reporting Program experiencing a suspected opioid or simulant related overdose. Blood samples were obtained for testing against an expansive library of drugs and other substances. Our findings provide near real-time assessment of drug markets and allude to resulting implications on clinical and forensic institutions.

TOXICOLOGY TESTING: Analysis was performed via liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS) and liquid chromatography tandem quadrupole mass spectrometry (LC-QQQ-MS). The scope of LC-QTOF-MS testing targeted more than 1,200 drugs, including a vast majority of NPS and metabolites. Drug classes included opioids, benzodiazepines, cannabinoids, stimulants, and hallucinogens, among other drugs. The LC-QQQ-MS test was quantitative, targeting fentanyl, norfentanyl, methamphetamine, amphetamine, cocaine, benzoylecgonine, xylazine, and naloxone. Additional targets included for quantitative testing were NPS of interest (e.g., bromazolam, cathinones, nitazene analogues, and others).

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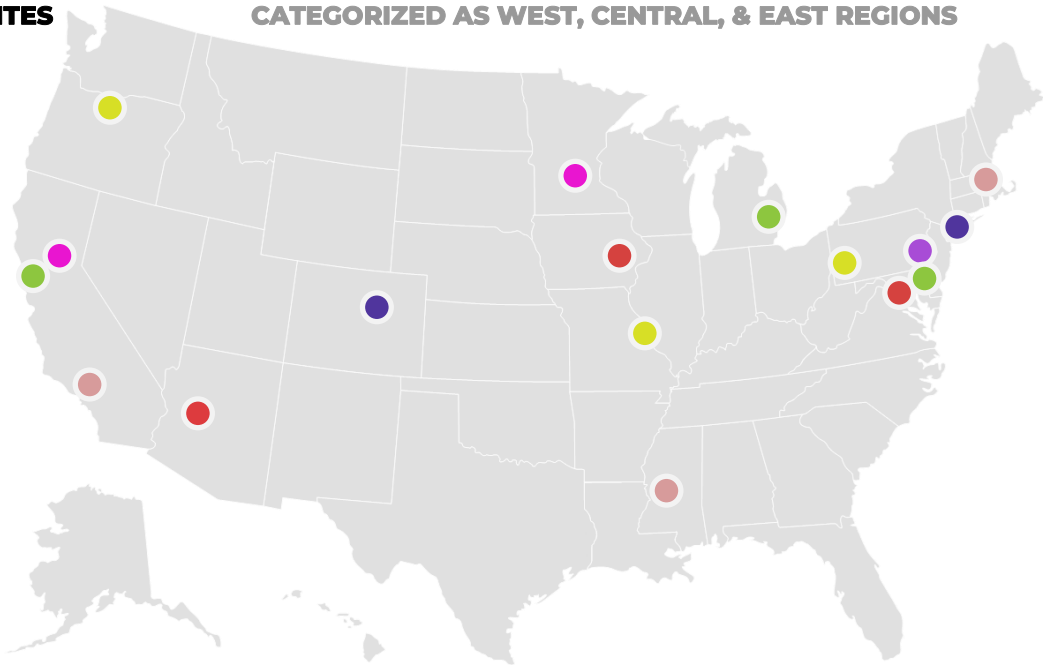
PARTICIPATING SITES

CATEGORIZED AS WEST, CENTRAL, & EAST REGIONS



WEST

Portland, OR
Oregon Health & Science University

Sacramento, CA
University of California, Davis

San Francisco, CA
University of California, San Francisco

Los Angeles, CA
University of California, Los Angeles, Ronald Reagan

Phoenix, AZ
Banner University Medical Center

CENTRAL

Denver, CO
University of Colorado

Minneapolis, MN
Hennepin Medical Center

Iowa City, IA
University of Iowa

EAST

Boston, MA
Harvard University

New York, NY
Weill Cornell Medical Center

Philadelphia, PA
University of Pennsylvania

Baltimore, MD
John's Hopkins Hospital

Washington, DC
Georgetown University

Pittsburgh, PA
University of Pittsburgh

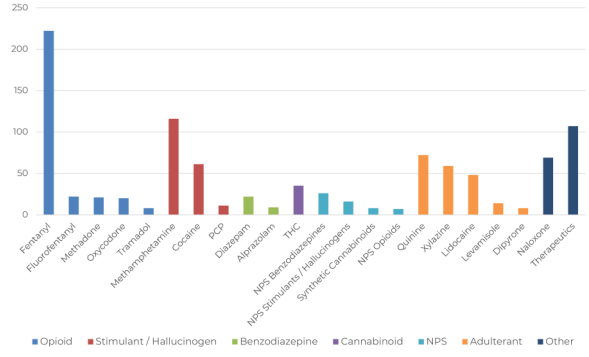
CENTRAL

Detroit, MI
Detroit Medical Center

St. Louis, MO
Washington University

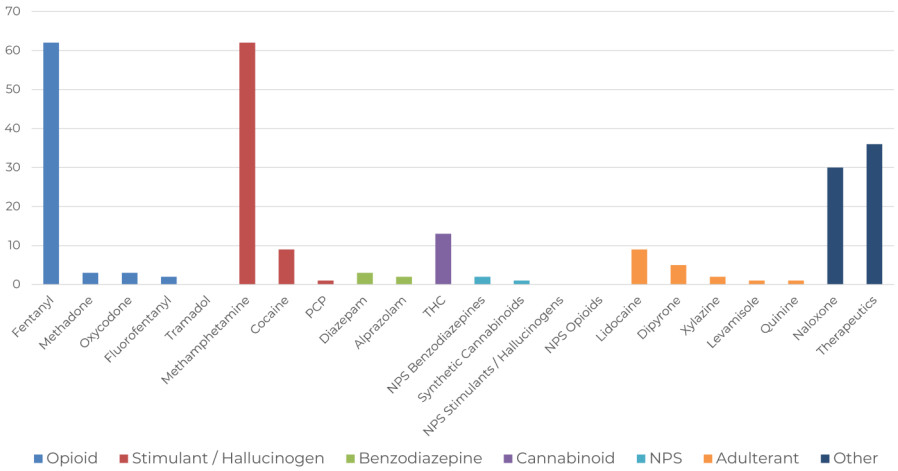
Jackson, MS
University of Mississippi

ALL SITE SUMMARY RESULTS (N=294)



Traditional Drugs (ng/mL)					NPS (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	24	110±105	79	9.9-390	Bromazolam	21	81±85	50	<5-310
Fentanyl	227	8.5±11	4.7	<1-100	Flubromazepam	2	-	-	<5->500
Norfentanyl	207	8.4±21	2.8	<1-200	*N,N*-Dimethylpentylone	11	24±19	16	<10-63
Methamphetamine	123	210±240	120	<1->1000	Pentylone	8	15±14	10	<10-54
Amphetamine	116	35±51	19	<1-280	Eutylone	3	25±22	10	<10-57
Cocaine	78	11±20	2.4	<1-67	*N*-Desethyl Isotonitazene	4	2.0±1.9	1.1	0.5-5.3
BZE	160	240±240	160	<1->1000	Metonitazene	1	-	-	1.0
Xylazine	58	14±28	4.9	<1-150	Protonitazene	1	-	-	<0.5
Naloxone	101	15±59	5.2	<1-510					

WEST REGION SUMMARY (N=74)



Traditional Drugs (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	8	80±50	88	10-180
Fentanyl	65	7.1±7.0	5.4	<1-31
Norfentanyl	59	3.8±4.8	2.2	<1-29
Methamphetamine	64	270±260	220	<1->1000
Amphetamine	62	41±53	26	<1-280
Cocaine	10	35±28	37	<1-67
BZE	29	120±190	44	<1->1000
Naloxone	41	26±85	6.2	<1-510

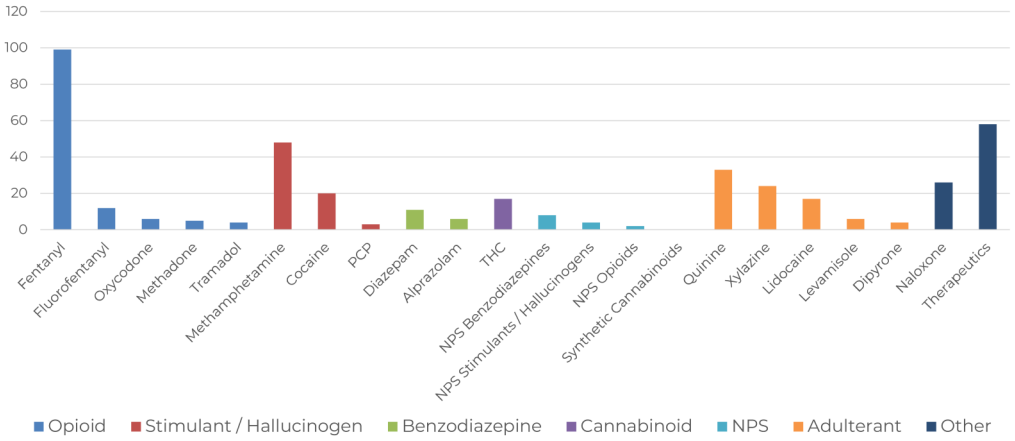
NPS (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range
Bromazolam	2	28±14	28	14-43

CENTRAL REGION SUMMARY (N=130)

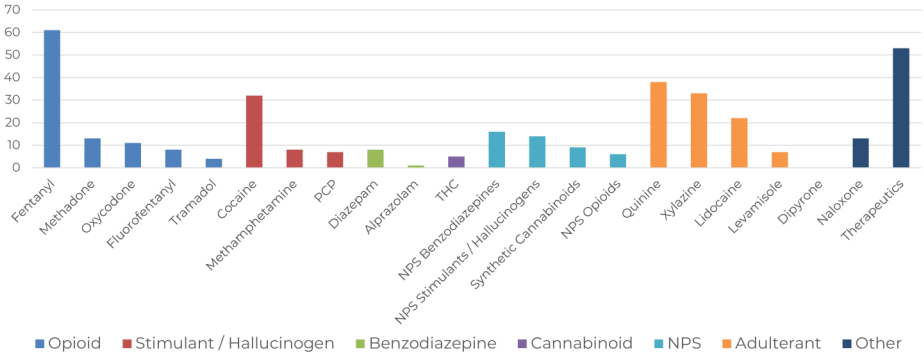
Traditional Drugs (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	9	170±140	130	20-390
Fentanyl	101	8.3±12	4.3	<1-100
Norfentanyl	89	9.2±27	2.8	<1-200
Methamphetamine	52	120±170	71	<1->1000
Amphetamine	47	23±30	11	<1-130
Cocaine	30	4.3±3.2	2.9	<1-9.4
BZE	66	260±249	175	<1->1000
Naloxone	44	6.2±4.0	5.0	<1-19
Xylazine	23	19±40	2.5	<1-150

NPS (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range
Bromazolam	6	61±37	55	<5-130

Drug	N	Range
Flubromazepam	2	<5->500



EAST REGION SUMMARY (N=90)

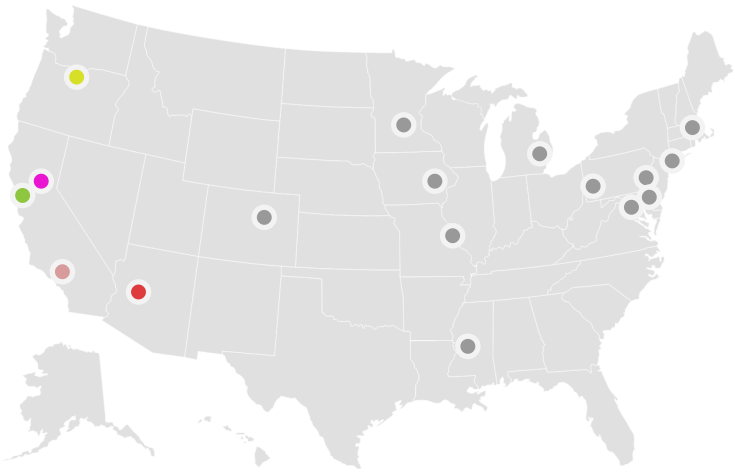


Traditional Drugs (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	7	91±75	57	10-230
Fentanyl	61	10±13	6.0	<1-77
Norfentanyl	59	11±21	4.7	<1-120
Methamphetamine	7	160±305	26	<1->1000
Amphetamine	7	65±107	14	<1-28
Cocaine	38	2.0±0.6	2.2	<1-2.9
BZE	65	270±230	240	<1->1000
Naloxone	16	4.9±3.6	3.3	<1-12
Xylazine	31	10±14	5.9	<1-48

NPS (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range
Bromazolam	13	103±100	54	<5-310
N,N-Dimethylpentylone	11	24±19	16	<1-63
Pentylone	8	15±14	10	<10-54
Eutylone	3	25±22	10	<10-57

Drug	N	Mean ± Std Dev	Median	Range
N-Desethyl Isotonitazene	4	2.0±1.9	1.1	0.5-5.3
Protonitazene	1	-	-	<0.5
Metonitazene	1	-	-	1.0

WEST REGION



PORTLAND, OR (N=25)

- 96% positive for at least one opioid or stimulant
- Fentanyl (84%) was the primary opioid detected
- Methamphetamine (92%) was the primary stimulant detected, followed by cocaine (16%)
- Combined opioid and stimulant use was common (84%)
- THC and metabolites were detected (24%)
- *Note: Xylazine and p-fluorofentanyl were not detected*
- NPS: Bromazolam (4%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	2	64±37	64	27-102	Cocaine	4	37±23	37	<1-61
Fentanyl	22	5.2±4.6	4.2	<1-22	BZE	7	53±39	65	<1->1000
Norfentanyl	21	2.0±1.1	1.6	<1-5.0	Naloxone	16	7.6±6.9	4.7	<1-28
Methamp.	24	270±240	230	2.3->1000	Amp.	24	38±52	25	<1-260
Bromazolam	1	43	-	-					

SACRAMENTO, CA (N=13)

- 100% positive for at least one opioid or stimulant
- Fentanyl (100%) was the primary opioid detected
- Methamphetamine (69%) was the primary stimulant detected, followed by cocaine (7%)
- Combined opioid and stimulant use was common (100%)
- THC and metabolites were detected (30%)
- *Note: Xylazine was not detected*
- NPS: *p*-Fluorofentanyl (7%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	1	43	-	-	Methamp.	9	310±260	270	25-880
Fentanyl	13	8.5±8.1	5.5	<1-31	Amp.	9	30±19	30	3.6-60
Norfentanyl	12	2.7±1.2	3.2	<1-3.8	BZE	7	160±210	49	<1->1000
Naloxone	11	14±8.8	15	<1-29					

SAN FRANCISCO, CA (N=16)

- 94% positive for at least one opioid or stimulant
- Fentanyl (88%) was the primary opioid detected, followed by methadone (13%) and oxycodone (13%)
- Methamphetamine (75%) was the primary stimulant detected, followed by cocaine (25%)
- Combined opioid and stimulant use was common (88%)
- NPS: *p*-Fluorofentanyl (6%), Bromazolam (6%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	3	120±42	107	80-180	Methamp.	14	104±120	25	<1->1000
Fentanyl	14	8.4±8.2	5.6	<1-25	Amp.	13	31±45	19	<1-160
Norfentanyl	14	4.4±3.6	2.9	<1-13	Cocaine	3	34±32	34	<1-67
Naloxone	4	3.4±1.7	1.5	1.6-6.2	BZE	9	160±280	40	<1->1000
Bromazolam	1	14	-	-					

PHOENIX, AZ (N=8)

- 100% positive for at least one opioid or stimulant
- Fentanyl (75%) was the primary opioid detected, followed by methadone (13%)
- Methamphetamine (88%) was the primary stimulant detected
- Combined opioid and stimulant use was common (75%)
- Xylazine detected alongside fentanyl (13%)
- *Note: p-Fluorofentanyl was not detected*
- No NPS were detected

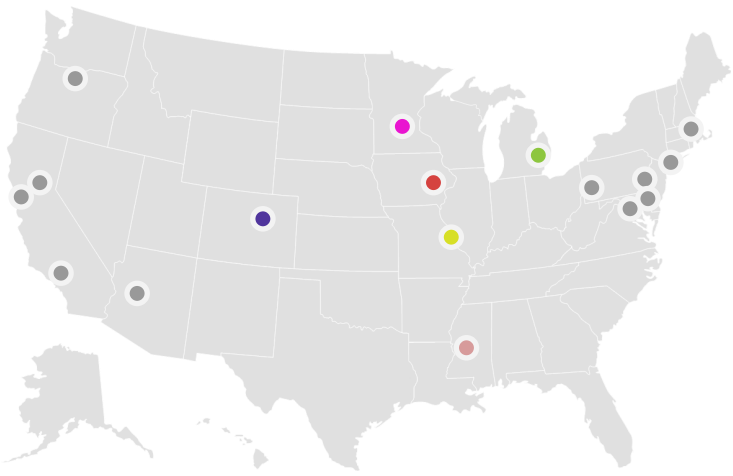
Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	1	97	-	-	Methamp.	7	380±260	410	7.8->1000
Fentanyl	6	6.5±7.8	2.5	<1-20	Amp.	6	48±30	42	9.9-92
Norfentanyl	5	3.2±1.3	2.6	<1-5.2	BZE	3	20±11	27	4.2-30
Naloxone	4	60±77	9.2	<1-170					

LOS ANGELES, CA (N=12)

- 83% positive for at least one opioid or stimulant
- Fentanyl (67%) was the primary opioid detected, followed by heroin (8%)
- Methamphetamine (83%) was the primary stimulant detected
- Combined opioid and stimulant use was observed (67%)
- THC and metabolites detected (17%)
- *Note: Xylazine and p-fluorofentanyl were not detected*
- NPS: MDMB-4en-PINACA (8%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	1	9.9	-	-	Methamp.	10	340±310	240	4.6-960
Fentanyl	10	9.2±6.6	5.7	<1-24	Amp.	10	65±84	22	<1-280
Norfentanyl	7	8.0±9.5	3.6	<1-29	BZE	3	180±30	180	<1-210
Naloxone	6	104±202	2.1	<1-510					

CENTRAL REGION



ST. LOUIS, MO (N=75)

- 92% positive for at least one opioid or stimulant
- Fentanyl (76%) was the primary opioid detected, followed by tramadol (5%) and methadone (4%)
- Methamphetamine (33%) and cocaine (22%) were the primary stimulants detected
- Combined opioid and stimulant use was observed (53%)
- Xylazine was detected alongside fentanyl (31%)
- NPS: *p*-Fluorofentanyl (11%), 2-Fluoro-2-oxo PCE (5%), Bromazolam (4%), Flubromazepam (3%), *N*-Desethyl Etonitazene (1%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	8	201±130	170	21-390	Cocaine	20	5.9±3.5	5.9	<1-9.4
Fentanyl	57	8.4±8.0	4.9	<1-32	BZE	45	280±260	215	<1->1000
Norfentanyl	53	6.7±11	2.8	<1-65	Xylazine	21	20±42	2.3	<1-150
Methamp.	26	95±110	52	<1-540	Bromazolam	3	82±33	63	55-130
Amp.	25	16±21	7.8	<1-83	Flubromazepam	2	-	-	<5->500
Naloxone	29	6.6±4.9	5.8	<1-19					

JACKSON, MS (N=12)

- 92% positive for at least one opioid or stimulant
- Fentanyl (67%) was the primary opioid detected, followed by methadone (8%) and oxycodone (8%)
- Methamphetamine (67%) was the only stimulant detected
- Combined opioid and stimulant use was identified (50%)
- *Note: Xylazine and p-fluorofentanyl were not detected*
- NPS: Bromazolam (8%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	8	18±36	3.0	<1-100	Methamp.	8	280±304	170	11->1000
Norfentanyl	7	68±93	3.5	<1-200	Amp.	8	51±46	27	2.4-130
BZE	2	27±26	26	<1-59					

MINNEAPOLIS, MN (N=10)

- 100% positive for at least one opioid or stimulant
- Fentanyl (80%) was the only opioid identified
- Methamphetamine (70%) was the primary stimulant detected
- Combined opioid and stimulant use was observed (50%)
- *Note: Xylazine and p-fluorofentanyl not detected*
- NPS: Bromazolam (10%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	1	20	-	-	Cocaine	1	3.4	-	-
Fentanyl	8	2.6±1.0	3.0	<1-4.0	BZE	1	>1000	-	-
Norfentanyl	6	1.2±0.2	1.1	<1-1.6	Naloxone	2	4.6±4.5	9.1	<1-9.1
Methamp.	8	99±110	32	<1-320	Bromazolam	1	16	-	-
Amp.	6	11±7.6	11	2.6-20					

DETROIT, MI (N=19)

- 95% positive for at least one opioid or stimulant
- Fentanyl (90%) was the primary opioid detected
- Methamphetamine (5%) and cocaine (5%) were detected
- Combined opioid and stimulant use was observed (37%)
- NPS: *p*-Fluorofentanyl (21%), Carfentanil (5%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	18	7.7±6.1	5.5	<1-22	Cocaine	8	1.2±0.1	1.2	<1-1.4
Norfentanyl	15	4.8±3.6	4.2	<1-14	BZE	13	230±208	160	26->1000
Methamp.	2	70±70	70	<1-140	Xylazine	2	4.5±4.4	4.5	<1-9.1
Amp.	1	6.4	-	-	Naloxone	5	1.9±1.8	1.0	<1-4.9

DENVER, CO (N=9)

- 89% positive for at least one opioid or stimulant
- Fentanyl (67%) was the only opioid detected
- Methamphetamine (56%) was the primary stimulant detected
- Combined opioid and stimulant use was observed (44%)
- No NPS were detected

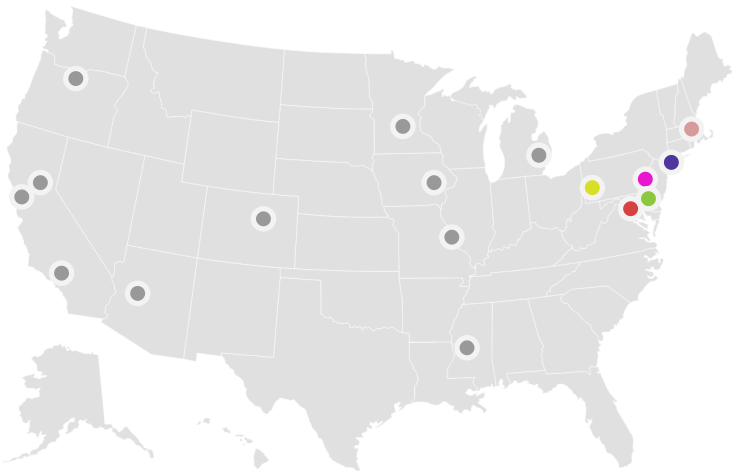
Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	6	4.8±1.5	4.6	<1-7.4	Methamp.	6	101±86	110	2.5->1000
Norfentanyl	6	2.0±0.8	2.0	<1-2.9	Amp.	6	25±29	14	9.9-88
Cocaine	1	8.1	-	-	Naloxone	4	5.6±1.6	5.6	3.9-7.4
BZE	4	30±27	30	<1->1000					

IOWA CITY, IA (N=5)

- 80% positive for at least one opioid or stimulant
- Oxycodone (80%) was the primary opioid detected, followed by fentanyl (60%) and morphine (20%)
- Methamphetamine was the only stimulant detected (20%)
- NPS: Bromazolam (20%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	4	1.9±0.4	1.9	<1-2.4	Naloxone	2	2.5±1.5	2.5	1.0-4.0
Methamp.	2	80±80	80	<1-160	Bromazolam	1	42	-	-
Amp.	1	20	-	-					

EAST REGION



WASHINGTON, DC (N=16)

- 94% positive for at least one opioid or stimulant
- Fentanyl (25%) was the primary opioid detected
- PCP (38%), methamphetamine (13%), & cocaine (13%) detected
- Combined stimulant and synthetic cannabinoid use was observed (44%)
- Xylazine was detected alongside fentanyl (13%)
- NPS: *N,N*-Dimethylpentylone (69%), Pentylone (38%), MDMB-4en-PINACA (38%), *N*-Cyclohexyl Butylone (6%), Methoxetamine (6%), ADB-BINACA (6%), ADB-INACA (6%), MDMB-INACA (6%), 4F-MDMB-BINACA (6%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	2	49±8.0	49	41-57	Cocaine	3	2.1±0.9	1.0	<1-2.1
Fentanyl	3	4.6±2.5	2.3	<1-4.6	BZE	8	230±320	60	<1->1000
Norfentanyl	3	3.7±1.0	3.7	<1-4.7	*N,N*-DMP	10	24±19	16	<10-63
Methamp.	2	2.2±1.0	1.1	<1-2.2	Pentylone	7	16±15	10	<10-54
Naloxone	3	6.7±3.7	4.9	3.4-12	Eutylone	3	25±22	10	<10-57

BALTIMORE, MD (N=27)

- 100% of samples positive for at least one opioid or stimulant
- Fentanyl (93%) was the primary opioid detected
- Cocaine (67%) was the only stimulant detected
- Combined opioid and stimulant use was common (67%)
- Xylazine was found alongside fentanyl (48%)
- NPS: Bromazolam (30%), *N*-Desethyl Isotonitazene (15%), *p*-Fluorofentanyl (15%), *N,N*-Dimethylpentylone (4%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	3	43±26	45	10-75	Cocaine	16	2.0±0.5	2.4	<1-2.5
Fentanyl	26	13±16	8.3	<1-77	BZE	24	310±210	260	<1->1000
Norfentanyl	25	17±29	6.6	<1-120	Bromazolam	8	50±21	44	<5-84
Xylazine	13	13±15	5.9	<1-48	*N*-Desethyl Isotonitazene	4	2.0±1.9	1.1	0.5-5.3
Naloxone	5	4.1±1.2	3.3	<1-5.8					

BOSTON, MA (N=4)

- 100% positive for at least one opioid or stimulant
- Fentanyl (75%) was the primary opioid detected
- Cocaine (25%) and MDMA (25%) were detected
- Xylazine was found alongside fentanyl (50%)
- NPS: *p*-Fluorofentanyl (25%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	3	5.4±2.7	6.7	1.7-8.0	BZE	2	410±407	410	4.1-820
Norfentanyl	3	3.2±1.0	2.5	2.5-4.7					

NEW YORK, NY (N=4)

- 75% positive for at least one opioid or stimulant
- Fentanyl (75%) was the primary opioid detected
- Cocaine (50%) was the primary stimulant identified
- Xylazine detected alongside fentanyl (25%)
- No NPS were detected

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	3	2.9±0.0	2.9	<1-2.9	Methamp.	1	>1000	-	-
Norfentanyl	3	6.2±3.2	8.5	1.7-8.6	Amp.	1	>1000	-	-
Naloxone	2	5.6±4.1	5.6	1.5-9.8	BZE	3	-	-	<1->1000

PITTSBURGH, PA (N=27)

- 88% of samples positive for at least one opioid or stimulant
- Fentanyl (67%) was the primary opioid detected
- Cocaine (41%) was the primary stimulant detected
- Combined opioid and stimulant use was common (52%)
- Xylazine was detected alongside fentanyl (41%)
- NPS: Bromazolam (15%), *p*-Fluorofentanyl (11%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	2	205±25	205	180-230	Methamp.	3	270±350	26	8.3-780
Fentanyl	18	9.4±11	5.0	<1-48	Amp.	3	10±10	4.8	1.5-25
Norfentanyl	18	5.8±7.1	2.3	<1-27	Cocaine	12	2.1±0.8	2.1	<1-2.9
Xylazine	9	10±15	6.0	<1-48	BZE	21	260±180	330	<1->1000
Naloxone	3	6.4±4.3	6.0	1.3-12	Bromazolam	4	170±120	170	30-310

PHILADELPHIA, PA (N=12)

- 100% positive for at least one opioid or stimulant
- Fentanyl (67%) & oxycodone (58%) were primary opioids detected
- Cocaine (58%) was the primary stimulant detected
- Xylazine was found alongside fentanyl (42%)
- NPS: Etizolam (25%), Bromazolam (8%), Metonitazene (8%), Protonitazene (8%)

Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Fentanyl	8	10±12	4.3	<1-38	BZE	7	210±230	120	4.7->1000
Norfentanyl	7	11±16	3.4	<1-48	Naloxone	3	1.8±0.4	1.9	1.2-2.3
Xylazine	5	7.1±4.0	7.0	<1-12	Bromazolam	1	46	-	-
Methamp.	1	28	-	-	Metonitazene	1	1.0	-	-
Amp.	1	14	-	-					