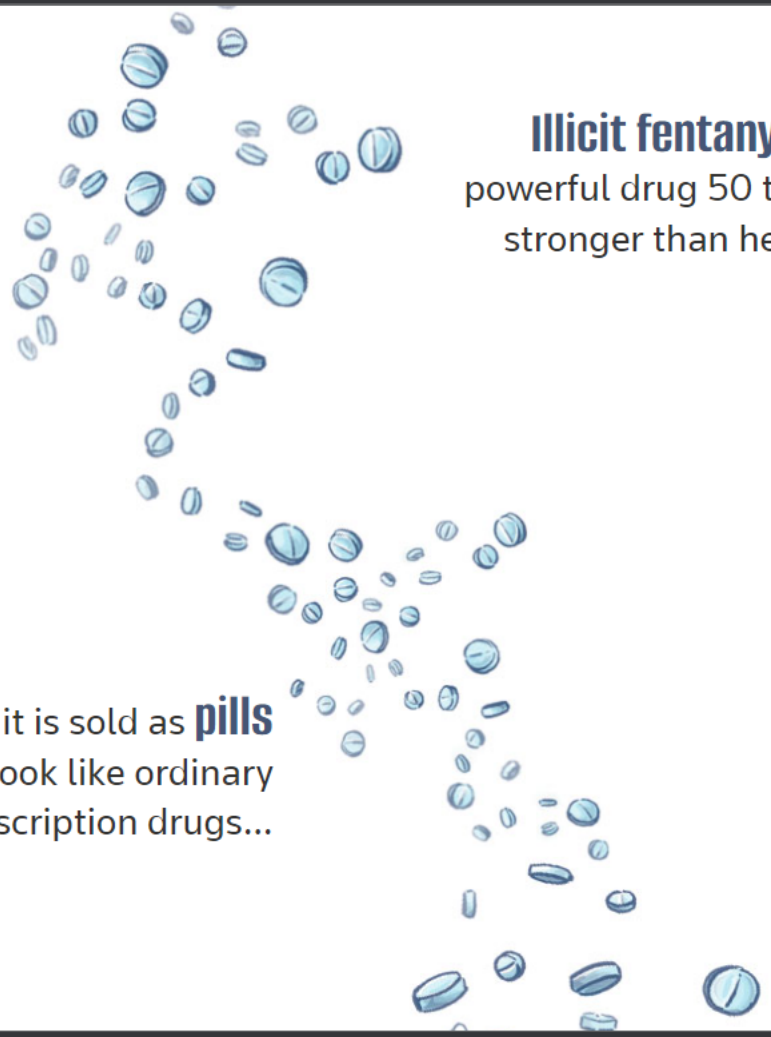
Fentanyl and adulterants

Tariffs and border militarization to stop the flow of fentanyl???

Dan Nauts, MD, FASAM

6/11/2025

The ease with which our reporters bought the drug-making chemicals exposed holes in the world's regulatory framework and law enforcement.

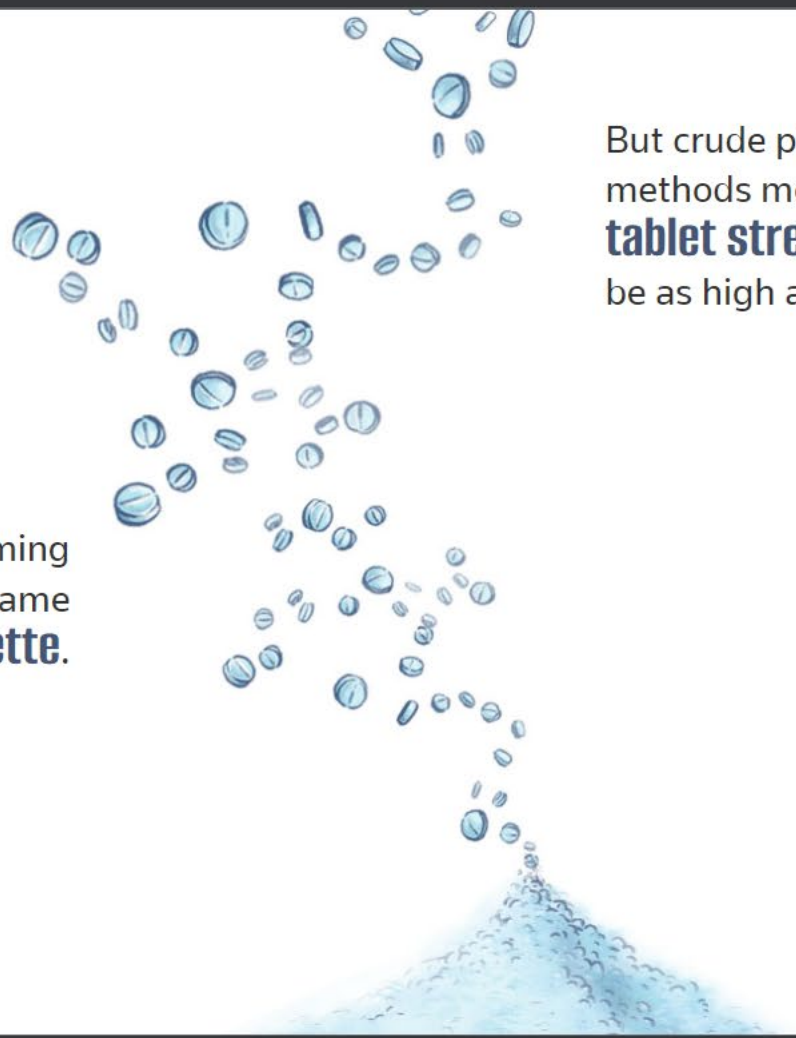


Illicit fentanyl is a powerful drug 50 times stronger than heroin.

Often, it is sold as **pills** that look like ordinary prescription drugs...

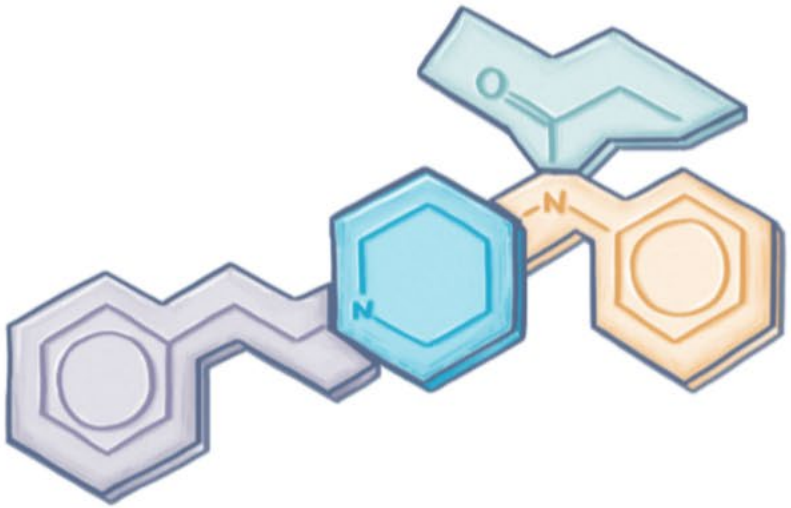
An average pill contains at least **2 mg** of fentanyl. That's a potentially lethal dose, the U.S. Drug Enforcement Administration (DEA) says.

...such as round **blue tablets** designed to look just like real oxycodone pills.



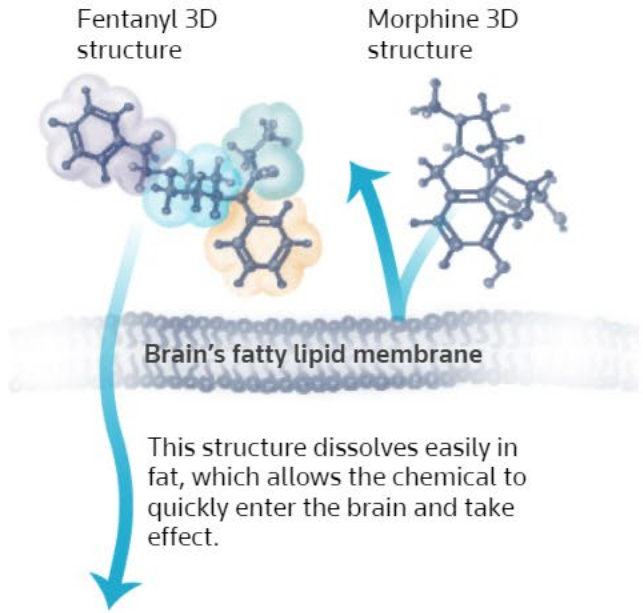
But crude pill-pressing methods means the **tablet strength** can be as high as 8.4 mg.

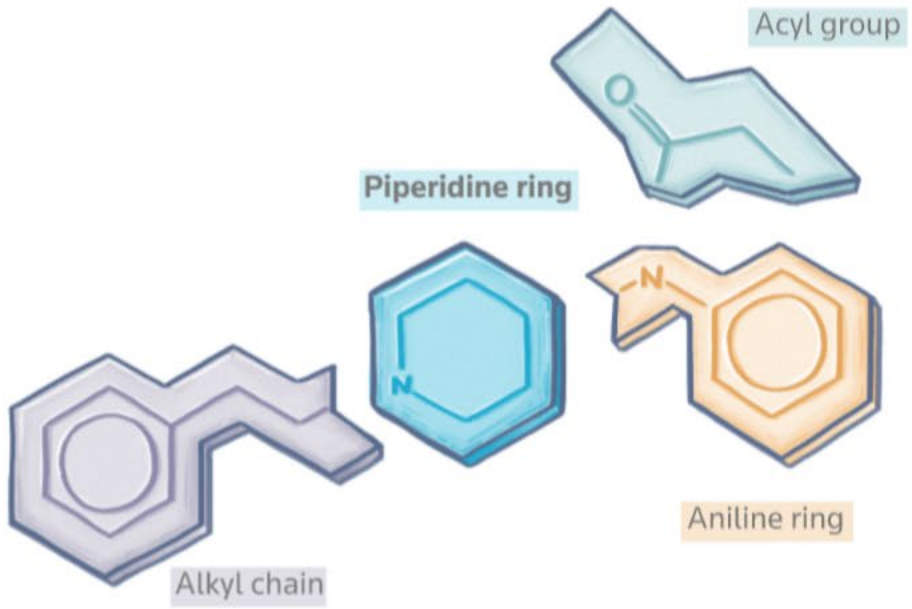
This turns consuming these pills into a game of **Russian roulette**.

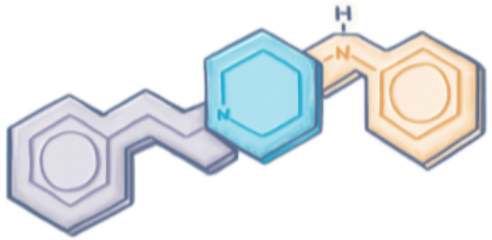


To understand these chemistry tricks, first consider the basic structure of fentanyl.

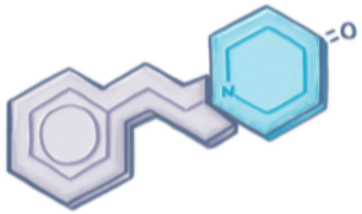
Fentanyl is much stronger than other opioids because its unique molecular structure allows it to easily enter parts of the brain that control pain and emotions.



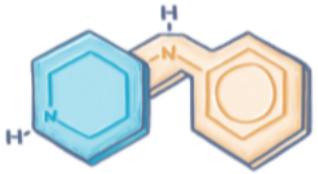




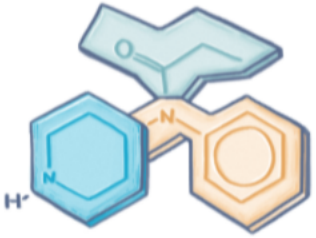
4-ANPP



NPP

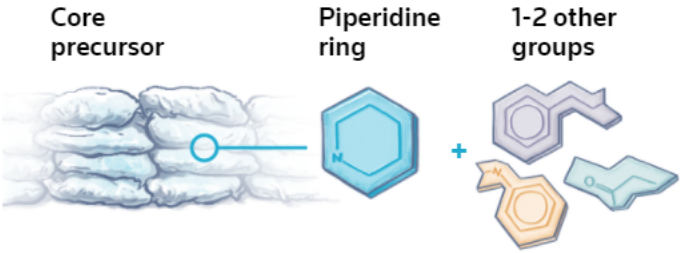


4-AP



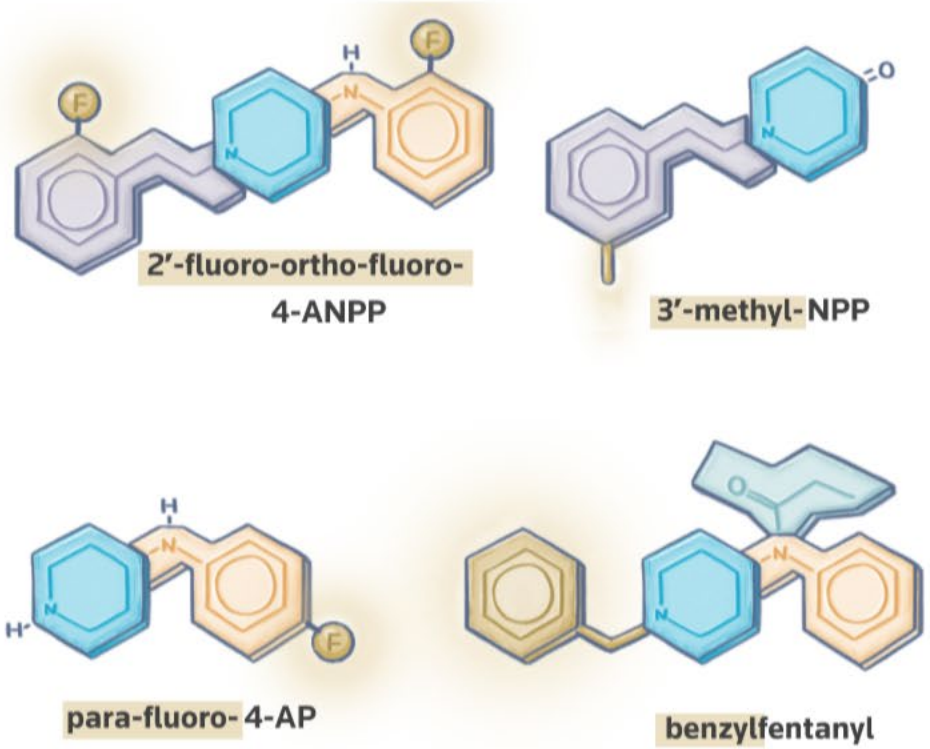
norfentanyl

Core precursors are chemical compounds made up of a piperidine ring and one or more of fentanyl's three other molecular groups. Here are four examples used by illicit makers.



But among these are the precursors that governments have placed the toughest restrictions on because they make producing street fentanyl such a snap. For example, the U.S. government tightly controls 4-ANPP and norfentanyl since they're what are known as immediate precursors, only one chemical reaction away from fentanyl itself.

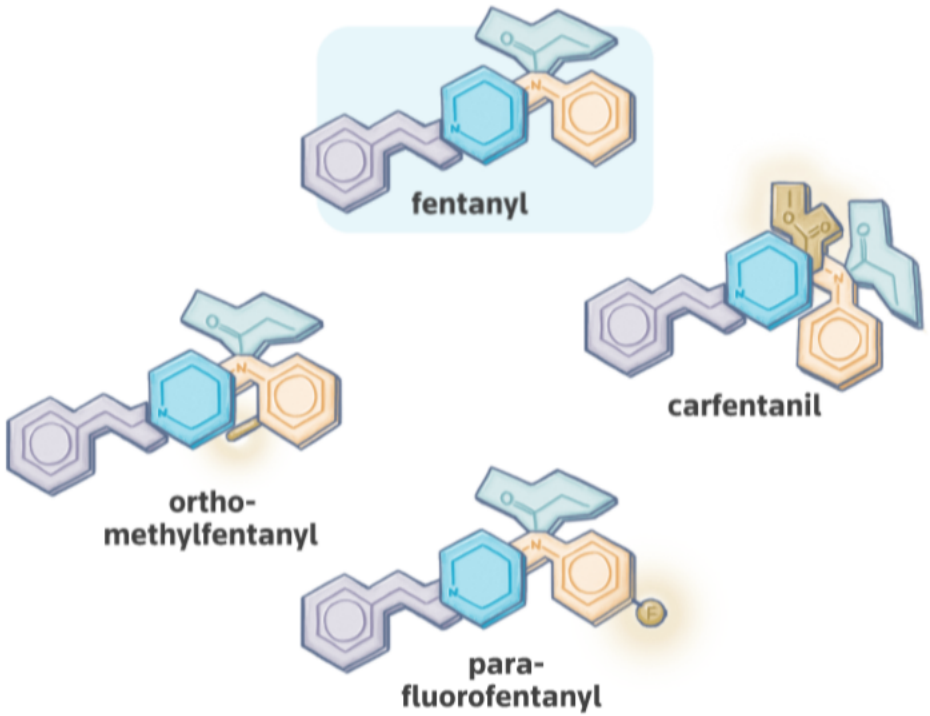
This is where creative chemistry comes in.



One way illicit fentanyl producers get around these regulations is to use **designer precursors** that have a similar, but slightly different chemical structure.

Imagine a Mr. Potato Head with its head, ears and nose – but in this case, the ears are gold, not the standard pink. The toy still looks and functions the same as the original.

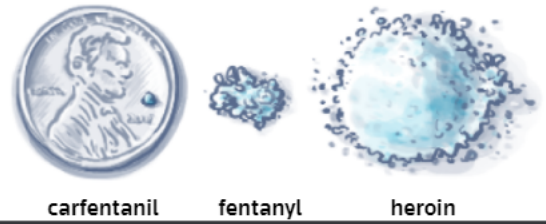
The chemistry equivalent of that is, for example, replacing a hydrogen atom with a **fluorine atom** (F) on the precursor chemical.

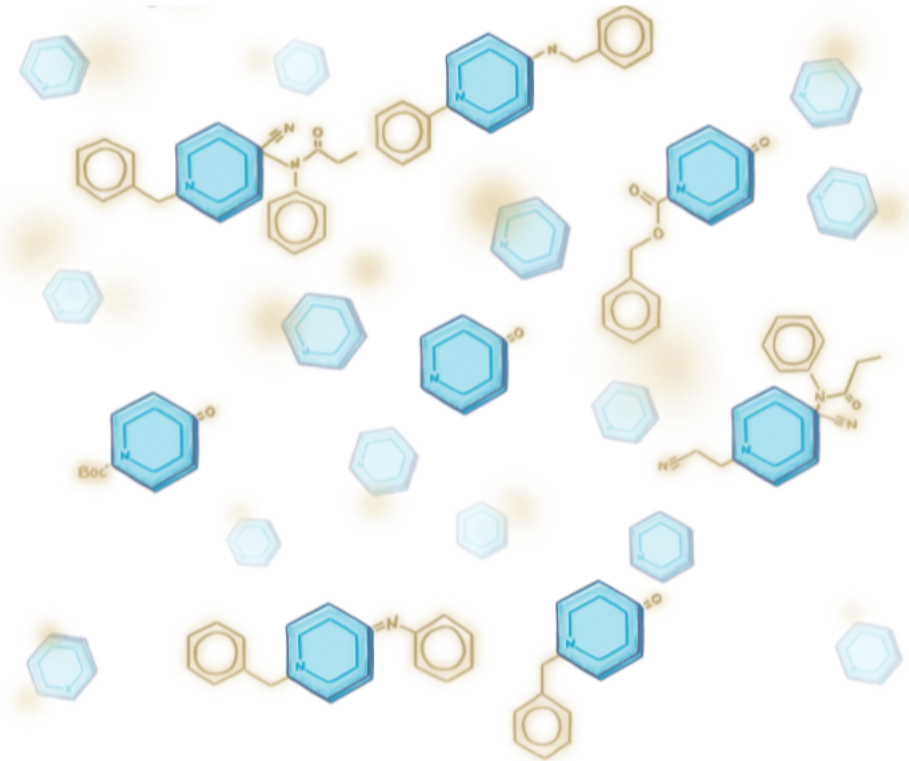


These changes help chemical sellers stay one step ahead of regulatory and interdiction efforts. The tweaked compounds can still be used to produce so-called **fentanyl analogs** that produce a similar high and are often just as dangerous — or even more dangerous — than fentanyl itself.

Here are three examples of fentanyl analogs common in the illicit drug market. **Carfentanil**, which was initially developed to sedate elephants and other large animals, is 100 times more potent than fentanyl, according to the DEA.

Comparison of potentially lethal doses



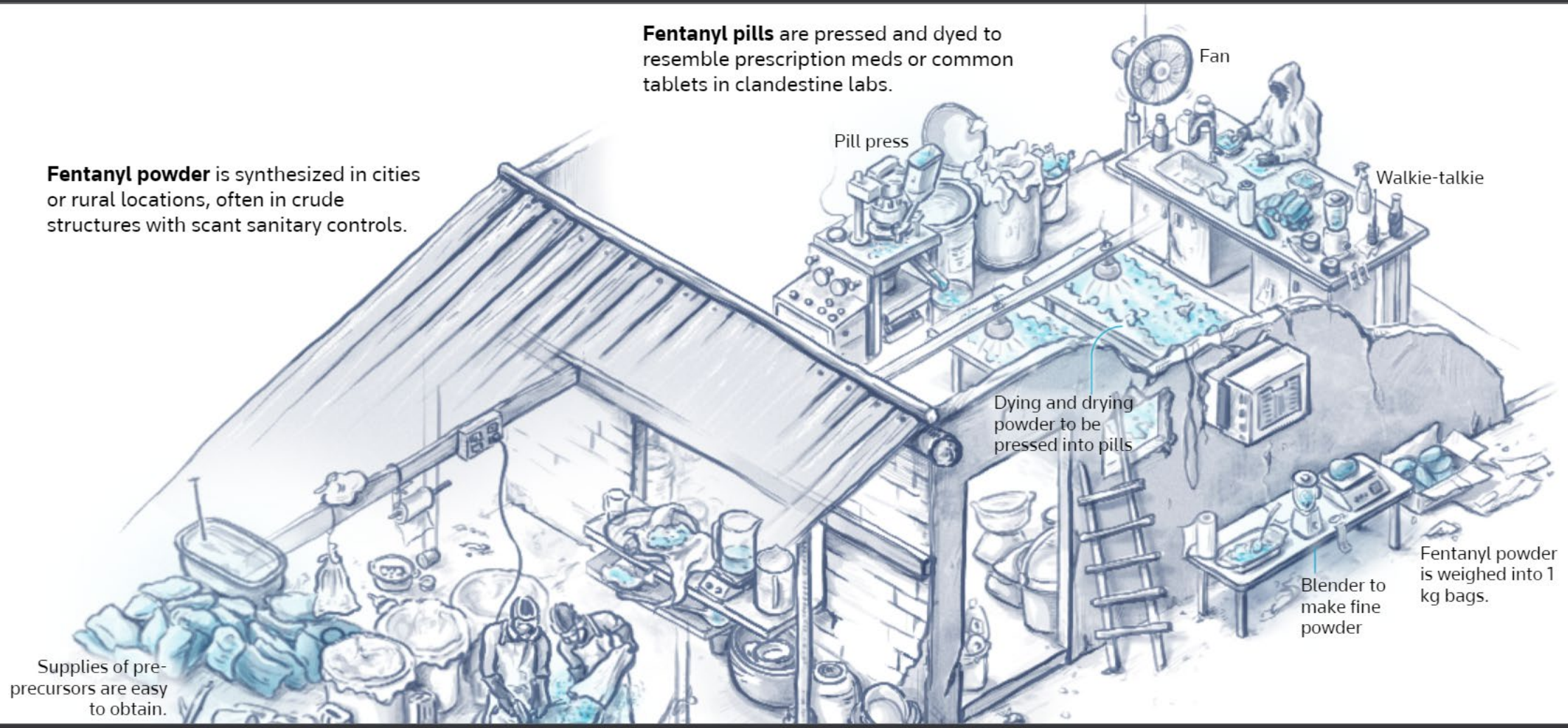


Pre-precursors

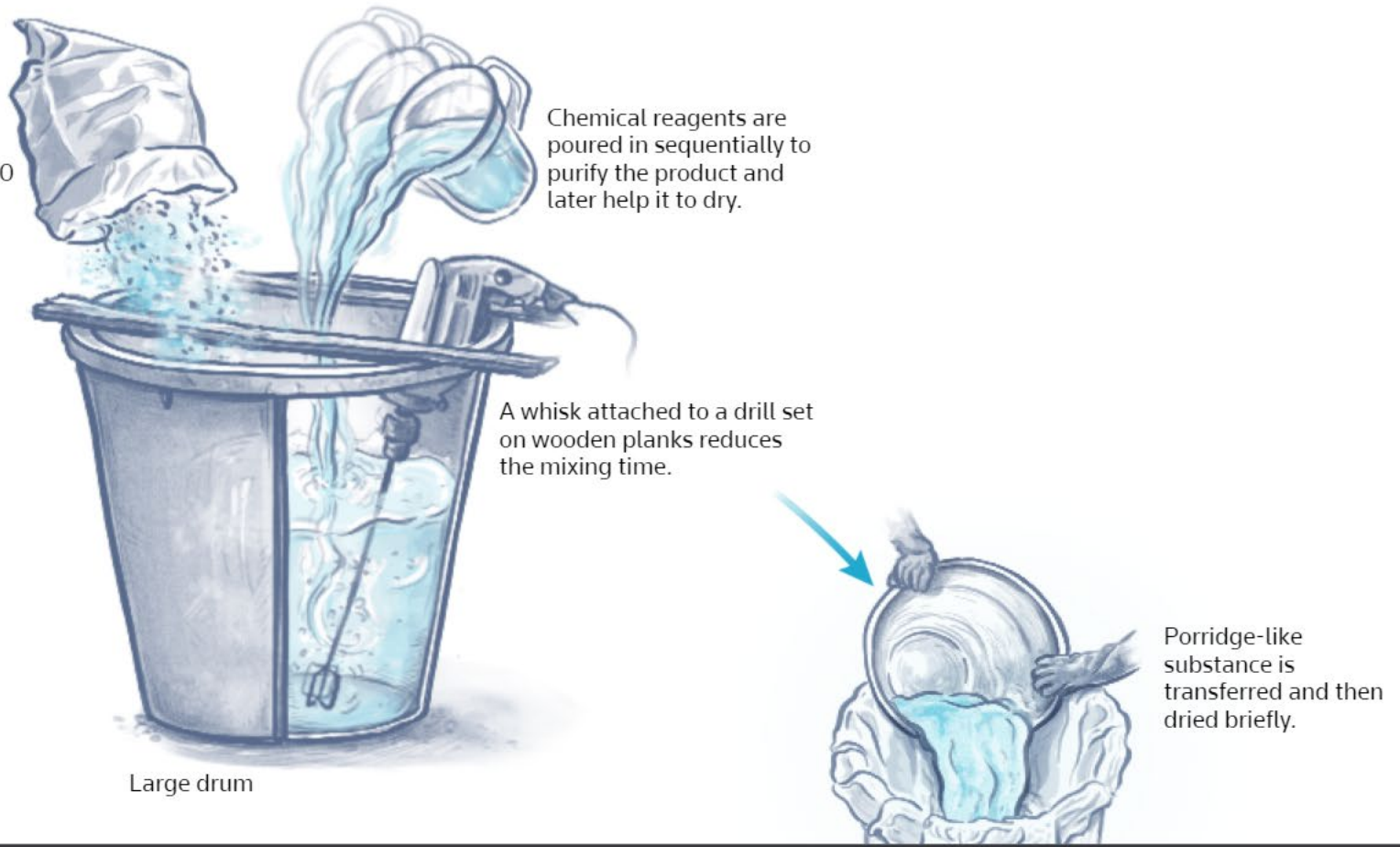
If packaged brownie mixes were banned, you could still make the dessert using eggs, chocolate, sugar and flour. That's the idea of **pre-precursors**.

These chemicals contain the all-important **piperidine ring**, and are the ingredients that can be used to create immediate precursors.

But legal industries also use pre-precursors to manufacture all sorts of goods, including fragrances, plastics, pesticides and lifesaving medications such as anti-tumor and anti-malarial drugs. That makes tightly regulating them much more complicated for authorities.

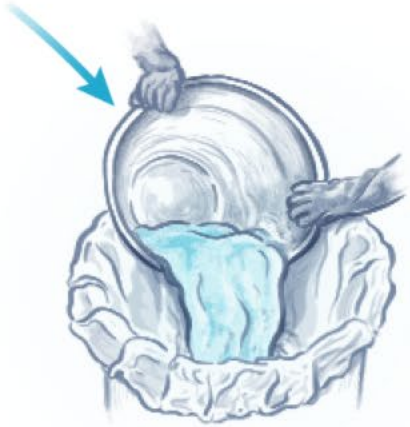


The process begins by adding "El 400" into the bucket.



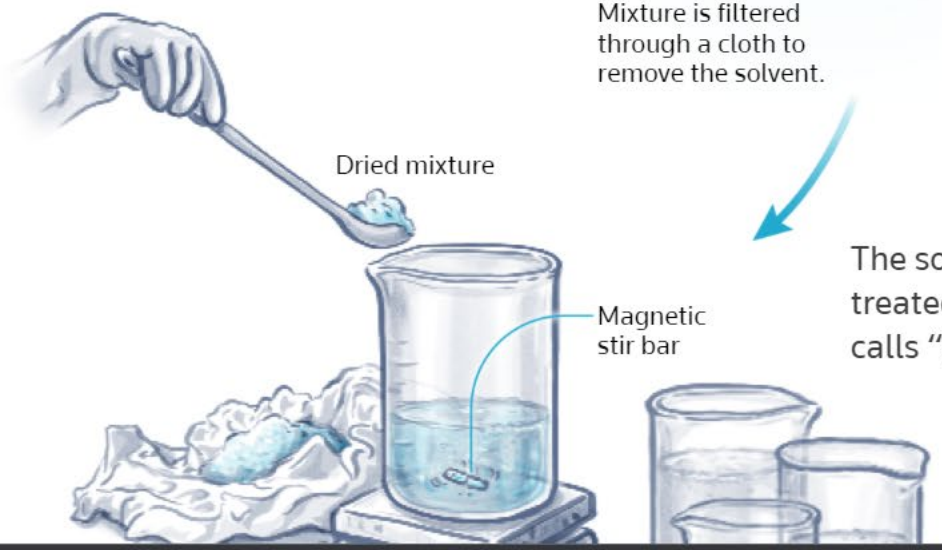
the mixing time.

Large drum

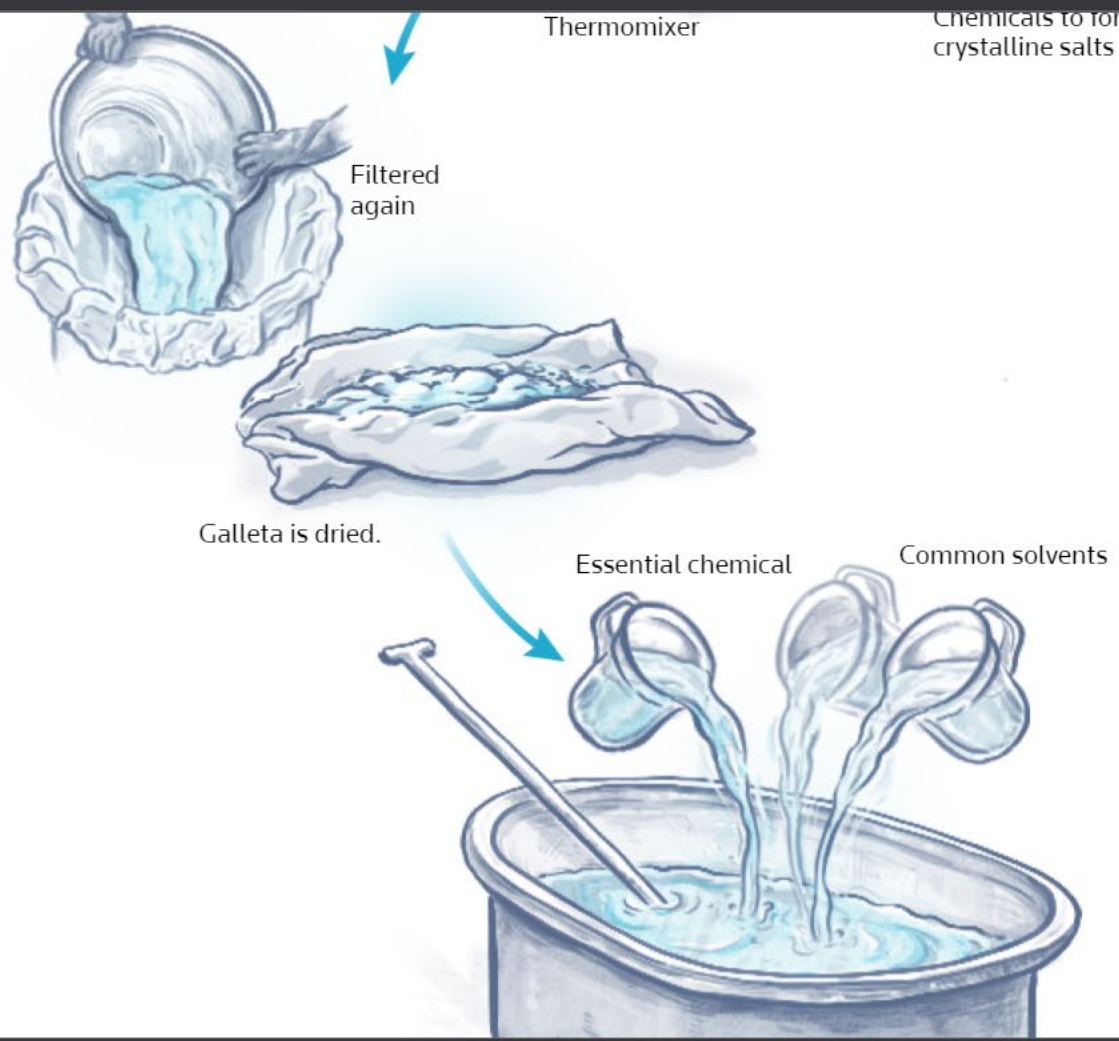


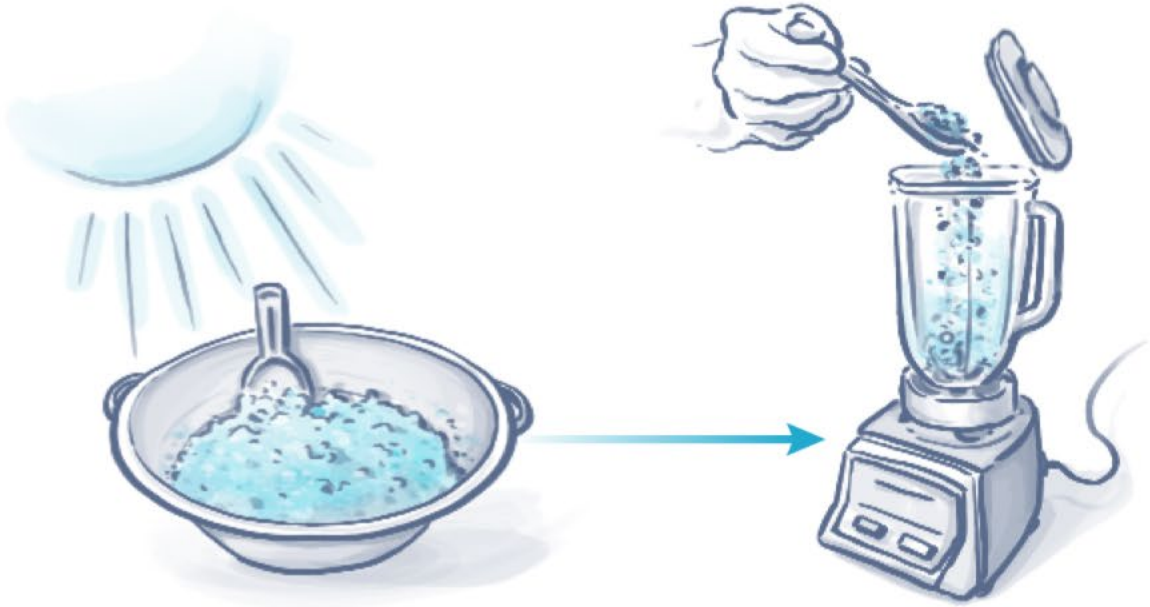
Porridge-like substance is transferred and then dried briefly.

Mixture is filtered through a cloth to remove the solvent.



The solution is mixed, cooled with ice and treated with a liquid to create what the cook calls "galleta," the Spanish word for cookie.



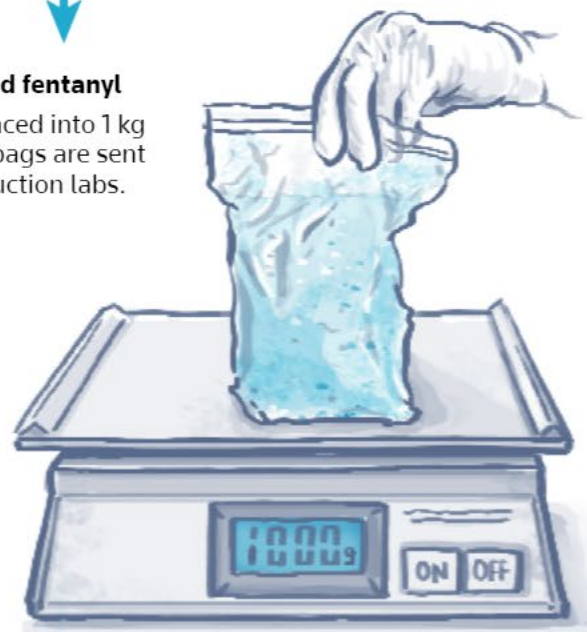


Fentanyl powder dries under the sun for a few hours.

The coarse powder is refined in a blender. This is a dangerous step: Cooks can overdose if they inhale the powder.

Powdered fentanyl

Powder is placed into 1 kg bags. Some bags are sent to post-production labs.

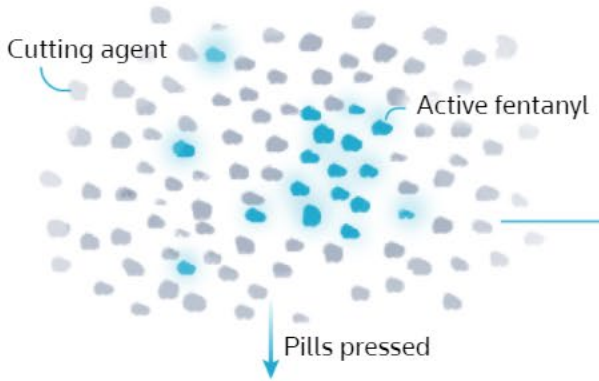


Pill-form fentanyl

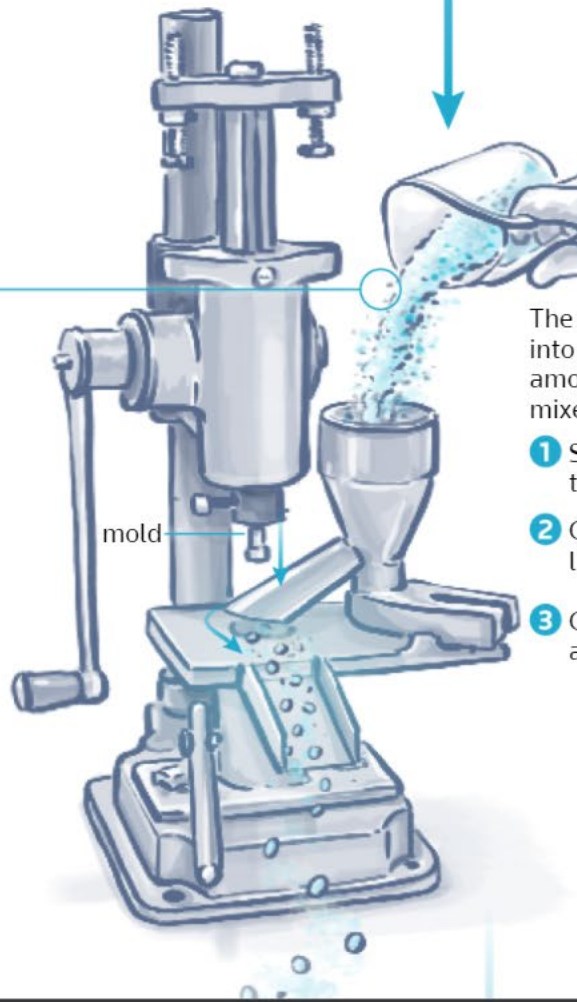
At those labs, pill die molds are used to press some of the powder into counterfeit pills that mimic oxycodone, a prescription painkiller.

Processing the fentanyl

and decrease its potency.



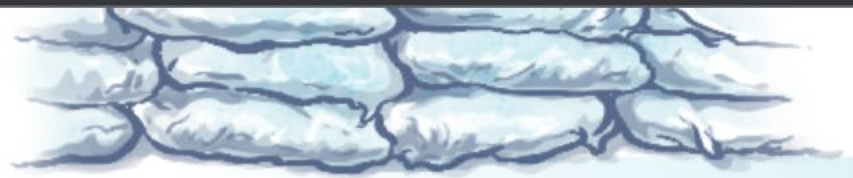
Like chocolate chips in a batch of cookies, the amount of active fentanyl in an illicit pill is never evenly distributed. The DEA has found tablets with widely varying amounts of active fentanyl – ranging from 0.01 mg to 8.4 mg per pill.



The powder to be pressed into pills includes tiny amounts of fentanyl mixed with:

1. Sugars to bulk up the product
2. Common painkillers like acetaminophen
3. Chemicals to bind and color the pills

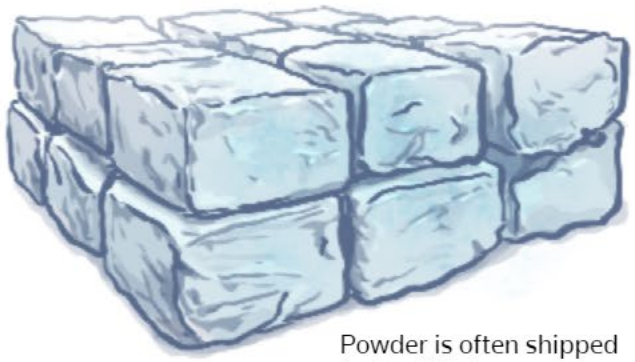
The most common sugar that Mexican producers add to fentanyl is mannitol, a low-calorie sweetener.



The powder is often cut again after crossing the border, especially with the powerful sedative xylazine, which can make fentanyl even more deadly.

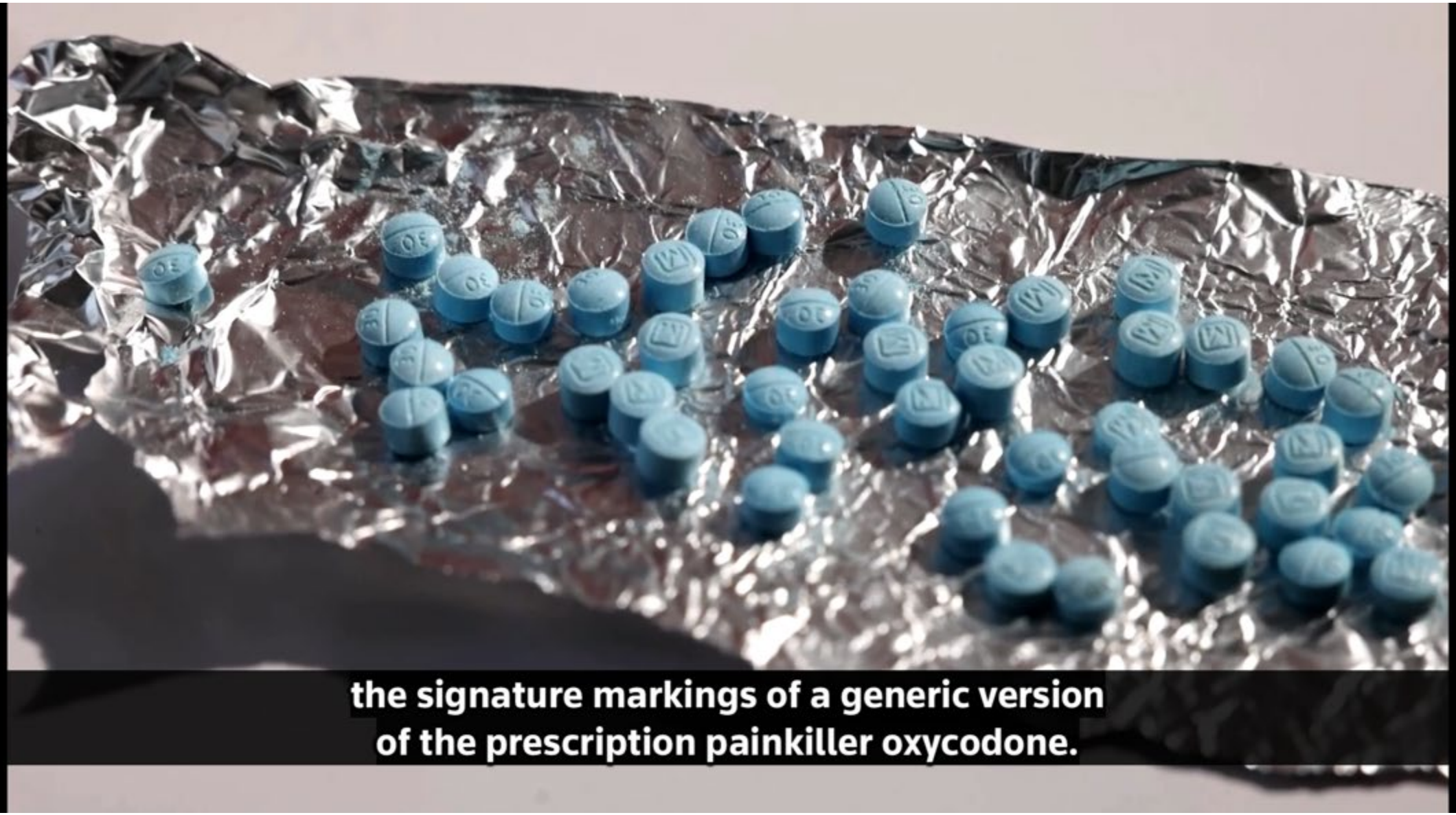
Shipping the drug to the U.S.

The vast majority of fentanyl powder and pills entering the U.S. is smuggled across the border in vehicles driven by American citizens through legal ports of entry, according to U.S. authorities.



Powder is often shipped to the U.S. in pressed-brick form.

Some of the powder is transported to pill-press mills across the U.S. **A single kilo** of pure fentanyl can make around **500,000 pills**.


the signature markings of a generic version
of the prescription painkiller oxycodone.

REUTERS VIDEO

CFSRE
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NPS Discovery

The Center for Forensic Science Research and Education

Novel Psychoactive Substance Discovery

Early warning system in the US

Public_Alert_Medetomidine_0520 | 2023_Q4_Clinical_ACMT_DOTS_Re | 2024_Clinical_ToxIC_Fentalog_Stu | Public_Alert_Medetomidine_0520

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PUBLIC ALERT

MAY 2024

MEDETOMIDINE RAPIDLY PROLIFERATING ACROSS USA — IMPLICATED IN RECREATIONAL OPIOID DRUG SUPPLY & CAUSING OVERDOSE OUTBREAKS

PURPOSE: The objective of this announcement is to notify public health, harm reduction, first responders, clinicians, medical examiners and coroners, forensic and clinical laboratories, and all other related communities about new information surrounding the emergent adulterant **medetomidine** (also referred to as dexmedetomidine).

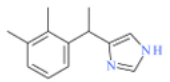
BACKGROUND: Medetomidine is an alpha-2 agonist, belonging to the same family of drugs as xylazine and clonidine. Medetomidine is synthetically manufactured and exists in two enantiomeric forms: **dexmedetomidine** and levomedetomidine, the former being active and potent. Dexmedetomidine is approved for use in humans and is administered in hospital, while differing forms of medetomidine are available for use in veterinary medicine. The effects of **medetomidine** can include sedation, analgesia, muscle relaxation, anxiolysis, bradycardia, hypotension, hyperglycemia, and hallucinations. Duration of action is noted to be longer for medetomidine relative to xylazine.

SUMMARY: Medetomidine is the latest CNS depressant to appear as an adulterant alongside fentanyl in the recreational drug supply. Recent mass overdose outbreaks in Philadelphia, Chicago, and elsewhere have all been associated with fentanyl or heroin drug products containing medetomidine, as well xylazine and/or other substances. In cases where medetomidine ingestion is suspected or confirmed, severe adverse effects have been noted, including **heightened sedation and profound bradycardia**. In December 2023, the CFSRE and the Colombo Plan issued a ***Toxic Adulterant Alert*** for medetomidine following its emergence in the recreational drug supply.

TIMEFRAME	DESCRIPTION OF MEDETOMIDINE IDENTIFICATIONS AND OVERDOSE EVENTS
Late 2022	Medetomidine begins appearing more regularly in the **Maryland** drug supply, following its first detection in July 2022. Medetomidine is commonly identified alongside fentanyl, xylazine, and other substances.
Mid-to-Late 2023	Medetomidine is sporadically identified in toxicology specimens collected from patients presenting to emergency departments after suspected opioid overdose (confirmed to not be administered). Overdose events originated from **Missouri, Colorado, Pennsylvania, California, and Maryland**. Medetomidine is commonly detected with fentanyl.
January 2024	An **alert** is issued out of **Toronto, ON**, about the emergence of medetomidine in the drug supply. This is followed by increased positivity in subsequent weeks and months, as medetomidine is found alongside fentanyl in suspected opioid products and commonly in combination with xylazine and other substances.
Early 2024	Medetomidine detections increase in drug materials and toxicology specimens originating from western Canada, including **Vancouver, BC**, commonly alongside fentanyl and other opioids.
Late April 2024	Medetomidine first appears in drug products in **Philadelphia, PA**, causing a large scale outbreak of overdoses and adverse events. Medetomidine is identified alongside fentanyl and xylazine.
Early May 2024	Medetomidine first appears in a drug product in **Pittsburgh, PA**, associated with overdoses and adverse events. Medetomidine is identified alongside fentanyl and xylazine.
Early May 2024	Medetomidine first appears in drug products in **Chicago, IL**, causing a large scale outbreak of overdoses and adverse events. Medetomidine is identified alongside fentanyl and xylazine, or alongside heroin without xylazine.

• GEOGRAPHICAL DISTRIBUTION OF MEDETOMIDINE EMERGENCE

Medetomidine has been identified across several states in the U.S. and Canada, and is recently being observed in severe overdose outbreaks in major metropolitan areas.



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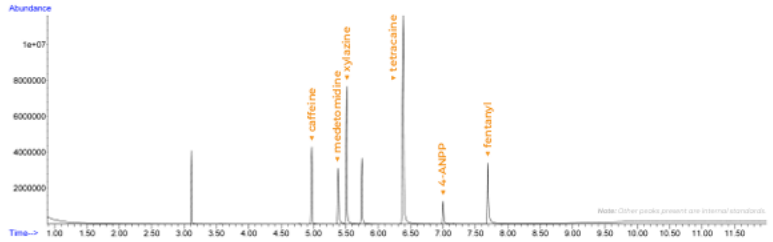
PUBLIC ALERT

MAY 2024

MEDETOMIDINE RAPIDLY PROLIFERATING ACROSS USA — IMPLICATED IN RECREATIONAL OPIOID DRUG SUPPLY & CAUSING OVERDOSE OUTBREAKS

EXAMPLE CHROMATOGRAM OF A DRUG MATERIAL CONTAINING MEDETOMIDINE COLLECTED FROM PHILADELPHIA IN EARLY MAY 2024



DRUG MATERIALS CONTAINING MEDETOMIDINE AND OTHER SUBSTANCES

SUMMARY OF RESULTS:

- *To date, medetomidine has been commonly identified alongside fentanyl and xylazine, and the proportion of medetomidine in the drug material varies by sample.*
- *Medetomidine has been identified alongside heroin, in the absence of xylazine.*
- *Tetracaine has been identified alongside fentanyl, xylazine, and medetomidine in drug products, but not uniformly or consistently.*
- *Real-time drug material and toxicological testing are on-going to track the emergence and proliferation of medetomidine.*

PHILADELPHIA, PA

DRUG	RELATIVE PARTS	DRUG	RELATIVE PARTS
Fentanyl	1p	Fentanyl	1p
Xylazine	1.9p	Xylazine	0.4p
Medetomidine	**0.8p**	**Medetomidine**	**1.9p**
Tetracaine	3.9p	*para*-Fluorofentanyl	0.1p
Other Substances?	Caffeine	*Other Substances?*	No

PITTSBURGH, PA

DRUG	RELATIVE PARTS
Fentanyl	1p
Xylazine	1.5p
Medetomidine	**0.1p**
Tetracaine	0.5p
Other Substances?	pFF, Caffeine

CHICAGO, IL

DRUG	RELATIVE PARTS	DRUG	RELATIVE PARTS
Fentanyl	1p	Heroin	1p
Xylazine	2p	Fentanyl	Trace
Medetomidine	**0.6p**	**Medetomidine**	**6.3p**
Diphenhydramine	0.5p	Diphenhydramine	2.6p
Other Substances?	pFF, Nitazenes, etc.	*Other Substances?*	No

ACKNOWLEDGEMENTS ... FUNDING ... SUGGESTED CITATION ...

ToxIC Fentalog Study Group — Quarterly NPS Report

CLINICAL **2024**

PURPOSE: This report provides new information regarding comprehensive drug testing of clinical toxicology specimens collected after suspected opioid 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 (EDs) 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 can contain undeclared or unwanted substances (e.g., toxic adulterants or NPS) which can potentiate effects or lead to adverse reactions. Understanding emerging drug trends and drug 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 synthetic opioids and other drugs among suspected overdose events in the U.S.

SAMPLE SOURCE: Patients presented to EDs within ACMT's Toxicology Investigators Consortium (ToxIC) experiencing a suspected opioid overdose. Residual, discarded biological samples were obtained for testing against an expansive library of drugs and other substances. Our findings provide a near real-time assessment of the drug market and allude to resulting implications on clinical institutions.

TOXICOLOGY TESTING: Analysis was performed via liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). The scope of testing targeted more than 1,200 drugs, including a vast majority of NPS and metabolites. Drug classes included opioids, benzodiazepines, cannabinoids,

Location ▸	Los Angeles, CA	Denver, CO		Grand Rapids, MI	Atlanta, GA	Pittsburgh, PA	Allentown, PA	New York City, NY			Newark, NJ
Quarter ▸	Q2	Q1	Q3	Q3	Q3	Q3	Q3	Q1	Q2	Q3	Q3
Total Samples	45	75	61	7	7	25	8	20	51	9	2
At Least One Opioid	37 (82%)	56 (75%)	48 (79%)	7 (100%)	6 (86%)	23 (92%)	8 (100%)	18 (90%)	42 (82%)	5 (56%)	2 (100%)
Fentanyl	31	49	46	5	5	21	8	17	38	4	2
Heroin	0	0	1	2	0	1	0	1	1	0	0
Buprenorphine	1	0	1	0	0	0	0	0	0	0	0
Methadone	2	0	3	1	0	6	1	6	14	1	0
Tramadol	0	0	6	1	2	6	1	0	0	0	0
Hydromorphone	1	0	0	0	0	0	0	0	0	0	0
Oxycodone	5	3	0	1	2	0	2	0	4	1	0
Hydrocodone	2	1	1	0	0	0	0	0	0	0	0
Methamphetamine	26	50	45	3	2	0	4	0	6	0	0
Cocaine	2	6	4	3	0	0	2	2	18	0	0
Diazepam	0	9	0	1	2	4	0	2	6	1	0
Alprazolam	0	2	0	0	0	1	0	3	4	2	0
PCP	0	0	0	0	0	0	0	0	4	2	0
Mitragynine	0	0	0	0	0	1	0	0	0	0	0
Xylazine	0	1	0	1	2	14	0	3	15	2	1
Medetomidine	0	1	0	0	0	0	0	0	0	0	0
Lidocaine	0	11	0	0	1	5	0	2	7	0	0
Cannabinoids (THC)	10	22	2	1	3	12	1	11	28	8	1
At Least One NPS	3 (7%)	4 (5%)	18 (30%)	0 (0%)	0 (0%)	16 (64%)	2 (25%)	4 (20%)	9 (18%)	1 (11%)	1 (50%)

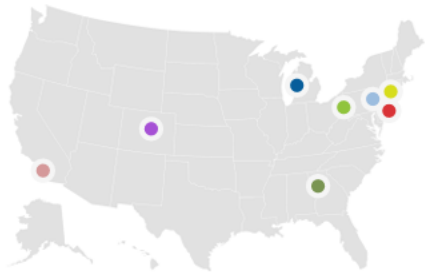
reactions. Understanding emerging drug trends and drug testing results can help direct new or revised approaches to clinical treatment and harm reduction.

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 synthetic opioids and other drugs among suspected overdose events in the U.S.

SAMPLE SOURCE: Patients presented to EDs within ACMT's Toxicology Investigators Consortium (ToxIC) experiencing a suspected opioid overdose. Residual, discarded biological samples were obtained for testing against an expansive library of drugs and other substances. Our findings provide a near real-time assessment of the drug market and allude to resulting implications on clinical institutions.

TOXICOLOGY TESTING: Analysis was performed via liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF-MS). The scope of 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.

SITE LOCATIONS:



Tramadol	0	0	6	1	2	6	1	0	0	0	0
Hydromorphone	1	0	0	0	0	0	0	0	0	0	0
Oxycodone	5	3	0	1	2	0	2	0	4	1	0
Hydrocodone	2	1	1	0	0	0	0	0	0	0	0
Methamphetamine	26	50	45	3	2	0	4	0	6	0	0
Cocaine	2	6	4	3	0	0	2	2	18	0	0
Diazepam	0	9	0	1	2	4	0	2	6	1	0
Alprazolam	0	2	0	0	0	1	0	3	4	2	0
PCP	0	0	0	0	0	0	0	0	4	2	0
Mitragynine	0	0	0	0	0	1	0	0	0	0	0
Xylazine	0	1	0	1	2	14	0	3	15	2	1
Medetomidine	0	1	0	0	0	0	0	0	0	0	0
Lidocaine	0	11	0	0	1	5	0	2	7	0	0
Cannabinoids (THC)	10	22	2	1	3	12	1	11	28	8	1
At Least One NPS	3 (7%)	4 (5%)	18 (30%)	0 (0%)	0 (0%)	16 (64%)	2 (25%)	4 (20%)	9 (18%)	1 (11%)	1 (50%)
NPS Detected	▸*p*-Fluorofentanyl ▸Clonazolam	Q1: ▸Bromazolam ▸*p*-Fluorofentanyl Q3: ▸*p*-Fluorofentanyl ▸Clonazolam ▸Bromazolam ▸MDMB-BINACA		N/A	N/A	▸*p*-Fluorofentanyl ▸Metonitazene ▸Protonitazene ▸N-Pyrrolidino Etonitazene ▸Bromazolam ▸Clonazolam ▸Desalkylgidazepam ▸Flubromazepam ▸MDMB-4en-PINACA	▸*p*-Fluorofentanyl ▸Bromazolam	Q1: ▸*p*-Fluorofentanyl ▸MDMB-4en-PINACA ▸4CN-CUMYL-BUTINACA ▸CH-FUBIATA ▸5F-MDMB-PICA ▸5F-BZO-POXIZID Q2: ▸*p*-Fluorofentanyl ▸MDMB-4en-PINACA ▸Bromazolam ▸2F-2oxo-PCE Q3: ▸*p*-Fluorofentanyl	▸MDMB-4en-PINACA
No Opioids Detected	8 (18%)	19 (25%)	13 (21%)	0 (0%)	1 (14%)	2 (8%)	0 (0%)	2 (10%)	9 (18%)	4 (44%)	0 (0%)

cfsre | NPS DISCOVERY

ACMT American College of Medical Toxicology
ToxIC Toxicology Investigators Consortium

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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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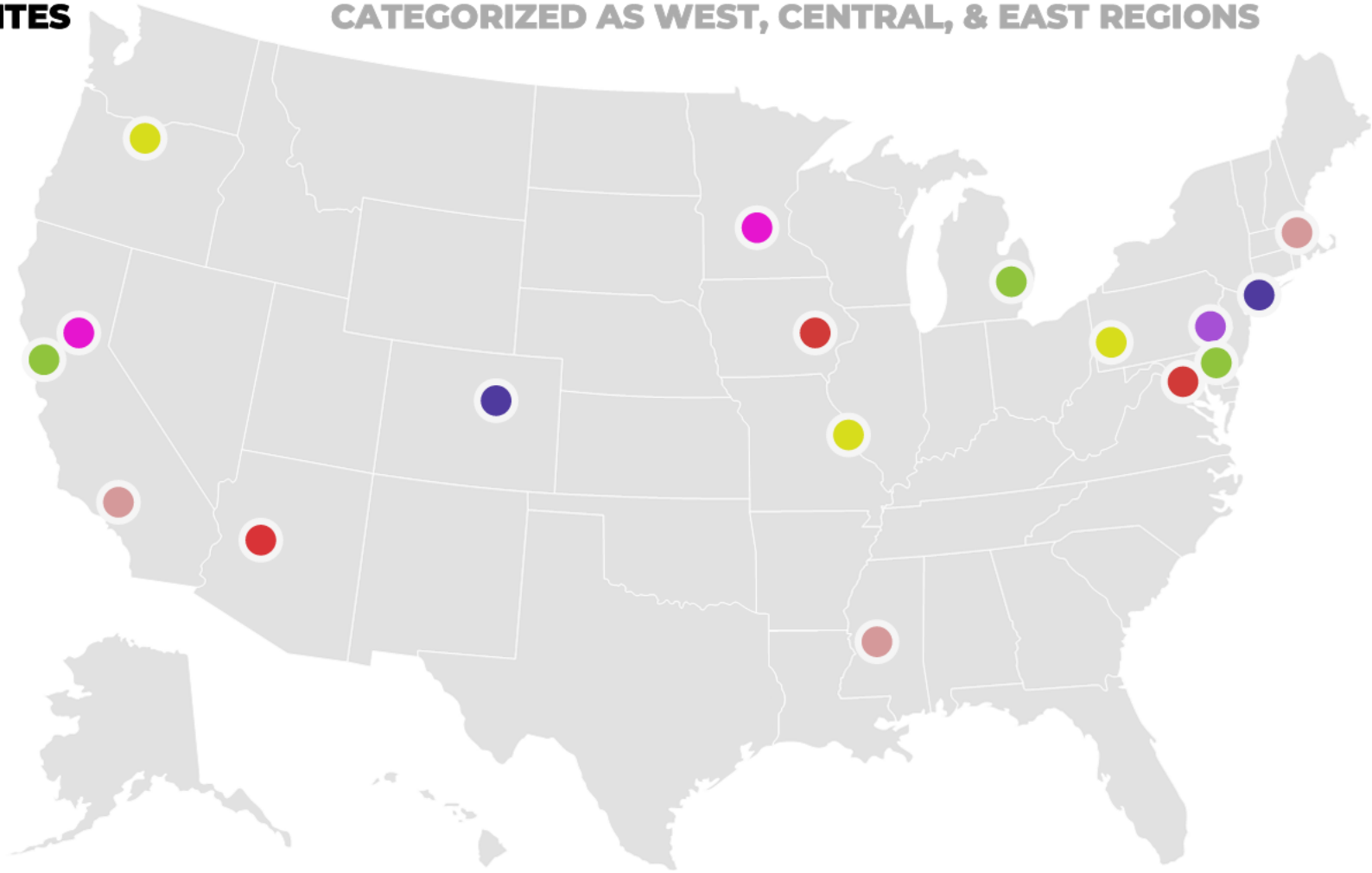
PARTICIPATING SITES

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

Minneapolis, MN
Hennepin Medical Center

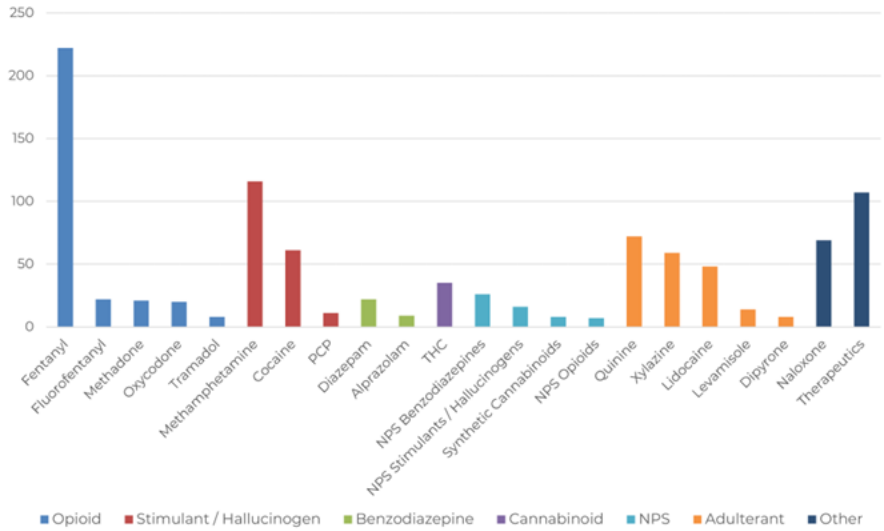
Iowa City, IA
University of Iowa

Detroit Medical Center

St. Louis, MO
Washington University

Jackson, MS
University of Mississippi

ALL SITE SUMMARY RESULTS (N=294)



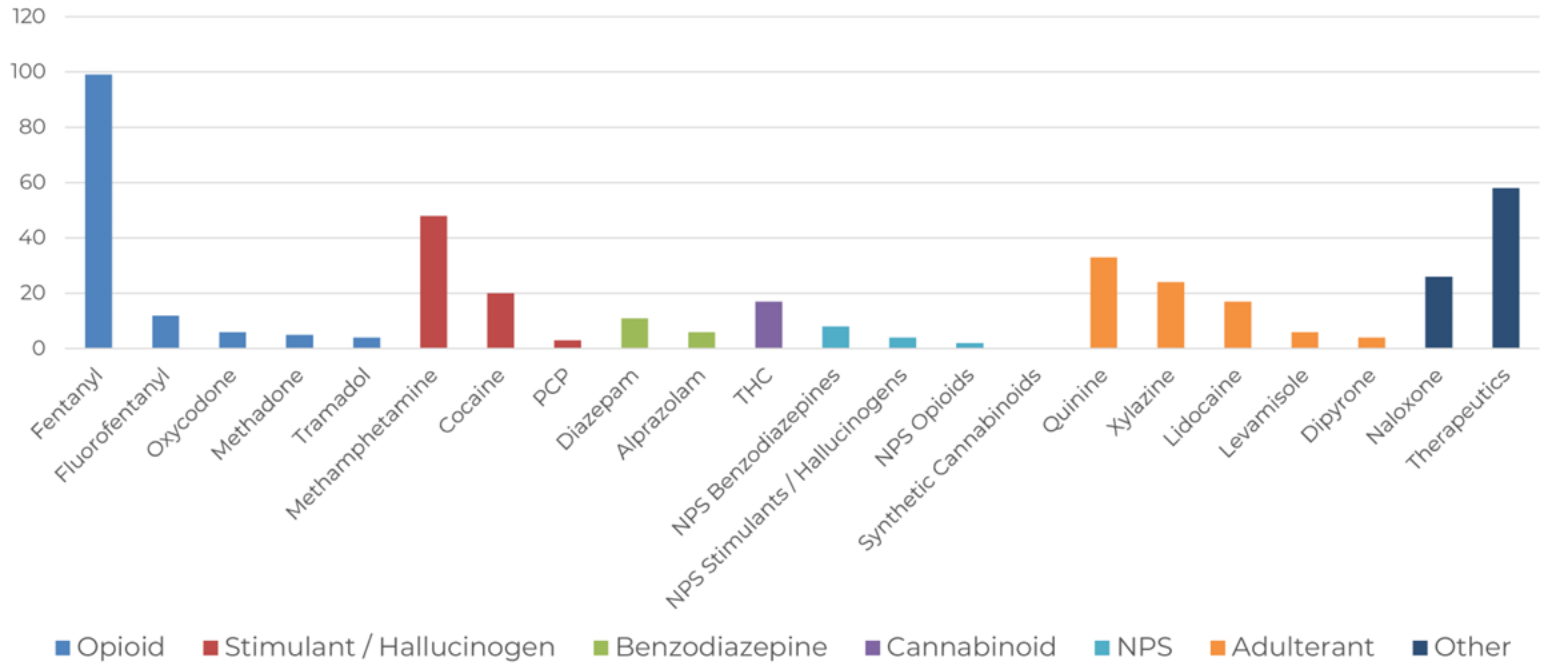
Traditional Drugs (ng/mL)					NPS (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range	Drug	N	Mean ± Std Dev	Median	Range
Ethanol (mg/dL)	24	110±105	79	9.9-390	Bromazolam	21	81±85	50	<5-310
Fentanyl	227	8.5±11	4.7	<1-100	Flubromazepam	2	-	-	<5->500
Norfentanyl	207	8.4±21	2.8	<1-200	*N,N*-Dimethylpentylone	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					

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

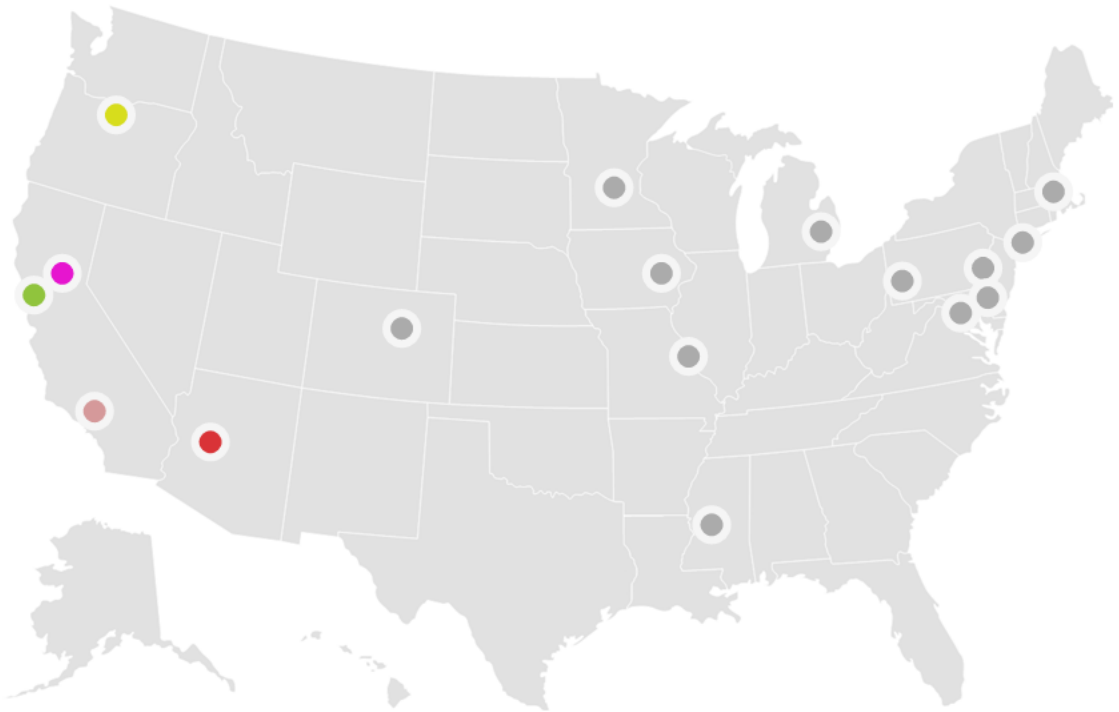
Drug	N	Range
Flubromazepam	2	<5->500



EAST REGION SUMMARY (N=90)

Traditional Drugs (ng/mL)				
Drug	N	Mean ± Std Dev	Median	Range

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=17)

SAN FRANCISCO, CA (N=16)

- 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%)

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,

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					

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	-	-					