



July 20, 2023

Subject: Report on Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Dear Stakeholders:

The enclosed report provides prevalence data of Novel Synthetic Opioids (NSO) and Xylazine in 2022 Accidental Overdose Deaths in the City and County of San Francisco. It is published by the Office of the Chief Medical Examiner (OCME), Forensic Laboratory Division, in response to a state grant aimed at determining the presence of potent novel synthetic opioids in fatal accidental overdoses and reporting these findings to policymakers.

The report reflects a high prevalence of previously undetected substances within the accidental overdose decedent population. Additionally, the findings highlight the presence of potent opioids and central nervous system depressant drugs, further contributing to the decedents' toxicological profile and increasing the likelihood of a fatal outcome.

Significantly, the report reveals the presence of a Novel Synthetic Opioid and/or Xylazine in 54 recently reported cases, establishing the prevalence of potent drugs circulating within the community. Furthermore, in line with the OCME's mission, these findings hold immense value as they not only inform public health initiatives but also enable a more comprehensive cause of death analysis to the public and families.

To achieve the grant objective, the OCME undertook the development, validation to national standards, and implementation of a comprehensive and sensitive method to detect over 250 novel synthetic opioids and prevalent drugs such as Xylazine. This developed technique was employed on the blood, urine other available biological samples from all available 2022 fatal accidental overdoses. The analysis of drug paraphernalia and material seized from the scene was further undertaken to determine the presence of novel drugs.

Results were confirmed by forensic standards before reporting and subsequently collated with case investigative information, pathology findings and previous toxicology data. Pertinent for accurate use of these reports is understanding the source of the data and its subsequent summarization process. Decedent demographic and case information were obtained from the OCME case management system.

The report is organized as follows:

- **drug prevalence** – chronological detections by month and prevalence of specific drug findings
- **demographics** – race, gender, age, fixed address status, fixed address location, and death location
- **drug prevalence in paraphernalia** – analysis of powders, pipes, straws, pushers, foil, and materials
- **drug monographs** – chemical, toxicological and epidemiological drug information
- **case series** – demographic, certified cause of death, original and new drug findings of each case
- **scope of reanalysis testing** – list of specific drugs and limits of detection in blood and urine

Of the 647 total Accidental Overdose cases in 2022, 617 cases were able to be re-analyzed.

Key prevalence findings were:

- A Novel Synthetic Opioid and/or Xylazine was newly identified in 54 cases
- One or more Novel Synthetic Opioid was identified in 48 cases
- Fluoro Fentanyl (a Novel Synthetic Opioid) was identified in 45 cases
- Other Novel Synthetic Opioids (Fentanyl Analogs and an Utopioid) were identified in 12 cases
- Xylazine (Veterinary Tranquiller) was identified in 15 cases

Literature review on drug data was described in detail for newly detected prevalent drugs, and in brief for all other newly detected drugs.

Key drug information findings were:

- The potency of different Fluoro Fentanyl isomers ranges from half to up to five times the potency of fentanyl.
- The highest prevalence and first observations of Fluoro Fentanyl, other NSO drugs and Xylazine, are from the East Coast of the United States.
- The findings in this report are some of the first reports from California and the West Coast, and suggests a migration of novel drug use across the country, akin to fentanyl use from 2013 to 2016.

Detailed case information for the 54 cases of new NSO and/or Xylazine identifications were obtained.

Key case series findings were:

- Although Fluoro Fentanyl was commonly detected in previously determined Fentanyl positive casework, Fluoro Fentanyl was the only opioid detected in several cases that contained only a stimulant such as methamphetamine and cocaine.
- All Xylazine detections in casework also contained Fentanyl.

Of the Accidental Overdose 2022 Cases, 137 paraphernalia items were available for analysis.

Key prevalence findings of paraphernalia were:

- Fluoro Fentanyl was observed in paraphernalia and/or drug material for 34 cases. Of these, all but one were positive for Fluoro Fentanyl in the decedent's biological samples.
- For cases in which fentanyl was detected in the decedent, precursors and/or byproducts of illicit Fentanyl production were consistently observed in paraphernalia material.
- Glass pipes, white powder and aluminum foil paraphernalia were found to contain the highest number of detected drugs

Sincerely,



Luke N. Rodda, Ph.D.

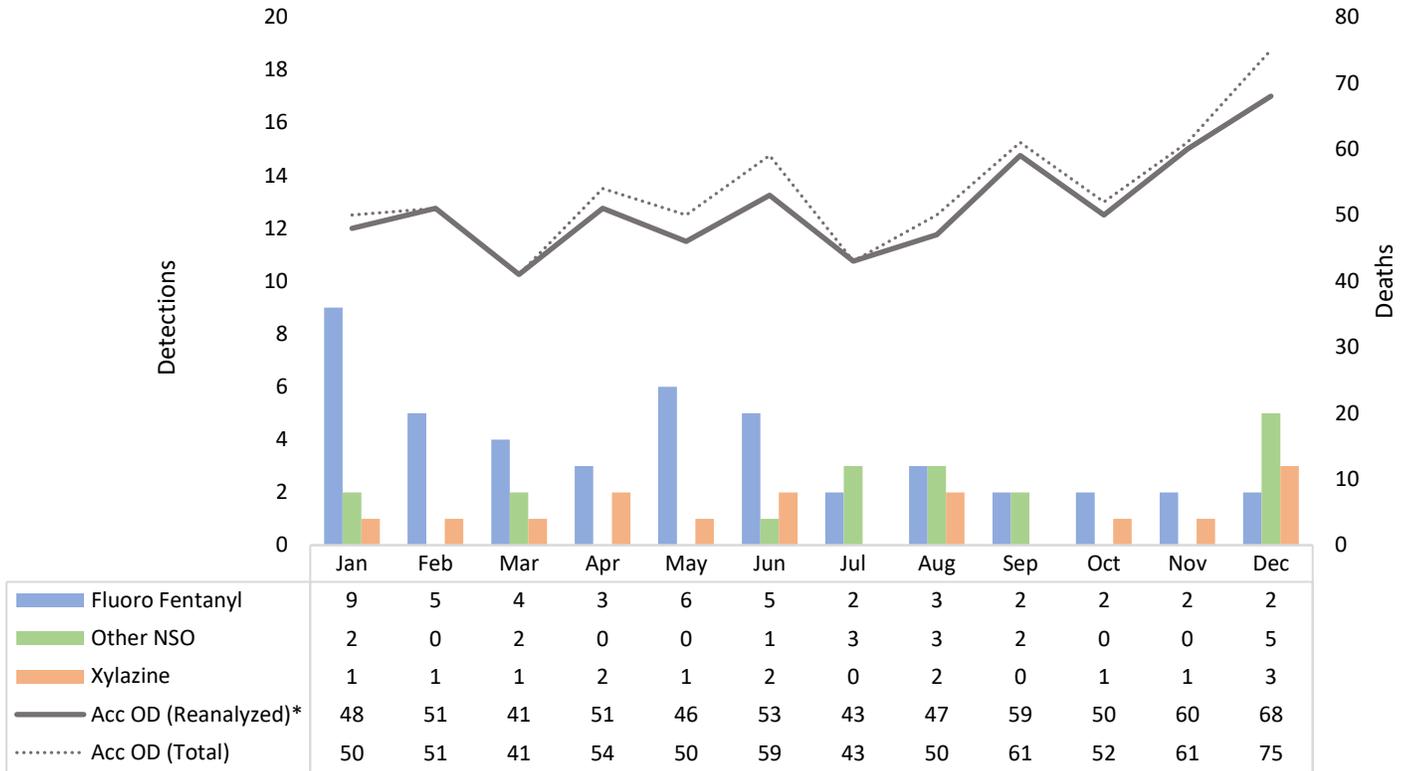
Chief Forensic Toxicologist and Director, Forensic Laboratory Division

cc: Office of the City Administrator
California Department of Public Health, Substance and Addiction Prevention Branch
enclosures: Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses Report



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Prevalence



Total Cases	9%	54
<i>Novel Synthetic Opioid</i>		
<i>Veterinary Tranquilizer</i>		
Novel Synthetic Opioid (Fentanyl Analog)	8%	48
Fluoro Fentanyl	7%	45
<i>[meta-/ortho-/para-]Fluoro Fentanyl</i>	6%	40
<i>Despropionyl para-Fluoro Fentanyl</i>	4%	24
<i>Despropionyl ortho-Fluoro Fentanyl</i>	<1%	2
Acryl Fentanyl	1%	5
3',4'-Dimethoxy Fentanyl	1%	4
N,N-Dimethylamindodespropionyl Fentanyl	<1%	2
Fluoro Furanyl Fentanyl	<1%	1
<i>[meta-/ortho-/para-]Fluoro Furanyl Fentanyl</i>	<1%	1
Benzyl Acryl Fentanyl	<1%	1

Novel Synthetic Opioid (Fentanyl Analog) – continued		
Chloro Fentanyl	<1%	1
<i>ortho-Chloro Fentanyl</i>	<1%	1
Chloro Cyclopropyl Fentanyl	<1%	1
<i>para-Chloro Cyclopropyl Fentanyl</i>	<1%	1
Fluoro Acetyl Fentanyl	<1%	1
<i>para-Fluoro Acetyl Fentanyl</i>	<1%	1
Tetrahydrofuran Fentanyl / Tetrahydrofuran Fentanyl 3-Tetrahydrofurancarboxamide	<1%	1
Novel Synthetic Opioid (Utopioid)	<1%	1
N-Desmethyl U-47700	<1%	1
Veterinary Tranquilizer	2%	15
Xylazine	2%	15

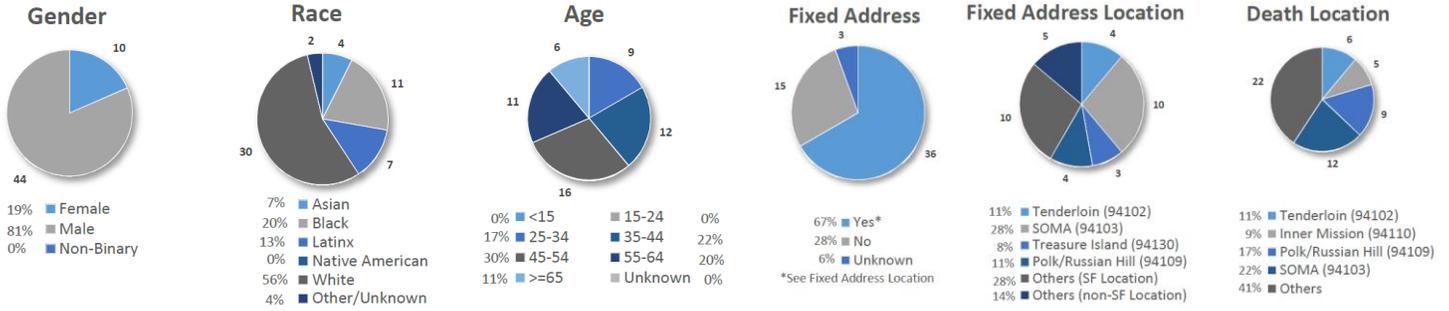
* Of the 647 total Accidental Overdose 2022 cases, 617 cases were able to be re-analyzed.



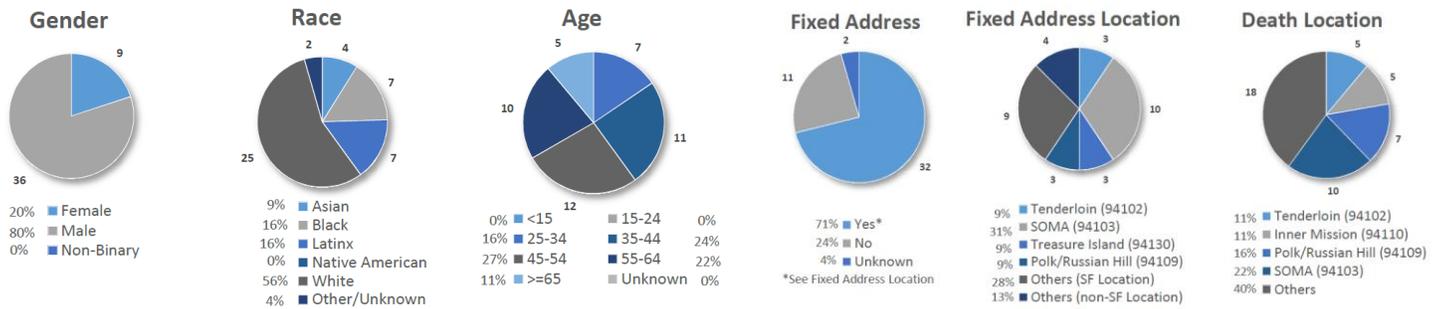
Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Demographics

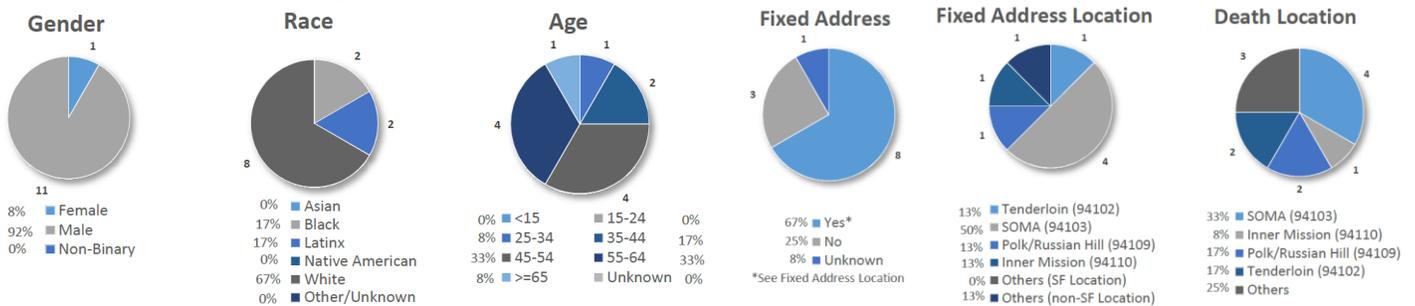
All Accidental Overdoses containing one or more NSO and/or Xylazine (54 cases):



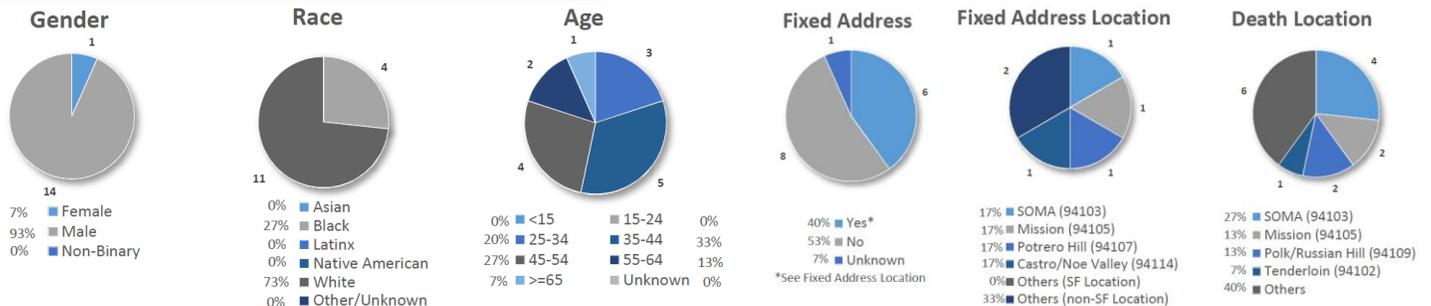
Accidental Overdoses containing Fluoro Fentanyl (45 cases):



Accidental Overdoses containing Other NSO (12 cases):



Accidental Overdoses containing Xylazine (15 cases):





Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Prevalence in Paraphernalia Analysis

Drug Class, Drug, Paraphernalia	Cases*
Novel Synthetic Opioid (Fentanyl Analog)	35
Fluoro Fentanyl	34
<i>[3'-/2'-Fluoro ortho-/3'-Fluoro ortho-/meta-/ortho-/para-]Fluoro Fentanyl</i>	33
<i>Glass pipe</i>	25
<i>Powder material</i>	13
<i>Aluminum foil</i>	7
<i>Straw</i>	7
<i>Plastic baggie/bindle</i>	6
<i>Syringe</i>	5
<i>Crystal substance</i>	3
<i>Pusher/Plunger</i>	2
<i>Cooker</i>	2
<i>Brown substance</i>	1
<i>Copper pad</i>	1
<i>Pill</i>	1
<i>Despropionyl meta-/ortho-/para-Fluoro Fentanyl</i>	26
<i>Glass pipe</i>	15
<i>Powder material</i>	11
<i>Aluminum foil</i>	8
<i>Straw</i>	7
<i>Plastic baggie/bindle</i>	4
<i>Pusher/Plunger</i>	2
<i>Cooker</i>	1
<i>Crystal substance</i>	1
<i>Syringe</i>	1
<i>Brown substance</i>	1
Despropionyl meta-/ortho-/para-Methyl Fentanyl	24
<i>Aluminum foil</i>	10
<i>Glass pipe</i>	10
<i>Straw</i>	6
<i>Powder material</i>	5
<i>Cooker</i>	1
<i>Plastic baggie/bindle</i>	1
<i>Syringe</i>	1
<i>Brown substance</i>	1
Phenyl Fentanyl	22
<i>Glass pipe</i>	8
<i>Aluminum foil</i>	6
<i>Powder material</i>	6
<i>Plastic baggie/bindle</i>	2
<i>Straw</i>	2
<i>Cooker</i>	1
Acryl Fentanyl	17
<i>Glass pipe</i>	9
<i>Straw</i>	6
<i>Powder material</i>	5
<i>Aluminum foil</i>	3
<i>Pusher/Plunger</i>	2
<i>Crystal substance</i>	2
<i>Syringe</i>	1
<i>Cooker</i>	1
<i>Plastic bindle</i>	1



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Prevalence in Paraphernalia Analysis

Drug Class, Drug, Paraphernalia	Cases*
Novel Synthetic Opioid (Fentanyl Analog)	35
Methoxyacetyl Fentanyl	14
Aluminum foil	9
Straw	5
Glass pipe	4
Syringe	3
Powder material	1
Pusher/Plunger	1
Brown unknown substance	1
Acetyl Fentanyl	12
2'-/3'-/4'-/beta-/meta-/ortho-/para-Methyl Acetyl Fentanyl	7
Glass pipe	3
Plastic baggie/bundle	2
Powder material	1
Aluminum foil	1
2'-/3'-/4'-Acetyl Fentanyl	5
Glass pipe	2
Powder material	2
Aluminum foil	2
Carboxy Butyryl Fentanyl	12
Aluminum foil	5
Glass pipe	5
Straw	4
Powder material	2
Furanyl Fentanyl 3-Furancarboxamide	12
Aluminum foil	9
Glass pipe	6
Straw	4
Syringe	1
Brown substance	1
para-Bromo Fentanyl	8
Powder material	3
Glass pipe	3
Aluminum foil	2
Plastic bundle	1
Syringe	1
Pill	1
Cyclobutyl Fentanyl / Senecioyl Fentanyl / ortho-Methyl Cyclopropyl Fentanyl	7
Glass pipe	5
Aluminum foil	1
Straw	1
Cyclopentenyl Fentanyl	7
Glass pipe	3
Straw	3
Syringe	1
ortho-Methyl Furanyl Fentanyl	6
Aluminum foil	3



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Prevalence in Paraphernalia Analysis

Drug Class, Drug, Paraphernalia	Cases*
Novel Synthetic Opioid (Fentanyl Analog)	35
<i>Glass pipe</i>	2
<i>Straw</i>	1
<i>Brown substance</i>	1
Miscellaneous NSO*	19
Fentanyl Analog	16
<i>Glass pipe</i>	14
<i>Aluminum foil</i>	9
<i>Powder material</i>	5
<i>Straw</i>	4
<i>Plastic bindle</i>	1
<i>Cooker</i>	1
Fentanyl Analog Precursor/Metabolite	4
<i>Glass pipe</i>	2
<i>Aluminum foil</i>	2
Nitazene	1
<i>Glass pipe</i>	1
Veterinary Tranquilizer	14
Xylazine	14
<i>Glass pipe</i>	5
<i>Straw</i>	4
<i>Syringe</i>	2
<i>Aluminum foil</i>	1
<i>Pusher/Plunger</i>	1
<i>Pill</i>	1
<i>Powder material</i>	1
<i>Brown substance</i>	1
<i>Plastic bindle</i>	1

Note: Of the 647 Total Accidental Overdose 2022 Cases, 137 cases were reanalyzed due to paraphernalia submitted and fentanyl detected within the case.

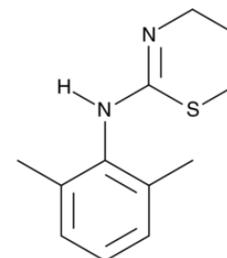
*Miscellaneous NSO include NSO that were detected in less than 5 cases.



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Monographs

Drug Name	Xylazine
Formula Name	N-(2,6-Dimethylphenyl)-5,6-dihydro-4H-1,3-thiazin-2-amine
Chemical Formula	C ₁₂ H ₁₆ N ₂ S
Drug Class	Veterinary drug
Molecular Weight	220.34 g/mol
Half-life	22-50 mins in animals ¹



Prevalence Data

As of March 2023, DEA has seized xylazine and fentanyl mixtures in 48 of 50 states²

- In 2022, approximately 23% of fentanyl powder and 7% of fentanyl pills seized by the DEA contained xylazine.²
- Between 2020 and 2021, xylazine identifications dramatically increased in the South (193%) and West (112%). During that time, drug toxicity deaths in which xylazine was detected increased by 1,127% in the South, 750% in the West, 516% in the Midwest and 103% in the Northeast.³
- Overdose data from 10 jurisdictions representing all four major US census regions:
 - Northeast: Highest prevalence region; xylazine was present in overdose deaths in Philadelphia, Pennsylvania (25.8% of overdose deaths in 2020), Maryland (19.3% in 2021), Connecticut (10.2% in 2020), and New Hampshire (1.2% in 2020).⁴
 - Midwest: Xylazine was present in overdose deaths in Cook County, Illinois (2.6% in 2021) and Milwaukee, Wisconsin (0.8% in 2020).⁴
 - South: Xylazine was present in overdose deaths in Harris County, Texas (0.4% in 2020) and Jefferson County, Alabama (8.4% in 2021).⁴
 - West: Lowest prevalence region; xylazine was present in overdose deaths in Phoenix, Arizona (0.1% in 2020 and 0% in 2021) and San Diego County, California (0.1% in 2020).⁴
- In 2015, a total xylazine prevalence of 0.36% was observed in the combined census regions. By 2020, this had grown to 6.7% of overdose deaths. The prevalence of xylazine from 2019–2020 alone increased by 44.8%.⁴

Precursors and Metabolites

- Major published equine urine metabolites are 4'-hydroxy-xylazine and 3'-hydroxy-xylazine with minor metabolites of 4-oxo-xylazine, and 2,6-dimethylaniline.⁵

¹ Garcia-Villar, R., Toutain, P. L., Alvinerie, M., & Ruckebusch, Y. (1981). The pharmacokinetics of xylazine hydrochloride: an interspecific study. *Journal of veterinary pharmacology and therapeutics*, 4(2), 87–92. <https://doi.org/10.1111/j.1365-2885.1981.tb00715.x>

² United States Drug Enforcement Administration (2023). DEA Reports Widespread Threat of Fentanyl Mixed with Xylazine. Public Safety Alert.

³ Canadian Center on Substance Use and Addiction (2023). An Update on Xylazine in the Unregulated Drug Supply: Harms and Public Health Responses in Canada and the United States. *CCENDU Bulletin*, pg. 5.

⁴ Friedman, J., Montero, F., Bourgeois, P., Wahbi, R., Dye, D., Goodman-Meza, D., & Shover, C. (2022). Xylazine spreads across the US: A growing component of the increasingly synthetic and polysubstance overdose crisis. *Drug and alcohol dependence*, 233, 109380. <https://doi.org/10.1016/j.drugalcdep.2022.109380>.

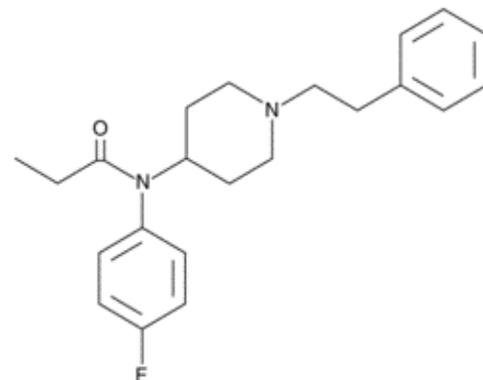
⁵ Spyridaki MH, Lyris E, Georgoulakis I, et al. Determination of xylazine and its metabolites by GC-MS in equine urine for doping analysis. *Journal of Pharmaceutical and Biomedical Analysis*. 2004 Apr; 35(1):107-116. DOI: 10.1016/j.jpba.2003.12.007.



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Monographs

Drug Name	Fluoro Fentanyl
Formula Name	N-(4-fluorophenyl)-N-[1-(2-phenylethyl)-4-piperidyl]propanamide ¹
Synonyms	ortho-Fluoro Fentanyl, meta-Fluoro Fentanyl, para-Fluoro Fentanyl, 2-Fluoro Fentanyl, 3-Fluoro Fentanyl, 4-Fluoro Fentanyl, FF, NIH 10491
Chemical Formula	C ₂₂ H ₂₇ FN ₂ O ¹
Drug Class	Novel synthetic opioid (Fentanyl analog)
Molecular Weight	354.5 g/mol
Potency	meta-Fluoro Fentanyl: 5-fold less potent than fentanyl ortho-Fluoro Fentanyl: Twice as potent as fentanyl para-Fluoro Fentanyl: 2.5-fold less potent than fentanyl ²
Scheduling	DEA Schedule I Controlled Substance



Prevalence Data

Of the Fluoro Fentanyl analogs listed in the above table, para-Fluoro Fentanyl is the most prevalent.

- From September 2020 to June 2021, para-Fluoro Fentanyl was involved in 1,658 (2.6%) of 64,915 overdose deaths reported by 42 states and the District of Columbia.³
- The deaths accounted for 3.9%, 2.9%, 1.9% and 1.1% of overdose deaths in included jurisdictions in the Northeast, South, Midwest, and West U.S. Census Bureau regions, respectively.⁴
- Six states—Illinois, Maryland, Michigan, New Jersey, Pennsylvania and Tennessee, reported more than 100 deaths involving para-Fluoro Fentanyl.⁴

Precursors and Metabolites

- Metabolites included N-dealkylation products (found to be the most abundant), hydroxylated metabolites, monohydroxylated metabolites (second most abundant), di-hydroxylated metabolites, and dihydrodiol metabolites.⁵
 - The following metabolites were detected in authentic urine samples: 2', 3' or 4'-hydroxy-fluorofentanyl; 4'-hydroxy-3'-methoxy-fluorofentanyl or 3'-hydroxy-4'-methoxy-fluorofentanyl; and norfluorofentanyl.⁵
- precursors of fluoro fentanyl include: despropionyl meta-fluoro fentanyl, despropionyl ortho-fluoro fentanyl, and despropionyl para-fluoro fentanyl.⁵

¹ The Center for Forensic Science Research & Education (2020). Fluorofentanyl.

² Truver, M. T., Chronister, C. W., Kinsey, A. M., Hoyer, J. L., & Goldberger, B. A. (2022). Toxicological Analysis of Fluorofentanyl Isomers in Postmortem Blood. *Journal of Analytical Toxicology*, 46(8), 835–843. <https://doi.org/10.1093/jat/bkac014>.

³ Higashikawa, Y., Suzuki, S. (2008). Studies on 1-(2-phenethyl)-4-(N-propionylanilino)piperidine (fentanyl) and its related compounds. VI. Structure-analgesic activity relationship for fentanyl, methyl-substituted fentanyls and other analogues. *Forensic Toxicol* 26, 1–5. <https://doi.org/10.1007/s11419-007-0039-1>.

⁴ Bitting J, O'Donnell J, Mattson CL. Notes from the Field: Overdose Deaths Involving Para-fluorofentanyl - United States, July 2020-June 2021. *MMWR Morb Mortal Wkly Rep*. 2022 Sep 30;71(39):1239-1240. doi: 10.15585/mmwr.mm7139a3. PMID: 36173752; PMCID: PMC9533727.

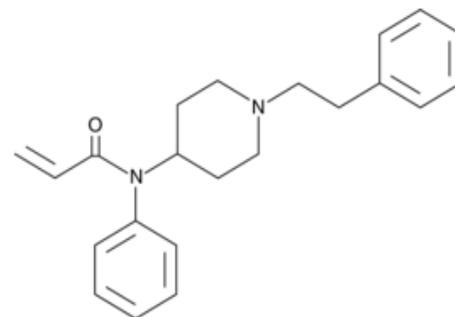
⁵ Watanabe, S., Vikingsson, S., Roman, M., et al. In vitro and in vivo metabolite identification studies for the new synthetic opioids acetylfentanyl, acrylfentanyl, furanylfentanyl, and 4-fluoro-isobutyrylfentanyl. *AAPS J*. 19(4), 1102-1122 (2017).



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Monographs

Drug Name	Acryl Fentanyl
Formula Name	N-phenyl-N-[1-(2-phenylethyl)-4-piperidinyl]-2-propenamamide
Synonyms	Acryloylfentanyl
Chemical Formula	C ₂₂ H ₂₆ N ₂ O
Drug Class	Novel synthetic opioid (Fentanyl analog)
Molecular Weight	334.5 g/mol
Potency	50-100 times more potent than morphine, similar to fentanyl. Less potent than other fentanyl analogs ¹
Scheduling	DEA Schedule I Controlled Substance



Prevalence Data

- From January-February 2017, 48% of accidental overdose decedents throughout 24 Ohio counties tested positive for acryl fentanyl.²
 - All of these specimens were also positive for fentanyl.
- Beginning in September 2016 until May 2017, the DEA received reports of 83 confirmed fatalities associated with acryl fentanyl. These fatalities occurred in Illinois (27), Maryland (22), New Jersey (1), Ohio (31), and Pennsylvania (2).³

Precursors and Metabolites

- Published synthesis routes of Acryl Fentanyl involve the acylation of 4-Anilino-N-Phenethylpiperidine (4-ANPP) with 3-chloropropionyl chloride or acryloyl chloride.⁴
- Major human urine metabolites include Acryl Norfentanyl.⁵

¹ New York State Office of Alcoholism and Substance Abuse Services (2017). National Heroin Coordination Group Statement on Naloxone Effectiveness. National Heroin Coordination Group.

² Daniulaityte, Ramintaq et al. (2017). Overdose Deaths Related to Fentanyl and Its Analogs — Ohio, January–February 2017. 66(34).

³ Schedules of Controlled Substances: Temporary Placement of Acryl Fentanyl Into Schedule I (2017). 82 FR 32453.

⁴ Ujváry, I., Jorge, R., Christie, R. et al. Acryloylfentanyl, a recently emerged new psychoactive substance: a comprehensive review. *Forensic Toxicol* 35, 232–243 (2017).

<https://doi.org/10.1007/s11419-017-0367-8>

⁵ Watanabe, S., Vikingsson, S., Roman, M., Green, H., Kronstrand, R., and Wohlfarth, A. (2017). In vitro and in vivo metabolite identification studies for the new synthetic opioids acetylfentanyl, acrylfentanyl, furanylfentanyl, and 4-fluoro-isobutyrylfentanyl. *AAPS J.* 19, 1102–1122. doi: 10.1208/s12248-017-0070-z



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Drug Monographs

Novel Synthetic Opioids	Chemical Formula	Molecular Weight (g/mol)	Drug Class	DEA Schedule	General Facts
3',4'-Dimethoxy Fentanyl	C ₂₄ H ₃₂ N ₂ O ₃	396.54	Fentanyl analog	I	
N,N-Dimethylamindo-despropionyl Fentanyl	C ₂₂ H ₂₉ N ₃ O	351.5	Fentanyl analog	I	
Fluoro Furanyl Fentanyl	C ₂₄ H ₂₅ FN ₂ O ₂	392.44	Fentanyl analog	I	Potency suspected to be similar to that of fentanyl
Benzyl Acryl Fentanyl	C ₂₁ H ₂₄ N ₂ O	320.44	Fentanyl analog		
Chloro Fentanyl	C ₂₂ H ₂₇ ClN ₂ O	370.94	Fentanyl analog	I	
Chloro Cyclopropyl Fentanyl	C ₂₃ H ₂₇ ClN ₂ O	382.94	Fentanyl analog	I	
Fluoro Acetyl Fentanyl	C ₂₁ H ₂₅ FN ₂ O	340.44	Fentanyl analog	I	
Tetrahydrofuran Fentanyl / Tetrahydrofuran Fentanyl 3-Tetrahydrofurancarboxamide	C ₂₄ H ₃₀ N ₂ O ₂	378.54	Fentanyl analog	I	
N-Desmethyl U-47700	C ₁₅ H ₂₀ Cl ₂ N ₂ O	315.2	Utopioid		Metabolite of U-47700
Acetyl Fentanyl	C ₂₁ H ₂₆ N ₂ O	322.44	Fentanyl Precursor/Fentanyl analog	I	Synonym: Desmethyl Fentanyl Prevalence: Reports to the DEA totaled 13,670 in 2019, 4,800 in 2020, and 3,925 in 2021 ¹ Potency: 15 times more potent than morphine; less potent than fentanyl ²
Acetyl Norfentanyl	C ₁₃ H ₁₈ N ₂ O	218.34	Fentanyl Precursor/Fentanyl analog		Metabolite of Acetyl Fentanyl with similar potency
4-Anilino N-Phenethylpiperidine (4-ANPP)	C ₁₉ H ₂₄ N ₂	280.4	Fentanyl Precursor/Metabolite	II	
beta-Hydroxy Fentanyl	C ₂₂ H ₂₈ N ₂ O ₂	352.5	Fentanyl Metabolite	I	
Benzyl Fentanyl	C ₂₁ H ₂₆ N ₂ O	322.4	Fentanyl Precursor	I	
N-Methyl Norfentanyl	C ₁₅ H ₂₂ N ₂ O	282.8	Fentanyl Precursor		
N-Phenethyl 4-Piperidone (NPP)	C ₁₃ H ₁₇ N ₂ O	203.28	Fentanyl Precursor	I	

Note: Half-life information is not available due to lack of data

¹ United States Drug Enforcement Administration (2023). Acetyl Fentanyl.

² Schueler H. E. (2017). Emerging Synthetic Fentanyl Analogs. Academic forensic pathology, 7(1), 36–40. <https://doi.org/10.23907/2017.004>



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Jan 6, 2022 M / 49 / White 94103 / 94103	Effects of Fentanyl and Methamphetamine	Fentanyl; Norfentanyl; Methamphetamine; Ephedrine/Pseudoephedrine; Amphetamine; Norephedrine/Norpseudoephedrine; THC; Carboxy THC	Fluoro Fentanyl; Fluoro Furanyl Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; NPP	Xylazine; Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Acryl Fentanyl; Cyclopentenyl Fentanyl; Furanyl Fentanyl 3- Furancarboxamide; Methyl Furanyl Fentanyl; Methoxyacetyl Fentanyl; N,N-Dimethylamindodespropionyl Fentanyl; para-Chloro Cyclobutyl Fentanyl; Phenyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; para-Bromo 4-ANPP; Fentanyl; 4-AP; 4-ANBP; 4-ANPP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; Ethyl 4-ANPP; N-Methyl Norfentanyl; N-Phenyl Propanamide; N-Propionyl Norfentanyl; Norfentanyl; NPP; Phenethyl 4-ANPP; Methamphetamine; Amphetamine; N,N-Dimethylamphetamine; Mephentermine; Lidocaine; Acetaminophen; Mannitol
Jan 7, 2022 M / 79 / Black 94102 / 94102	Cocaine Toxicity	Cocaine; Norcocaine; meta-/para-Hydroxy Cocaine; Cocaethylene; Benzoylecgonine; Anhydroecgonine Methyl Ester; Carboxy THC	Benzyl Acryl Fentanyl; 4-ANPP	Not Available
Jan 8, 2022 M / 46 / Black NFA / 94103	Acute Mixed Drug (Fentanyl and Methamphetamine) Intoxication	Fentanyl; Norfentanyl; Naloxone; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Cocaine; meta-/para-Hydroxy Cocaine; Benzoylecgonine; Olanzapine; Diphenhydramine; Norlidocaine	Xylazine; 4-ANPP; N-Methyl Norfentanyl	Not Available



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Jan 13, 2022 M / 65 / Black 94102 / 94109	Effects of Fentanyl, Heroin, Methamphetamine, And Cocaine	Fentanyl; Acetyl Fentanyl; Norfentanyl; Morphine; Codeine; 6-Monoacetylmorphine (6-MAM); Norcodeine; Hydromorphone; Cocaine; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Benzoyllecgonine; THC; Doxylamine	Fluoro Fentanyl ; 4-ANPP; beta-Hydroxy Fentanyl	Fentanyl; Methamphetamine; Cocaine
Jan 20, 2022 M / 65 / White 94109 / 94109	Mixed Drugs (Methamphetamine, Fentanyl)	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Benzoyllecgonine; 7-Amino Clonazepam; THC; Carboxy THC; Gabapentin; Amitriptyline; Nortriptyline; Citalopram/Escitalopram; Hydroxyzine; Cetirizine/Levocetirizine; Norchlorcyclizine	Fluoro Fentanyl ; 4-ANPP; beta-Hydroxy Fentanyl	Fluoro Fentanyl ; Despropionyl para-Fluoro Fentanyl ; para-Bromo Fentanyl ; Phenyl Fentanyl ; Fentanyl; 4-AP; 4-ANPP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; N-Phenethyl 4-Piperidone (NPP); Phenethyl 4-ANPP; para-Fluoro Phenethyl 4-ANPP; Methamphetamine; Mannitol
Jan 21, 2022 M / 67 / Unknown 94130 / 94130	Toxic Effects of Methamphetamine and Cocaine	Cocaine; Benzoyllecgonine; Methamphetamine; Amphetamine; meta-/para-Hydroxy Cocaine; Norephedrine/Norpseudoephedrine; Norchlorcyclizine; Cetirizine/Levocetirizine	Fluoro Fentanyl ; Despropionyl para-Fluoro Fentanyl ; Papaverine	Not Available
Jan 25, 2022 M / 50 / Latinx 94130 / 94130	Toxic Effects of Fentanyl and Methamphetamine	Fentanyl; Norfentanyl; Naloxone; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Olanzapine	Despropionyl para-Fluoro Fentanyl ; 4-ANPP; N-Methyl Norfentanyl; 4-Anilino piperidine (4-AP); beta-Hydroxy Fentanyl	Fentanyl; Norfentanyl; 4-ANPP; Methamphetamine; Amphetamine; Mannitol
Jan 27, 2022 M / 63 / White 94109 / 94109	Effects of Fentanyl and Methamphetamine	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Benzoyllecgonine;	Despropionyl para-Fluoro Fentanyl ; 4-ANPP	Methamphetamine; Amphetamine; Mephentermine; Cocaine; Anhydroecgonine Methyl Ester; THC; Cannabinol;



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
		Carboxy THC; Doxepin; Nordoxepin		Cannabidiol; Cannabichromene; Acetaminophen; Ibuprofen; Diphenhydramine
Jan 28, 2022 M / 47 / White NFA / 94102	Toxic Effects of Fentanyl, Methamphetamine and Cocaine	Fentanyl; Norfentanyl; Cocaine; Benzoylcegonine; Methamphetamine; Amphetamine; meta-/para-Hydroxy Cocaine	Fluoro Fentanyl ; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl	Not Available
Jan 29, 2022 M / 40 / White 94102 / 94102	Toxic Effects of Heroin, Fentanyl, Methadone and Methamphetamine	Fentanyl; Norfentanyl; 6-Monoacetylmorphine (6-MAM); Morphine; Codeine; Norcodeine; Methadone; Naloxone; Hydrocodone; Hydromorphone; EDDP (Methadone Metabolite); Methamphetamine; Amphetamine; Norephedrine/Norpseudoephedrine; 9-Hydroxy Risperidone	Despropionyl para-Fluoro Fentanyl ; 4-ANPP; beta-Hydroxy Fentanyl; Papaverine	Fentanyl; Monoacetylmorphine; Morphine; Codeine; Papaverine; Noscapine; Cocaine; Heroin; THC; Cannabinol Ibuprofen; Laudanosine
Jan 31, 2022 M / 47 / White 96001 / 94109	Acute Mixed Drug (Heroin and Fentanyl) Intoxication	Fentanyl; Norfentanyl; 6-Monoacetylmorphine (6-MAM); Morphine; Codeine; Hydromorphone; Norcodeine; Mirtazapine; Sertraline; Norsertaline	Despropionyl para-Fluoro Fentanyl	Not Available
Feb 13, 2022 M / 59 / White 94122 / 94122	Mixed Drugs (Fentanyl, Ethanol)	Fentanyl; THC; Cannabigerol (CBG); Cannabinol (CBN); Carboxy THC; Gabapentin; Acetaminophen; Ethanol	Fluoro Fentanyl	4-ANPP; Wintergreen; Salsalate



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Feb 18, 2022 M / 44 / White NFA / 94109	Acute Mixed Drug (Fentanyl, Heroin and Methamphetamine) Intoxication	Fentanyl; Norfentanyl; 6-Monoacetylmorphine (6-MAM); Morphine; Naloxone; Tramadol; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Cocaine; Benzoylcegonine; Carboxy THC; Lidocaine; Norlidocaine	Despropionyl para-Fluoro Fentanyl; Xylazine; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; NPP	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Xylazine; alpha'-Methoxy Fentanyl / para- Hydroxy Butyryl Fentanyl / ortho- Methyl Methoxyacetyl Fentanyl / Ethoxyacetyl Fentanyl; Carboxy Butyryl Fentanyl; Cyclobutyl Fentanyl / Senecieryl Fentanyl / ortho-Methyl Cyclopropyl Fentanyl; Furanyl Fentanyl 3- Furancarboxamide; para-Chloro Methoxyacetyl Fentanyl; Phenyl Fentanyl; Tetrahydrofuran Fentanyl / Tetrahydrofuran Fentanyl 3- Tetrahydrofurancarboxamide; Despropionyl ortho-Methyl Fentanyl; Fentanyl; N-Phenyl Propanamide; N-Propionyl Norfentanyl; 4-AP; 4-ANBP; 4-ANPP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; NPP; para-Bromo 4-ANPP; Phenethyl 4-ANPP; Heroin; Monoacetylmorphine; Papaverine; Morphine; Methamphetamine; Amphetamine; THC; Cannabinol; Cannabichromene; Lidocaine; Mannitol; Ibuprofen; Tramadol; Nicotine
Feb 20, 2022 M / 43 / White 94134 / 94134	Acute Mixed Drug (Fentanyl and Methamphetamine) Intoxication	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Methamphetamine; THC; Cannabinol (CBN); Tetrahydrocannabinol Acid; (THCA); Trazodone; Olanzapine; Risperidone; 9-Hydroxy Risperidone	Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; beta-Hydroxy Fentanyl; NPP	Not Available



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Feb 24, 2022 M / 43 / White 94102 / 94102	Toxic Effects of Fentanyl, Etizolam, Flualprazolam, Flubromazepam, Alprazolam, Cocaine, And Methamphetamine	Fentanyl; Norfentanyl; Cocaine; Norcocaine; meta-/para-Hydroxy Cocaine; Benzoyllecgonine; Anhydroecgonine Methyl Ester; Methamphetamine; Cocaethylene; Etizolam; Flualprazolam; Flubromazepam; Alprazolam; alpha-Hydroxy Alprazolam; THC; Cannabigerol (CBG); Cannabinol (CBN); Mitragynine; Lidocaine; Norlidocaine; Carboxy THC; Ethanol	Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; NPP	Fluoro Fentanyl; Despropionyl Fluoro Fentanyl; Fentanyl; Acryl Fentanyl; ortho-Isopropyl Furanyl Fentanyl; 4-AP; 4-ANPP; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; N-Phenethyl 4-Piperidone (NPP); para-Fluoro 4-ANBP; Methamphetamine; Cocaine; Tropacocaine; Norcocaine; Anhydroecgonine Methyl Ester; cis-Cinnamoyl Cocaine; Lidocaine; Levamisole
Feb 28, 2022 M / 34 / Black NFA / 94107	Fentanyl Toxicity	Fentanyl; Norfentanyl; Methamphetamine; Lidocaine; Norlidocaine	Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl	Not Available
Mar 6, 2022 M / 52 / White 94130 / 94130	Mixed Drug (Methamphetamine, Fentanyl) Toxicity	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Diazepam; Nordiazepam; Norchlorcyclizine	Fluoro Fentanyl; 4-ANPP	4-ANPP; Methamphetamine; Diazepam
Mar 7, 2022 M / 54 / Latinx 94103 / 94103	Probable Fentanyl Toxicity	Fentanyl; Norfentanyl; 11-Hydroxy THC; Carboxy THC; Cannabidiol (CBD); Gabapentin; O-/N-Desmethyl Venlafaxine; Venlafaxine	Fluoro Fentanyl; 4-ANPP	Not Available
Mar 16, 2022 M / 50 / White 94103 / 94103	Toxic Effects of Fentanyl, Acetyl Fentanyl, Phenobarbital, And Alprazolam	Fentanyl; Acetyl Fentanyl; Norfentanyl; Methadone; Benzoyllecgonine; Phenobarbital; Alprazolam; alpha-Hydroxy Alprazolam; 7-Amino Clonazepam; Gabapentin; Topiramate;	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Xylazine; Acryl Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP	Not Available



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
		Norchlorcyclizine; Diphenhydramine; Acetaminophen; Cetirizine/Levocetirizine; Salicylic Acid; Ethanol		
Mar 18, 2022 M / 52 / Black 94109 / 94109	Mixed Drug (Methamphetamine, Fentanyl) Toxicity	Fentanyl; Norfentanyl; Naloxone; Methamphetamine; Amphetamine; Ethanol	para-Chloro Cyclopropyl Fentanyl	Not Available
Mar 23, 2022 M / 67 / Black 94109 / 94109	Cocaine Toxicity	Cocaine; Cocaethylene; Benzoylcegonine; meta-/para-Hydroxy Cocaine; Acetaminophen; Salicylic Acid	Fluoro Fentanyl Despropionyl para- Fluoro Fentanyl	Not Available
Apr 20, 2022 F / 35 / White 94107 / 94107	Mixed Drug Toxicity (Fentanyl, Heroin, Methamphetamine)	Fentanyl; Acetyl Fentanyl; Norfentanyl; Morphine; Codeine; Norcodeine; Hydromorphone; Buprenorphine; Norbuprenorphine; Naloxone; Methamphetamine; Amphetamine; Norephedrine/Norpseudoephedrine; Gabapentin; Fluoxetine; Norfluoxetine; Cetirizine/Levocetirizine; Norchlorcyclizine	Fluoro Fentanyl; 4-ANPP; Papaverine	4-ANPP
Apr 22, 2022 F / 36 / Black NFA / 94118	Toxic Effects of Fentanyl, Oxycodone, Methadone, Cocaine, And Methamphetamine	Fentanyl; Norfentanyl; Hydromorphone; Methadone; EDDP (Methadone Metabolite); Noroxycodone; Oxymorphone; Cocaine; Norcocaine; meta-/para-Hydroxy Cocaine; Benzoylcegonine; Anhydroecgonine Methyl Ester; Methamphetamine; Amphetamine; Lidocaine; Norlidocaine	Xylazine 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl	N-Phenyl Promanamide; N-Propionyl Norfentanyl; N-Methyl Norfentanyl; Fluoro Fentanyl; Fentanyl; 4-ANPP; Cocaine; Tropacocaine; Norcocaine; Anhydroecgonine Methyl Ester; Lidocaine; Acetaminophen; Nicotine; Gabapentin; Xylazine



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Apr 23, 2022 M / 32 / Black NFA / 94103	Acute Mixed Drug (Fentanyl, Heroin, Cocaine and Methamphetamine) Intoxication	Fentanyl; Norfentanyl; 6-Monoacetylmorphine (6-MAM); Morphine; Codeine; Naloxone; Norcodeine; Cocaine; Norcocaine; meta-/para-Hydroxy Cocaine; Cocaethylene; Benzoylcegonine; Anhydrocegonine Methyl Ester; Methamphetamine; Amphetamine; THC; Carboxy THC; Tetrahydrocannabinol Acid (THCA); Lidocaine; Norlidocaine; Norephedrine/Norpseudoephedrine	Xylazine; Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP; Papaverine	Fluoro Fentanyl; Xylazine; Acryl Fentanyl; Carboxy Butyryl Fentanyl; Cyclopentenyl Fentanyl; Methoxyacetyl Fentanyl; ortho-Methyl Furanyl Fentanyl; para-Chloro Methoxyacetyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Despropionyl para-Fluoro Fentanyl; Fentanyl; 4-AP; 4-ANBP; 4-ANPP; Acetyl Norfentanyl; Benzyl Fentanyl; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; NPP; para-Bromo 4-ANPP; Papaverine; Cocaine; Tropacocaine; Norcocaine; Anhydrocegonine Methyl Ester; Mannitol
Apr 24, 2022 F / 48 / White NFA / 94133	Fentanyl and Methamphetamine Toxicity	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; THC; 11-Hydroxy THC; Carboxy THC; Lidocaine; Norlidocaine	Fluoro Fentanyl; 4-ANPP; beta-Hydroxy Fentanyl; NPP	Methamphetamine
May 2, 2022 M / 27 / Pacific Islander- Hawaiian NFA / 94110	Toxic Effects of Fentanyl and Methamphetamine	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Benzoylcegonine; THC; 11-Hydroxy THC; Carboxy THC;	Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Carboxy Butyryl Fentanyl; Furanyl Fentanyl 3- Furancarboxamide; meta-Methyl Furanyl Fentanyl / para- Methyl Furanyl Fentanyl; Methoxyacetyl Fentanyl; ortho-Methyl Furanyl Fentanyl; para-Bromo Fentanyl; para-Methoxy Methoxyacetyl Fentanyl; Phenyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Fentanyl; 4-AP; 4-ANBP; 4-ANPP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; NPP;



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
				para-Bromo 4-ANPP; Methamphetamine
May 12, 2022 F / 35 / Asian 94928 / 94110	Mixed Drug (Fentanyl, Cocaine, Methamphetamine) Toxicity	Fentanyl; Norfentanyl; Naloxone; Cocaine; Benzoyllecgonine; Methamphetamine; Amphetamine	Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; NPP	Not Available
May 17, 2022 M / 34 / Black Unknown / 94108	Acute Mixed Drug (Fentanyl and Methamphetamine) Intoxication	Fentanyl; Norfentanyl; Dextromethorphan/Levomethorphan; Naloxone; Dextrorphan/Levorphanol; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Benzoyllecgonine; THC; 11-Hydroxy THC; Carboxy THC; Tetrahydrocannabinol Acid (THCA)	Fluoro Fentanyl; 4-ANPP	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Benzyl Acryl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Phenyl Fentanyl; Thiophene Fentanyl; Fentanyl; 4-AP; 4-ANBP; 4-ANPP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; NPP; para-Bromo 4-ANPP; Papaverine
May 17, 2022 F / 53 / Latinx 94103 / 94103	Probable Acute Mixed Drug (Fentanyl and Cocaine) Intoxication	Fentanyl; Norfentanyl; Hydrocodone; Norhydrocodone; Methadone; EDDP (Methadone Metabolite); Cocaine; Norcocaine; meta-/para-Hydroxy Cocaine; Benzoyllecgonine; Anhydroecgonine Methyl Ester; N-Desmethyl Cyclobenzaprine; Doxepin; Nordoxepin; Venlafaxine; O-/N-Desmethyl Venlafaxine; Levetiracetam; Topiramate; Norchlorcyclizine; Acetaminophen	Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Xylazine; Acryl Fentanyl; para-Bromo Fentanyl; Phenyl Fentanyl; Fentanyl; 4-AP; 4-ANPP; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; NPP; para-Bromo 4-ANPP; Phenethyl 4-ANPP; Papaverine; Thebaine; Cocaine; Tropacocaine; Norcocaine; Anhydroecgonine Methyl Ester; Acetaminophen; Baclofen; Trazodone
May 19, 2022 M / 56 / Latinx 94112 / 94112	Toxic Effects of Cocaine and Ethanol	Cocaine; meta-/para-Hydroxy Cocaine; Cocaethylene; Benzoyllecgonine; Anhydroecgonine Methyl Ester; Norcocaine; Ethanol	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl	Not Available



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
May 23, 2022 M / 45 / White 94114 / 94114	Probable Acute Mixed Drug (Fentanyl, Cocaine and Alprazolam) Intoxication	Fentanyl; Norfentanyl; Cocaine; Cocaethylene; Benzoyllecgonine; Norcocaine; meta-/para-Hydroxy Cocaine; Anhydroecgonine Methyl Ester; Alprazolam; alpha-Hydroxy Alprazolam; Acetaminophen; Ethanol	Xylazine	Not Available
May 24, 2022 M / 51 / White 94103 / 94103	Mixed Drug Toxicity (Fentanyl, Methamphetamine)	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ethanol	Despropionyl ortho-Fluoro Fentanyl; 4-ANPP	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Acryl Fentanyl; Benzyl Fentanyl; Fentanyl; 4-AP; 4-ANPP; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; NPP; para-Bromo 4-ANPP; Phenethyl 4-ANPP
Jun 7, 2022 M / 64 / White 94103 / 94103	Mixed Drug Toxicity (Fentanyl, Methamphetamine)	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Norephedrine/Norpseudoephedrine; Ephedrine/Pseudoephedrine; THC; Carboxy THC	3',4'-Dimethoxy Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP; Benzyl Fentanyl	Not Available
Jun 14, 2022 M / 38 / Asian NFA / 94115	Acute Fentanyl Intoxication	Fentanyl; Norfentanyl; THC; Carboxy THC; Olanzapine	Despropionyl ortho-Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl	Fluoro Fentanyl; Xylazine; Carboxy Butyryl Fentanyl; Cyclobutyl Fentanyl / Senecioyl Fentanyl / ortho-Methyl Cyclopropyl Fentanyl; Cyclopentenyl Fentanyl; Methoxyacetyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Fentanyl; 4-AP; 4-ANBP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; NPP; para-Bromo 4-ANPP; Cocaine; Anhydroecgonine Methyl Ester; Lidocaine



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Jun 17, 2022 M / 56 / White 10001 / 94105	Fentanyl and Cocaine Toxicity	Fentanyl; Norfentanyl; Cocaine; Cocaethylene; Benzoyllecgonine; Norcocaine; meta-/para-Hydroxy Cocaine; Alprazolam; Diazepam; Nordiazepam; Gabapentin; Trazodone; 1-(3-Chlorophenyl)-Piperazine (McPP); Cetirizine/Levocetirizine; Acetaminophen; Norchlorcyclizine; Ethanol	Despropionyl para-Fluoro Fentanyl; Xylazine; Fluoro Fentanyl; 4-ANPP; beta-Hydroxy Fentanyl	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Xylazine; 4-AP; 4-ANPP
Jun 18, 2022 M / 39 / White NFA / 94102	Toxic Effects of Fentanyl and Methamphetamine	Fentanyl; Norfentanyl; Naloxone; Methamphetamine; Amphetamine; Benzoyllecgonine; Citalopram/Escitalopram; Olanzapine	Xylazine; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; 4-ANPP; Papaverine; Methamphetamine; Cocaine; Anhydroecgonine Methyl Ester
Jun 18, 2022 F / 32 / White 94103 / 94103	Toxic Effects of Fentanyl, Heroin, And Methamphetamine	Fentanyl; Norfentanyl; 6-Monoacetylmorphine (6-MAM); Morphine; Codeine; Dihydrocodeine; Hydrocodone; Norhydrocodone; Naloxone; Norcodeine; Hydromorphone; Methamphetamine; Amphetamine; Norephedrine/Norpseudoephedrine; Ephedrine/Pseudoephedrine; Benzoyllecgonine; Acetaminophen	Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; Papaverine	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; Xylazine; Cyclopentenyl Fentanyl; Furanyl Fentanyl 3- Furancarboxamide; Methoxyacetyl Fentanyl; ortho-Methyl Furanyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Fentanyl; 4-ANPP; Benzyl Fentanyl; beta-Hydroxy Fentanyl; N-Methyl Norfentanyl; para-Bromo 4-ANPP; Monoacetylmorphine; Morphine; Papaverine; Methamphetamine; 4-Methylethcathinone; Heroin
Jul 5, 2022 M / 64 / White 94561 / 94143	Fentanyl Toxicity	Fentanyl; Acetyl Fentanyl; Norfentanyl; Naloxone; Methamphetamine; Amphetamine; Acetaminophen	3',4'-Dimethoxy Fentanyl; Acryl Fentanyl; N,N-Dimethylamindodespropionyl Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP;	Not Available



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
			Benzyl Fentanyl	
Jul 29, 2022 F / 52 / Black 94103 / 94103	Mixed Drug Toxicity (Fentanyl, Cocaine, Ethanol)	Fentanyl; Cocaine; Cocaethylene; Benzoyllecgonine; meta-/para-Hydroxy Cocaine; Risperidone; 9-Hydroxy Risperidone; Ethanol	Fluoro Fentanyl	Not Available
Aug 2, 2022 M / 67 / Black 94105 / 94110	Fentanyl Toxicity	Fentanyl; Acetyl Fentanyl; Norfentanyl; Naloxone; Cocaine; Benzoyllecgonine; meta-/para-Hydroxy Cocaine; Methamphetamine; THC; Carboxy THC; Tetrahydrocannabivarinic Acid (THCVA); Gabapentin; 11-Hydroxy THC	Xylazine; Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP	Not Available
Aug 26, 2022 M / 28 / White 94110 / 94110	Toxic Effects of Fentanyl and Methamphetamine	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine	Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; Tetrahydrofuran Fentanyl / Tetrahydrofuran Fentanyl 3- Tetrahydrofurancarboxamide; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP	Not Available
Aug 30, 2022 M / 35 / White NFA / 94123	Acute Mixed Drug (Fentanyl and Methamphetamine) Intoxication	Fentanyl; Acetyl Fentanyl; Norfentanyl; Naloxone; Methamphetamine; THC; 11-Hydroxy THC; Carboxy THC; Tetrahydrocannabinol Acid (THCA); Cannabigerol (CBG); Olanzapine	Xylazine; 3',4'-Dimethoxy Fentanyl; Acryl Fentanyl; Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP	Not Available
Sep 4, 2022 M / 49 / Latinx Unknown / 94102	Acute Mixed Drug (Fentanyl, Acetyl Fentanyl and Methamphetamine) Intoxication	Fentanyl; Acetyl Fentanyl; Norfentanyl; Naloxone; Methamphetamine; Amphetamine; Norephedrine/Norpseudoephedrine	N,N-Dimethylamindodespropionyl Fentanyl; Despropionyl para-Fluoro Fentanyl; Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP; Benzyl Fentanyl	Fluoro Fentanyl; Furanyl Fentanyl; Heptanoyl Fentanyl; ortho-Methyl Phenyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Phenyl Fentanyl; Fentanyl; 4-AP; 4-ANBP; 4-ANPP; Benzyl Fentanyl;



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
				beta-Hydroxy Fentanyl; Ethyl 4-ANPP; N-Methyl Norfentanyl; NPP; para-Bromo 4-ANPP; Phenethyl 4-ANPP; Papaverine
Sep 26, 2022 F / 59 / White 94103 / 94103	Mixed Drug Toxicity (Fentanyl, Cocaine)	Fentanyl; Acetyl Fentanyl; Norfentanyl; Methadone; EDDP (Methadone Metabolite); Cocaine; Benzoylcegonine; Norcocaine; meta-/para-Hydroxy Cocaine; Anhydroecgonine Methyl Ester; Lidocaine	Fluoro Fentanyl; Acryl Fentanyl; Despropionyl para-Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; 4-Anilinopiperidine (4-AP); beta-Hydroxy Fentanyl; NPP	Not Available
Oct 14, 2022 F / 30 / Unknown 94103 / 94110	Mixed Drug Toxicity (Fentanyl, Methamphetamine)	Fentanyl; Norfentanyl; Dextromethorphan/Levomethorphan; Dextrorphan/Levorphanol; Naloxone; Tramadol; Methamphetamine; Norephedrine/Norpseudoephedrine; Amphetamine; Norketamine; Doxylamine	Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; NPP	Not Available
Oct 17, 2022 M / 26 / White 94044 / 94134	Toxic Effects of Fentanyl, Acetyl Fentanyl, Ethanol and Cocaine	Fentanyl; Acetyl Fentanyl; Norfentanyl; Acetyl Fentanyl; Cocaine; Norcocaine; Cocaethylene; Benzoylcegonine; meta-/para-Hydroxy Cocaine; THC; Carboxy THC; Tetrahydrocannabinol Acid; (THCA); Ethanol	Xylazine; 4-ANPP	Not Available
Oct 31, 2022 M / 55 / Latinx NFA / 94109	Toxic Effects of Fentanyl	Fentanyl; Norfentanyl; Dextromethorphan/Levomethorphan; Dextrorphan/Levorphanol; Methamphetamine; Carboxy THC; Chlorpheniramine; Acetaminophen	Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl; NPP	Fluoro Fentanyl; Cyclobutyl Fentanyl / Senecioyl Fentanyl / ortho-Methyl Cyclopropyl Fentanyl; Despropionyl ortho-Methyl Fentanyl; Furanyl Fentanyl 3- Furancarboxamide; Heptanoyl Fentanyl; Phenyl Fentanyl; Fentanyl; 4-AP; 4-ANPP; para-Bromo 4-ANPP; NPP



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Nov 16, 2022 M / 41 / White 94107 / 94107	Acute Mixed Drug (Fentanyl and Methamphetamine) Intoxication	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; Alprazolam; alpha-Hydroxy Alprazolam; Temazepam; Lamotrigine; Lidocaine; Acetaminophen; Norlidocaine	Xylazine; Fluoro Fentanyl	Not Available
Nov 17, 2022 M / 55 / White 94132 / 94132	Acute Fentanyl and Heroin Intoxication	Carboxy THC; Norfentanyl; Morphine; 6-Monoacetylmorphine (6-MAM); THC; Carboxy THC; Acetaminophen	Fluoro Fentanyl; 4-ANPP; N-Methyl Norfentanyl; Papaverine	Not Available
Dec 3, 2022 M / 42 / Latinx NFA / 94143	Methamphetamine Toxicity	Norfentanyl; Methamphetamine; Amphetamine; Ephedrine/Pseudoephedrine; Norephedrine/Norpseudoephedrine; alpha-Hydroxy Midazolam; Midazolam; Desalkyl Flurazepam; Carboxy THC; Levetiracetam	3',4'-Dimethoxy Fentanyl; Acryl Fentanyl; ortho-Chloro Fentanyl; Despropionyl para-Fluoro Fentanyl; N-Desmethyl U-47700; Fluoro Fentanyl; 4-ANPP; beta-Hydroxy Fentanyl	Not Available
Dec 12, 2022 M / 27 / White Unknown / 94105	Acute Fentanyl Intoxication	Fentanyl; Norfentanyl; Methamphetamine; Amphetamine; Carboxy THC	Xylazine; 4-ANPP; N-Methyl Norfentanyl; beta-Hydroxy Fentanyl	Not Detected
Dec 23, 2022 F / 58 / Asian 94112 / 94112	Toxic Effects of Fentanyl, Heroin, Cocaine and Ethanol	Fentanyl; Norfentanyl; 6-Monoacetylmorphine (6-MAM); Morphine; Codeine; Cocaine; Norcocaine meta-/para-Hydroxy Cocaine; Cocaethylene; Benzoylcegonine; Anhydrocegonine Methyl Ester; Lidocaine; Lamotrigine; Norlidocaine; Ethanol	Fluoro Fentanyl; Despropionyl para-Fluoro Fentanyl; 4-ANPP; beta-Hydroxy Fentanyl; Papaverine	Not Available



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Case Series

Date of Death Gender / Age / Race Fixed Address / Death Zip	Certified Cause of Death	Originally Reported Drugs	Newly Reported Drugs (Blood and Urine Testing)	Newly Reported Drugs (Paraphernalia Testing)
Dec 24, 2022 M / 62 / White NFA / 94109	Mixed Drug Toxicity (Fentanyl, Ethanol)	Fentanyl; Methamphetamine; Nordiazepam; Ethanol	Xylazine; para-Fluoro Acetyl Fentanyl; 4-ANPP; N-Methyl Norfentanyl	Not Available
Dec 25, 2022 M / 53 / White NFA / 94103	Toxic Effect of Fentanyl, Acetyl Fentanyl and Methamphetamine	Fentanyl; Acetyl Fentanyl; Norfentanyl; Dextromethorphan/Levomethorphan; Dextrorphan/Levorphanol; Cocaine; Benzoylcegonine; Methamphetamine; Amphetamine; Norephedrine/Norpseudoephedrine; meta-/para-Hydroxy Cocaine; Ephedrine/Pseudoephedrine; THC; 11-Hydroxy THC; Carboxy THC; Tetrahydrocannabivarinic Acid (THCVA); 9-Hydroxy Risperidone; Risperidone	Xylazine; 4-ANPP	Not Available

Note: Bold indicates new findings of an NSO and/or Xylazine



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Re-analysis Scope of Testing

Drug	Limit of Detection (ng/mL)	Drug	Limit of Detection (ng/mL)
Fentanyl Analogs and Precursors / Metabolites			
[3'-/4'-/meta-/para-]Methyl Fentanyl / Butyryl Fentanyl / Isobutyryl Fentanyl	0.1	Benzodioxole Fentanyl / 2,3-Benzodioxole Fentanyl	0.05
[cis-3-/alpha'-/para-]Methyl Butyryl Fentanyl / para-Methyl Isobutyryl Fentanyl / Isovaleryl Fentanyl / Pivaloyl Fentanyl / Valeryl Fentanyl	0.05	Benzyl Acryl Fentanyl	0.05
[cis-3-/trans-3-/alpha-/beta-/ortho-]Methyl Fentanyl / Isobutyryl Fentanyl	0.075	Benzyl Carfentanil	0.05
[cis-3-/trans-3-/alpha-]Methyl Thiofentanyl	0.075	beta-Hydroxy Acetyl Thiofentanyl	0.075
[meta-/ortho-/para-]Fluoro Acryl Fentanyl	0.075	beta-Hydroxy Thiofentanyl	0.075
[meta-/ortho-/para-]Fluoro Butyryl Fentanyl / [meta-/ortho-/para-]FIBF / para-Chloro Acryl Fentanyl	0.075	Butyryl Norfentanyl / Isobutyryl Norfentanyl	0.25
[meta-/ortho-/para-]Fluoro Fentanyl	0.05	Carboxy Butyryl Fentanyl	0.05
[meta-/ortho-/para-]Fluoro Furanyl Fentanyl	0.05	Carfentanil	0.05
[meta-/ortho-/para-]Fluoro Valeryl Fentanyl	0.05	cis-3-Methyl Norfentanyl / trans-3-Methyl Norfentanyl	0.05
[meta-/ortho-/para-]Fluoro Methoxyacetyl Fentanyl	0.1	cis-Isorefentanyl	0.25
[meta-/ortho-/para-]Methoxy Furanyl Fentanyl	0.05	Crotonyl Fentanyl / Cyclopropyl Fentanyl / ortho-Methyl Acryl Fentanyl	0.075
[meta-/para-]Methyl Methoxyacetyl Fentanyl / Ethoxyacetyl Fentanyl	0.075	Cyclobutyl Fentanyl / Senecieryl Fentanyl / ortho-Methyl Cyclopropyl Fentanyl	0.1
2,2,3,3-Tetramethyl Cyclopropyl Fentanyl	0.05	Cyclohexyl Fentanyl	0.1
2,3-Seco Fentanyl	0.025	Cyclopentenyl Fentanyl	0.075
2',3'-Dimethoxy Fentanyl	0.05	Cyclopentyl Fentanyl	0.075
2',4'-Dimethoxy Fentanyl	0.05	Cyclopropane Acetyl Fentanyl / Tigloyl Fentanyl	0.075
2',5'-Dimethoxy 3',4'-Dimethyl Fentanyl / 2',5'-Dimethoxy 4'-Methyl alpha-Methyl Fentanyl	0.05	Cyclopropyl Norfentanyl	0.1
2',5'-Dimethoxy 4'-Bromo alpha-Methyl Fentanyl	0.075	Despropionyl 2'-Fluoro ortho-Fluoro Fentanyl	0.75
2',5'-Dimethoxy 4'-Bromo Fentanyl	0.075	Despropionyl meta-Fluoro Fentanyl	0.25
2',5'-Dimethoxy 4'-Butyl alpha-Methyl Fentanyl	0.05	Despropionyl ortho-Fluoro Fentanyl	0.25
2',5'-Dimethoxy 4'-Chloro alpha-Methyl Fentanyl	0.075	Despropionyl ortho-Methyl Fentanyl	0.075
2',5'-Dimethoxy 4'-Chloro Fentanyl	0.05	Despropionyl para-Fluoro Fentanyl	0.5
2',5'-Dimethoxy 4'-Ethyl alpha-Methyl Fentanyl	0.05	Fentanyl Carbamate	0.075
2',5'-Dimethoxy 4'-Ethyl Fentanyl	0.05	Fentanyl Methyl Carbamate	0.25
2',5'-Dimethoxy 4'-Ethylthio Fentanyl	0.05	Furanyl Ethyl Fentanyl	0.25
2',5'-Dimethoxy 4'-Iodo alpha-Methyl Fentanyl	0.05	Furanyl Fentanyl	0.05
2',5'-Dimethoxy 4'-Iodo Fentanyl	0.05	Furanyl Fentanyl 3-Furancarboxamide	0.05
2',5'-Dimethoxy 4'-Isopropylthio Fentanyl	0.05	Furanyl Norfentanyl	0.1
2',5'-Dimethoxy 4'-Methyl Fentanyl	0.05	Heptanoyl Fentanyl	0.025
2',5'-Dimethoxy 4'-Methylthio Fentanyl	0.05	Hexanoyl Fentanyl	0.05
2',5'-Dimethoxy 4'-Nitro Fentanyl	0.05	meta-Chloro Fentanyl / para-Chloro Fentanyl	0.5
2',5'-Dimethoxy 4'-Propyl Fentanyl / 2',5'-Dimethoxy 4'-Isopropyl Fentanyl	0.05	meta-Methyl Acetyl Fentanyl / para-Methyl Acetyl Fentanyl	0.25
2',5'-Dimethoxy 4'-Propylthio Fentanyl	0.05	meta-Methyl Furanyl Fentanyl / para-Methyl Furanyl Fentanyl	0.05
2',5'-Dimethoxy 4'-Trifluoro Methyl Fentanyl	0.05	Methacryl Fentanyl	0.075
2',5'-Dimethoxy alpha-Methyl Fentanyl	0.05	Methoxyacetyl Fentanyl	0.1
2',5'-Dimethoxy Fentanyl	0.1	Methoxyacetyl Norfentanyl	0.25
2',6'-Dimethoxy Fentanyl	0.05	N-(2-APB) Fentanyl	0.05
2'-Fluoro Fentanyl	0.05	N-(2C-B-fly) Fentanyl	0.075
2'-Methyl Acetyl Fentanyl	0.05	N-(3C-B-FLY) Fentanyl	0.05
3',4',5'-Trimethoxy alpha-Methyl Fentanyl	0.075	N-(3-Ethylindole) Fentanyl	0.05
3',4'-Dimethoxy Fentanyl	0.075	N-(6-APB) Fentanyl	0.05
3',4'-Methylenedioxy alpha-Methyl Fentanyl	0.1	N-(6-Dihydrobenzofuranylethyl) alpha-Methyl Fentanyl	0.075
3',5'-Dimethoxy Fentanyl	0.075	N,N-Dimethylamindodespropionyl Fentanyl	0.05
3'-Fluoro Fentanyl	0.075	N-Benzyl Furanyl Norfentanyl	0.05
3'-Methyl Acetyl Fentanyl / 4'-Methyl Acetyl Fentanyl	0.075	N-Benzyl Phenyl Norfentanyl	0.05
3'-ortho-Difluoro Fentanyl	0.075	N-Methyl Cyclopropyl Norfentanyl	0.05
4-Phenyl Fentanyl / beta'-Phenyl Fentanyl	0.075	N-Methyl Norcarfentanil	0.05
Acetyl Norfentanyl	0.5	Norcarfentanil	0.075
Acryl Fentanyl	0.075	Norsufentanil	0.025
Alfentanil	0.05	ortho-Chloro Fentanyl	0.5
alpha'-Methoxy Fentanyl / para-Hydroxy Butyryl Fentanyl / ortho-Methyl Methoxyacetyl Fentanyl / Ethoxyacetyl Fentanyl	0.05	ortho-Isopropyl Furanyl Fentanyl	0.05
alpha-Dimethyl Fentanyl	0.05	ortho-Methyl Phenyl Fentanyl	0.1
alpha-Methyl Acetyl Fentanyl / beta-Methyl Acetyl Fentanyl	0.075	ortho-Methyl Acetyl Fentanyl	1
		ortho-Methyl Furanyl Fentanyl	0.05
		para-Bromo 4-ANPP	0.5
		para-Bromo Fentanyl	0.5
		para-Chloro Acetyl Fentanyl	0.5
		para-Chloro Butyryl Fentanyl / para-Chloro Isobutyryl Fentanyl	0.075
		para-Chloro Cyclobutyl Fentanyl	5
		para-Chloro Cyclopentyl Fentanyl	0.25
		para-Chloro Cyclopropyl Fentanyl	0.075



Novel Synthetic Opioid and Xylazine Re-Analysis of 2022 Accidental Overdoses

Re-analysis Scope of Testing

Drug	Limit of Detection (ng/mL)
para-Chloro Furanyl Fentanyl	0.05
para-Chloro Furanyl Fentanyl 3-Furancarboxamide	0.05
para-Chloro Methoxyacetyl Fentanyl	0.075
para-Chloro Valeryl Fentanyl	0.05
para-Fluoro 4-ANBP	0.05
para-Fluoro Acetyl Fentanyl	0.075
para-Fluoro Benzyl Fentanyl	0.05
para-Fluoro Crotonyl Fentanyl	0.1
para-Fluoro Cyclopentyl Fentanyl / para-Methoxy Valeryl Fentanyl	1
para-Fluoro Tetrahydrofuran Fentanyl	0.05
para-Fluoro Cyclopropyl Fentanyl	0.1
para-Fluoro Furanyl Fentanyl 3-Furancarboxamide	0.075
para-Methoxy Acryl Fentanyl	0.075
para-Methoxy Butyryl Fentanyl / ortho-Methoxy Butyryl Fentanyl	0.075
para-Methoxy Fentanyl	0.25
para-Methoxy Methoxyacetyl Fentanyl	0.05
para-Methyl Tetrahydrofuran Fentanyl	0.05
Phenoxyacetyl Fentanyl	0.05
Phenyl Fentanyl	0.1
Remifentanyl	0.075
Sufentanyl	0.05
Tetrahydrofuran Fentanyl / Tetrahydrofuran Fentanyl 3-Tetrahydrofurancarboxamide	0.025
Tetrahydrothiophene Fentanyl	0.075
Thienyl Fentanyl	0.075
Thiofentanyl	0.05
Thiophene Fentanyl	0.05
Thiophene Fentanyl 3-Thiophenecarboxamide	0.05
Fentanyl Precursors / Metabolites	
4-Anilino N-Phenethylpiperidine (4-ANPP)	0.075
4-Anilino-1-Boc-Piperidine (N-Boc-4-AP)	10
4-Anilinopiperidine (4-AP)	5
4-Anilino-1-Benzylpiperidine (4-ANBP)	0.05
Benzyl Fentanyl	0.05
beta-Hydroxy Fentanyl	0.25
N-Methyl Norfentanyl	0.075
N-Phenethyl 4-Piperidone (NPP)	0.25
Utopioids	
3,4-Ethylenedioxy U-47700	0.025
3,4-Ethylenedioxy U-51754	0.075
4-Phenyl U-51754	0.05
Deschloro U-47700	0.075
N,N-Didesmethyl U-47700	0.5
N-Desmethyl U-47700	0.075
N-Methyl U-47931E	0.05
Propyl U-47700	0.05
U-47700	0.05
U-47931E	0.1
U-48753E	0.25
U-48800	0.075
U-49900	0.075
U-50488	0.25
U-51754	0.075
U-69593	0.05
Nitazenes	
5-Amino Isotonitazene	0.25
5-Methyl Etodesnitazene	0.75
Butonitazene	0.1

Drug	Limit of Detection (ng/mL)
Clonitazene	0.75
Etodesnitazene	0.075
Etonitazene	0.5
Flunitazene	0.25
Isotonitazene	0.1
Metodesnitazene	0.5
Metonitazene	0.25
N-Desethyl Isotonitazene	
N-Piperidiny Etonitazene	0.5
N-Pyrrolidino Etonitazene	0.5
N-Pyrrolidino Metonitazene	0.25
N-Pyrrolidino Protonitazene	0.25
Protonitazene	0.1
Opium Poppy Production Compounds	
Papaverine	0.025
Thebaine	0.25
Miscellaneous Opioids	
2-Fluoro MT-45	0.05
2-Fluoro Viminol	0.1
2-Methyl AP-237	0.05
3-Hydroxy PCP	0.1
AH-7921	0.1
AP-237	0.075
AP-238	0.075
Brophine	0.1
Deschloro W-19	0.5
Dipyanone	0.05
Meperidine	0.075
MT-45	0.075
Normeperidine	0.075
Piperidyl Thiambutene	1
Tianeptine	0.25
W-15	0.75
W-18	0.1
W-19	0.75
Veterinary Tranquilizer	
Xylazine	0.025

Note: Table is specific for biological (e.g., blood and urine) analysis. Paraphernalia analysis received this scope of testing, with additional untargeted testing.