

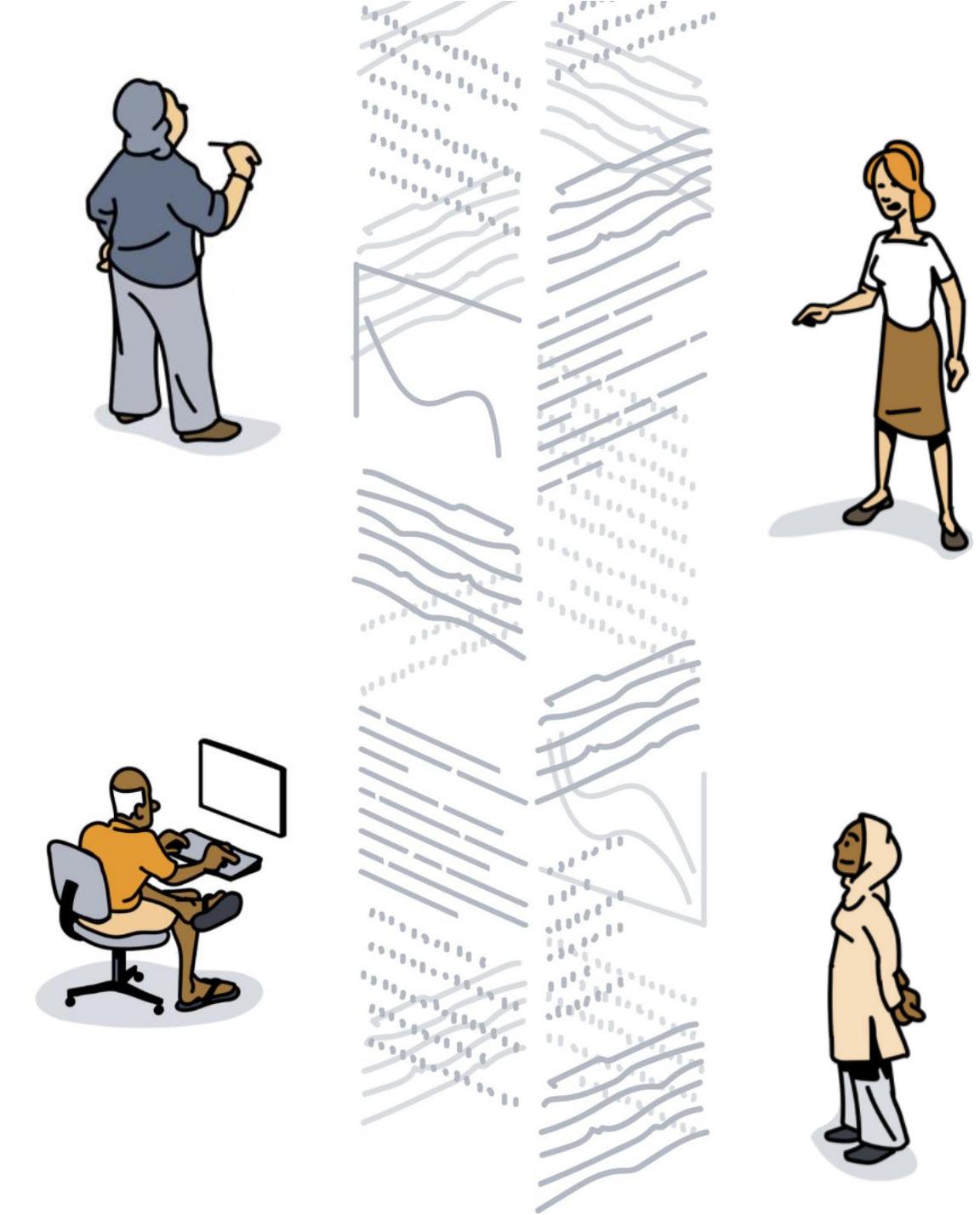
Data Viz & Chemistry & Art & Public Health

Making Sense of Street Drugs

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University of North Carolina at Chapel Hill

Aug 29, 2024 • DataBytes

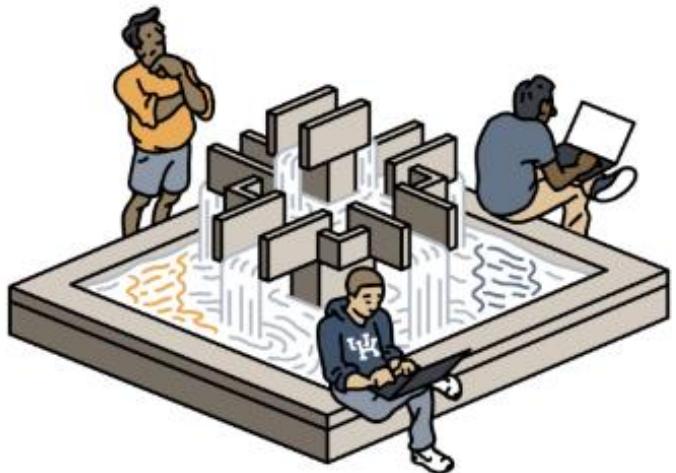




Opioid Data Lab



Theory



Foundational Studies

Biostatistics
Epidemiology methods
Psychology of communication
Pharmacology

Practice



Applied Research

Pharmacy
Medicine
Vital statistics
Harm reduction

Lived Experience



Practical Applications

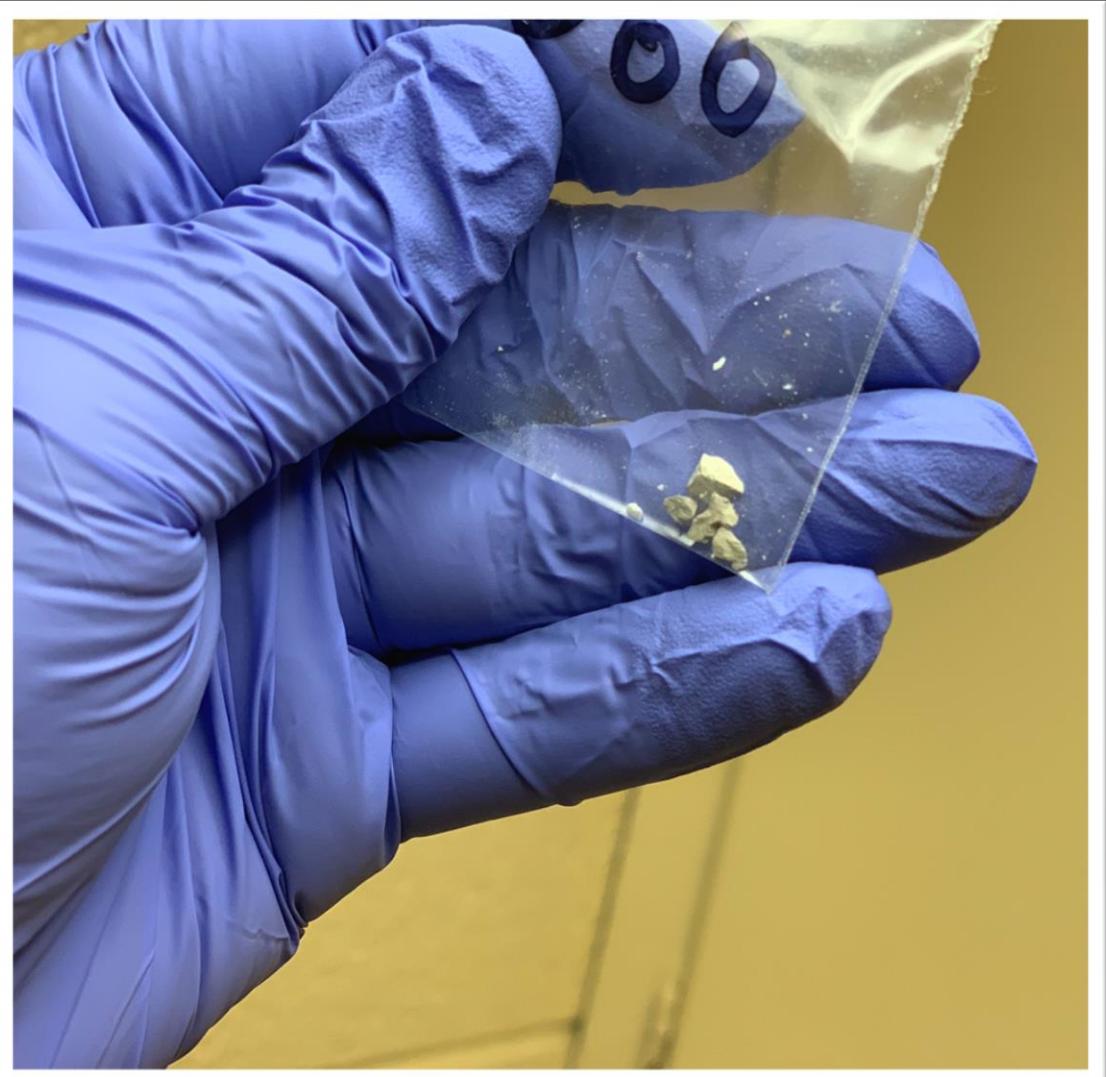
Drug checking
Sociology (qualitative)
Evidence-making interventions
History of asylums

Our Approach is Different.

Science

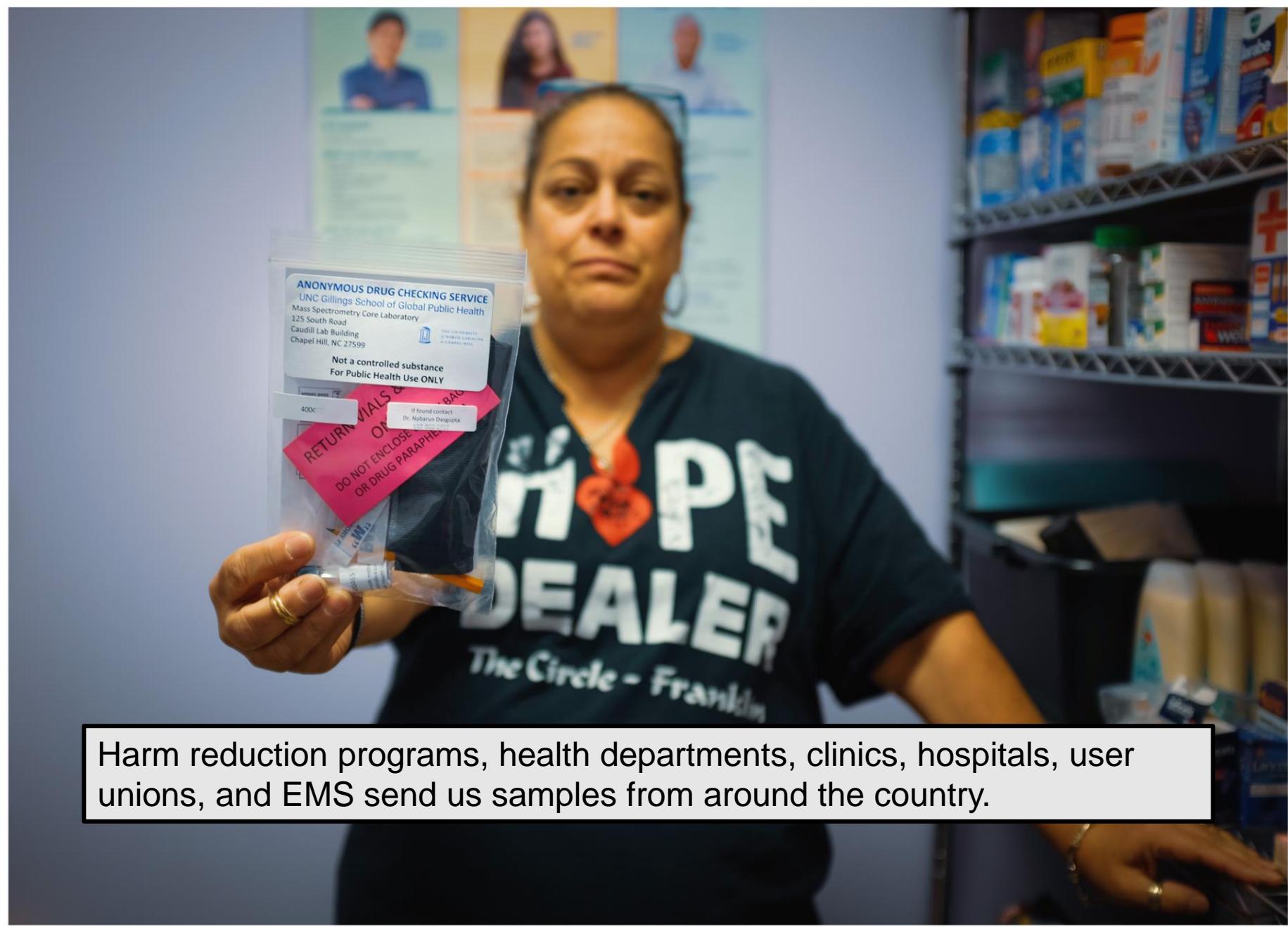
in

Service



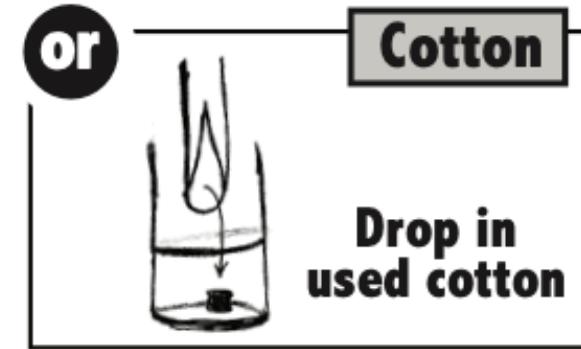
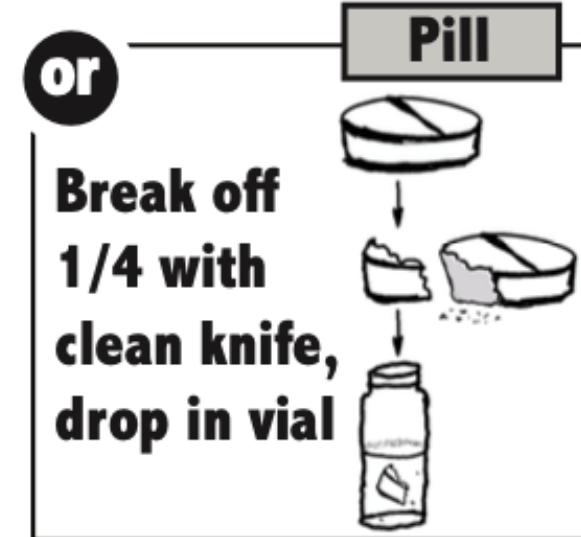
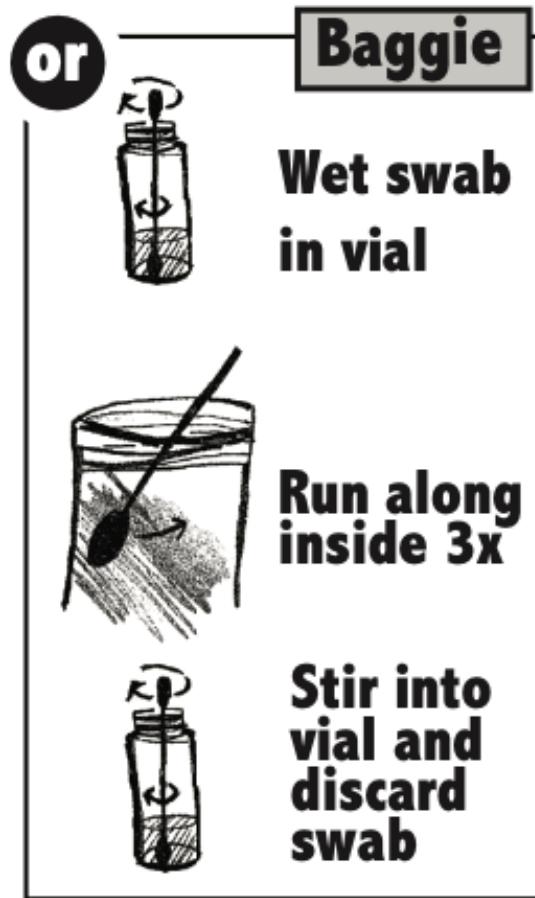
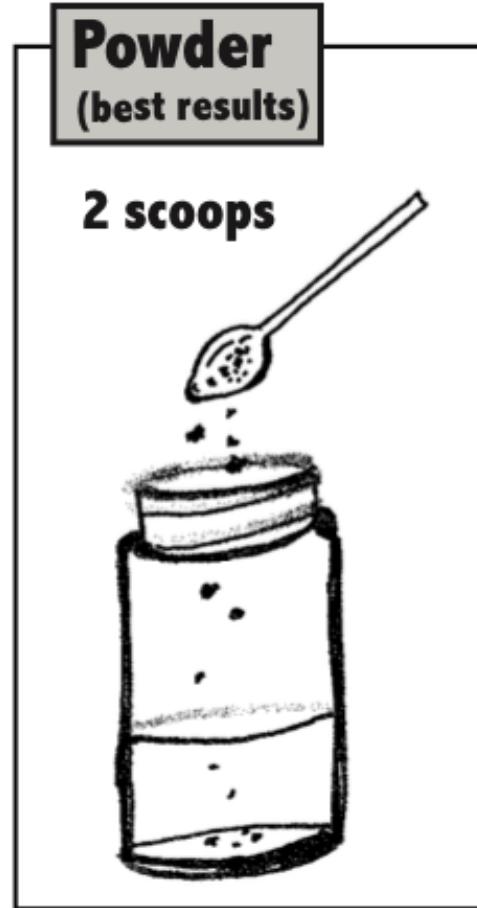
Street drugs change constantly.





Harm reduction programs, health departments, clinics, hospitals, user unions, and EMS send us samples from around the country.

Samples can be collected via scoop, residue swab, pill fragment, or used cotton.



We've detected a multitude of substances in drug supply.



1. Helping Individuals



Questions we have helped answer

Is there fentanyl in black tar heroin?

Are nitazenes causing these overdoses?

What killed my husband?

Can xylazine explain these skin wounds?

How accurate are test strips?
Handheld machines used by police?

Can black lights identify xylazine and nitazenes?

MDMA used by psychedelic therapy patients?

300731

From Asheboro, North Carolina on
11/2/2022

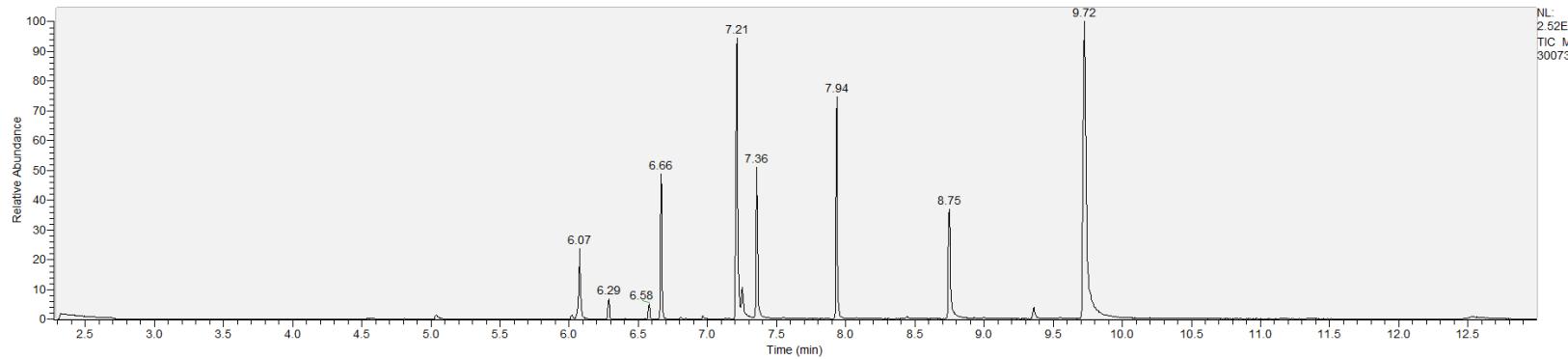
Assumed to be heroin

This is a messy brew of 10 major substances:

- phenacetin
- caffeine
- procaine
- meconin
- hydrocotarnine
- fentanyl
- levamisole
- 4-ANPP
- xylazine
- cocaine

But we found lots of contaminants too, with traces of acetaminophen + N-phenylpropanamide + melatonin + noscapine + heroin + dimethyl sulfone (methylsulfonylmethane MSM). Trace substances in small quantities can sometimes be harmless, but other times can cause health problems. If you have unexpected sensations, it may be due to these.

Messy Brew of 16 Substances



Medicine: phenacetin, acetaminophen, melatonin

Veterinary medicine: levamisole, xylazine

Numbing agents: procaine

Stimulants: caffeine, cocaine

Organic origin: **noscapine**, meconin, hydrocotarnine, heroin

Synthetic opioids: fentanyl

Byproducts: 4-ANPP, N-phenylpropanamide, MSM

From GCMS Output to Harm Reduction

The Problem:

- Chemical names are *intimidating* and *arcane*
- Site users copy and paste into search engines when they see substance they don't know, returning *complicated* or *ineffective* information.
- In data analysis, we have only rudimentary capabilities to identify classes of molecules, and existing taxonomies are not built-for-purpose.

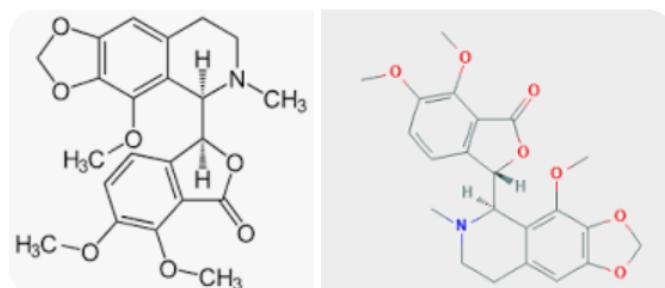
noscapine

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Noscapine is a phthalide isoquinoline non-narcotic alkaloid derived from the opium poppy *Papaver somniferum*, with mild analgesic, antitussive, and potential antineoplastic activities. Noscapine exerts its antitussive effects through the activation of sigma opioid receptors.

 National Institutes of Health (NIH) (.gov)
<https://pubchem.ncbi.nlm.nih.gov/compound/Nosca...>

Noscapine | C22H23N07 | CID 275196 - PubChem



We need harm-reduction *specific* translations

What information will support communities to have safer interactions with drugs?

Our solution: The Chemical Dictionary

Google's Output:

phthalide

isoquinoline

non-narcotic

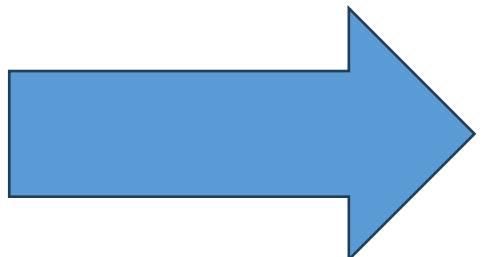
alkaloid

papaver

somniferum

?

Input of "noscapine"



Chem Dictionary's Output:

heroin impurity

weak opioid

anti-cough

downer

established

Uncommon cough
medicine; From
opium poppy

It lacks significant hypnotic, euphoric,
or analgesic effects affording it with
very low addictive potential

Building The Chemical Dictionary

Features

- 270+ unique substances
- Keys (PubChem, CAS)
- synonyms, vernacular, pronunciation
- sixwords
- notes
- categorization
- tags

Fentanyl synthesis leftover, rotting fish smell

Classic upper in coffee and pills

Bitter taste, used in rubbing alcohol

Tagging System

- Tags allow for flexible labeling as the *context for use* of substance changes
- Allows for nuance in the automated categorization process
- Curated by our wonderful team of chemists, physicians & epidemiologists!

noscapine tags:

PLANT GROWN ESTABLISHED
WEAK OPIOID OPIOID
HEROIN IMPURITY DOWNER

Categorization

Opioid

Cannabinoid

Sedative

Stimulant

Psychedelic

Steroid

Other

2. Helping Frontline Public Health Orgs

Top 10 Substances Identified

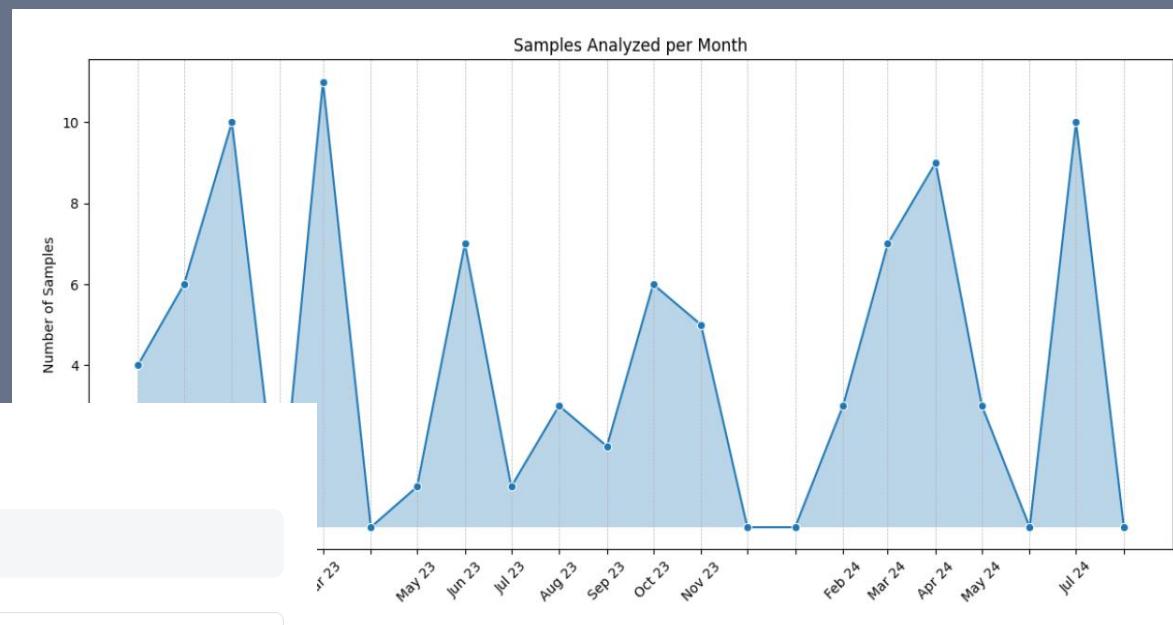
Rank	Substance	Samples	Description
1	fentanyl	39	Potent opioid, prescription uses, potentially lethal
2	4-ANPP	36	Leftover/inactive part of fentanyl production
3	methamphetamine	27	Description pending, currently unavailable
4	cocaine	21	Classic upper, coke or crack forms
5	p-fluorofentanyl	10	Fentanyl-analog, likely more potent and deadly
6	ketan		
7	xylazi		
8	lidoca		
9	despr		
10	dimet (meth)		

OD Drug Combos

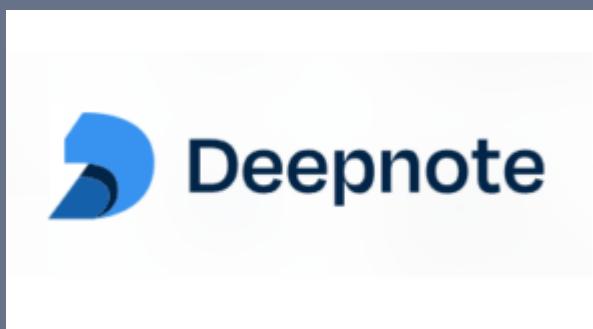
💡 Combinations of substances in overdose reports.

Total number of samples involved in overdoses: 9

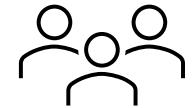
Collection Dates	Frequency	Combination of Substances
2024-Feb-15		
2024-Apr-17	3	4-ANPP; fentanyl
2023-Apr-29		
2022-Nov-25	1	methadone
2023-Feb-14	1	4-ANPP; ethyl-4-ANPP; fentanyl; lidocaine; p-fluorofentanyl; tramadol; xylazine
2023-Feb-01	1	4-ANPP; despropionyl p-fluorofentanyl; fentanyl; lidocaine; p-fluorofentanyl; t
2023-Jun-27	1	4-ANPP; N-phenylpropanamide; fentanyl; mannitol
2024-Feb-29	1	4-ANPP; fentanyl; methamphetamine
2024-Feb-29	1	4-ANPP; fentanyl; xylazine



Live reports application project created by student researcher Bryn & Nab!



3. Seeing Patterns: Public and Scientists



Let's zoom out even more...

- Our vision is to make the drug supply seem knowable – to anyone & everyone
- We want a conversation starter, an eye-catcher!

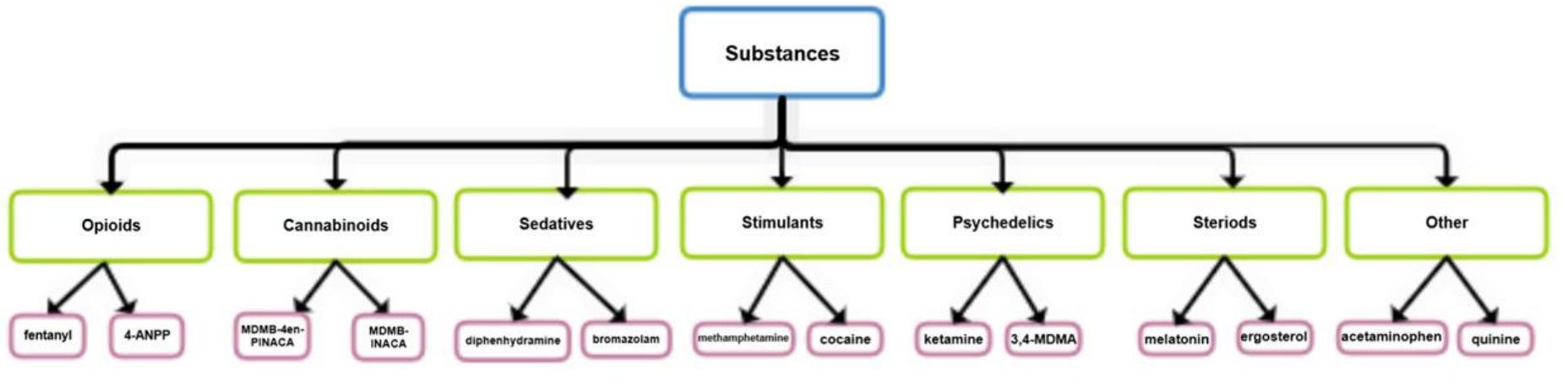
The drug supply is “not this massive, lethal, heaving beast,” Dr. Green said. “It is something that we’re coexisting with.”

-quote from [NYT article](#) about our lab, by Traci Green, a friend and collaborator

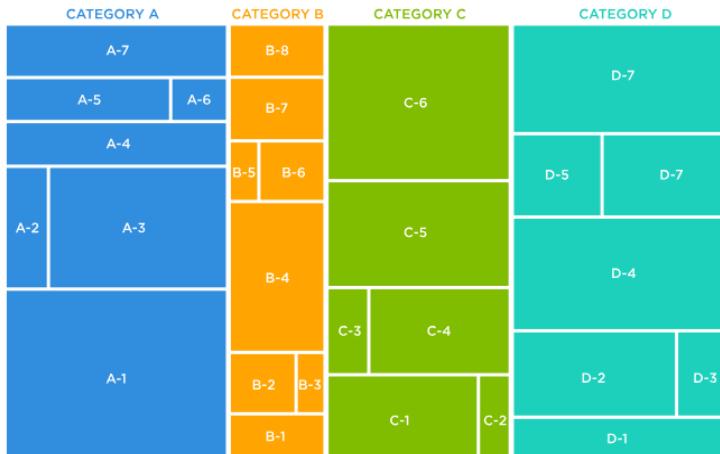
Our audience:



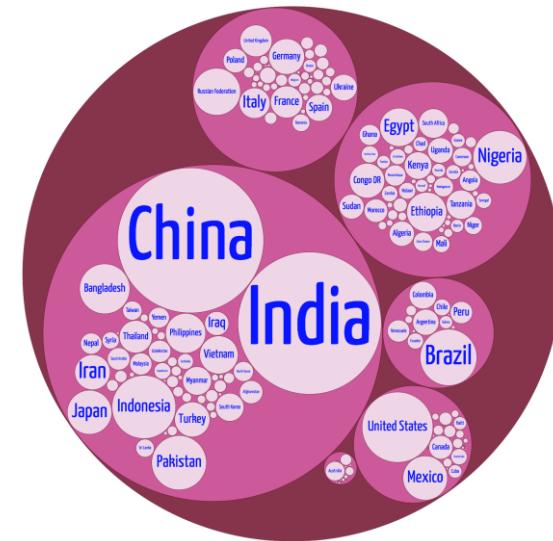
Hierarchical Tree Structure



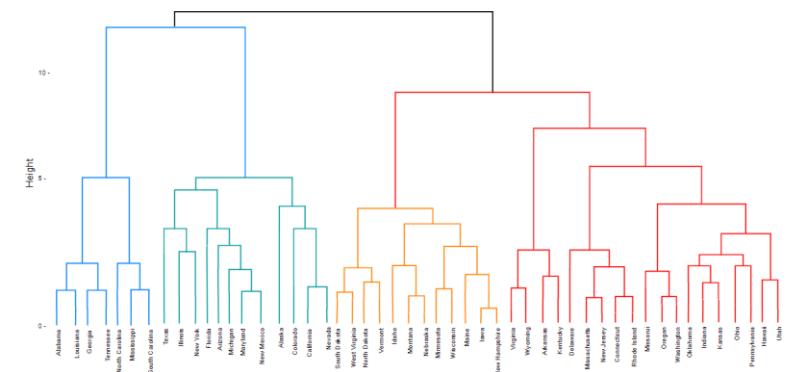
Tree Diagram



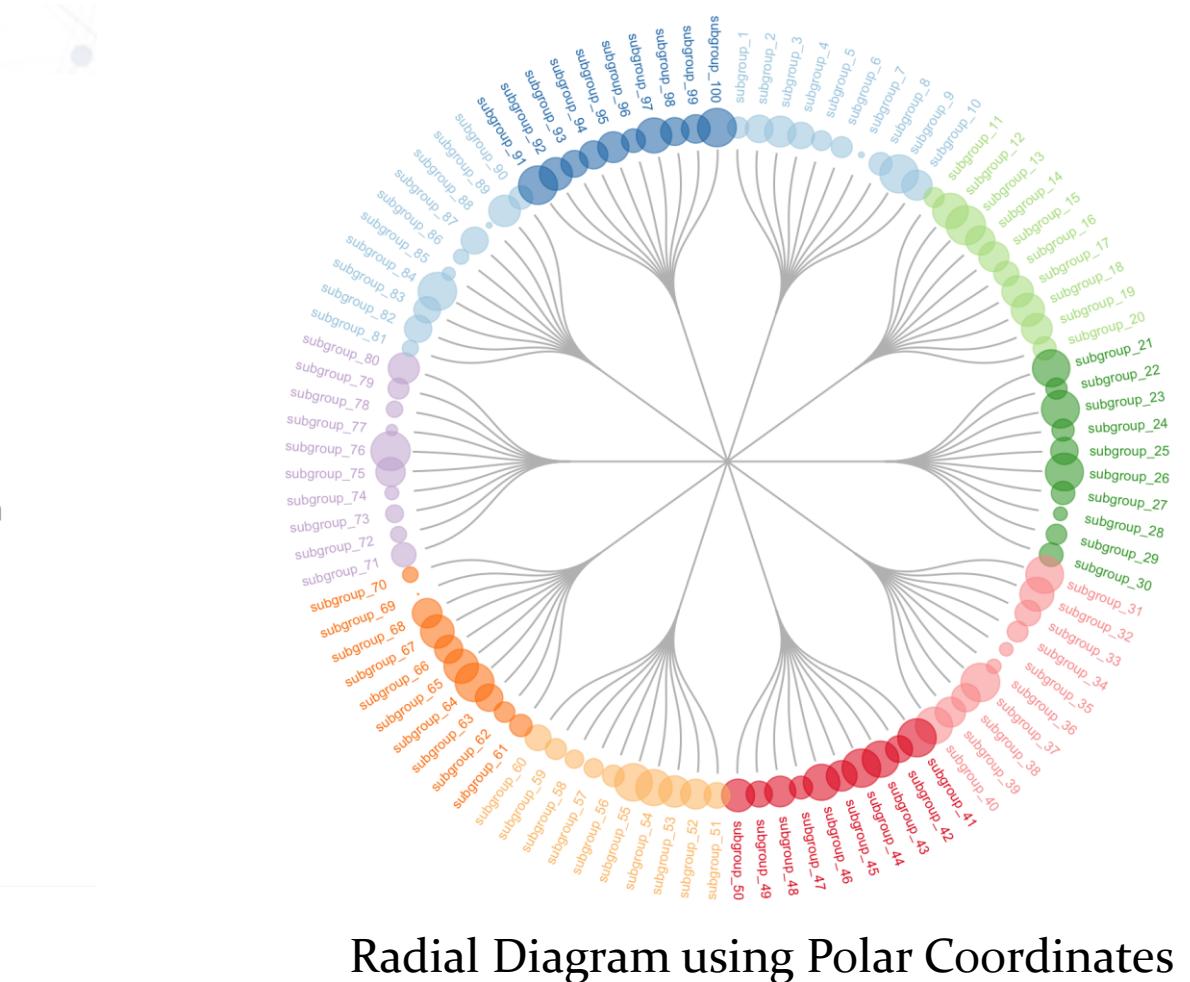
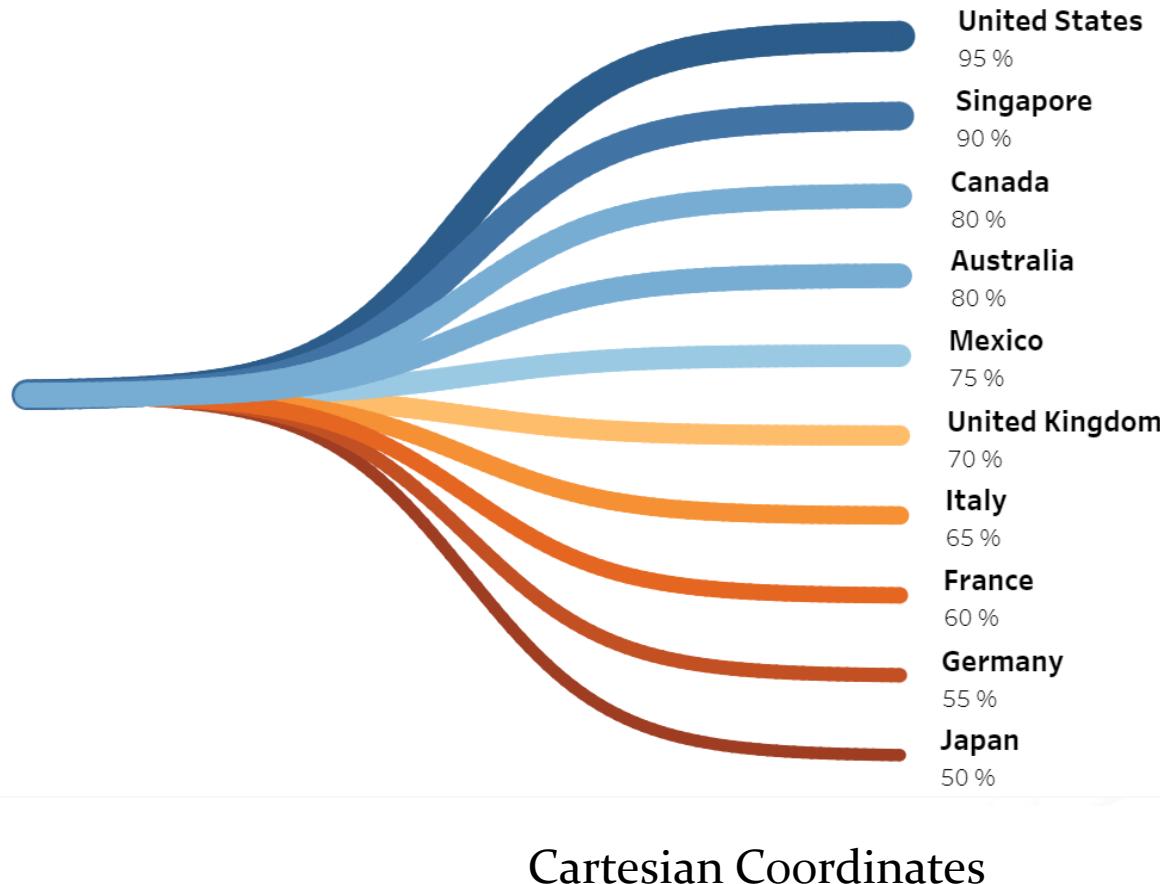
Circle Packing/Enclosure Diagrams



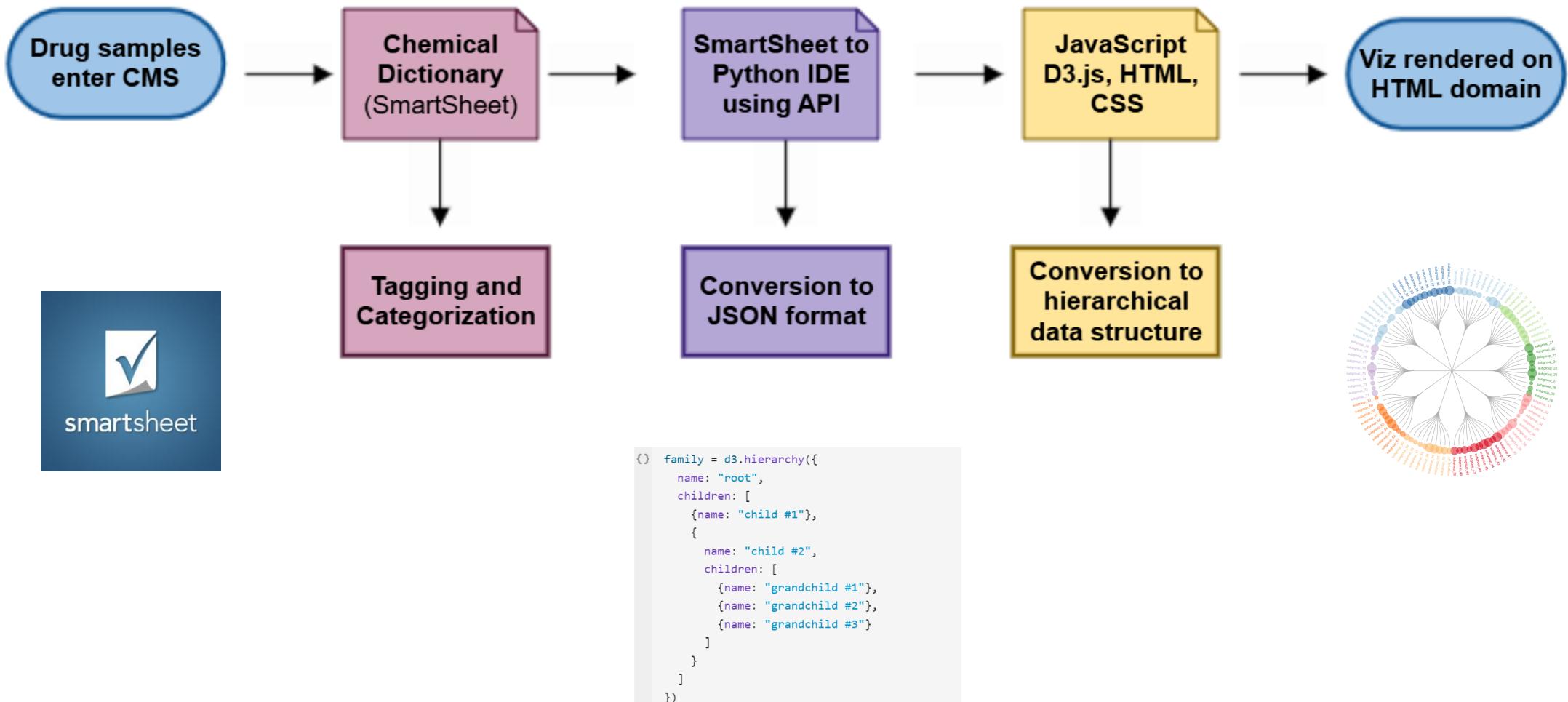
Tidy Trees



Dendograms (Single Level Tidy Trees)

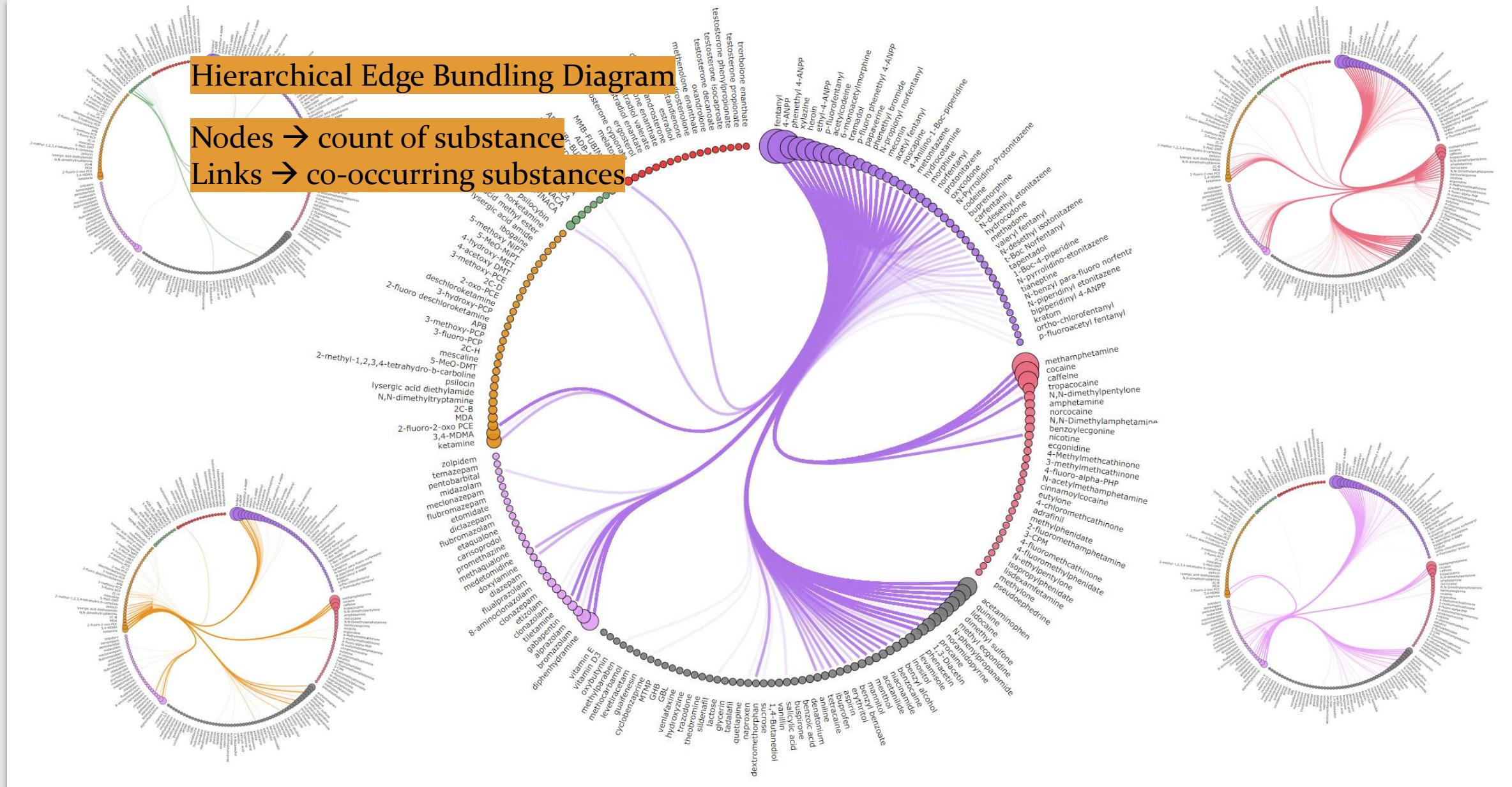


Data Processing Pipeline



Hierarchical Edge Bundling Diagram

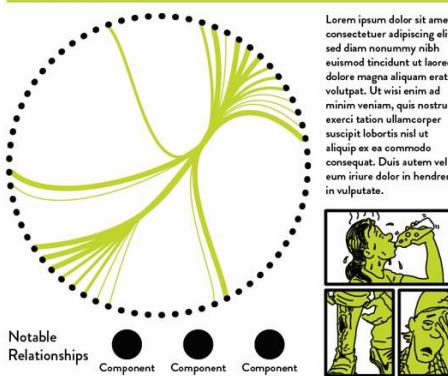
Nodes → count of substance
Links → co-occurring substances



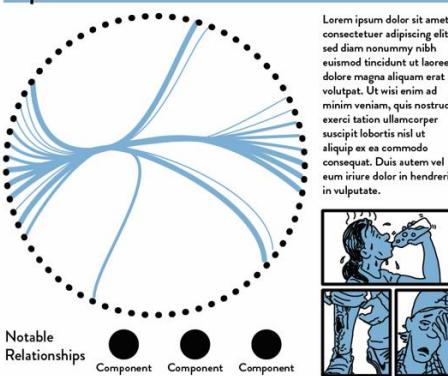
Sampling of the National Street Drug Supply

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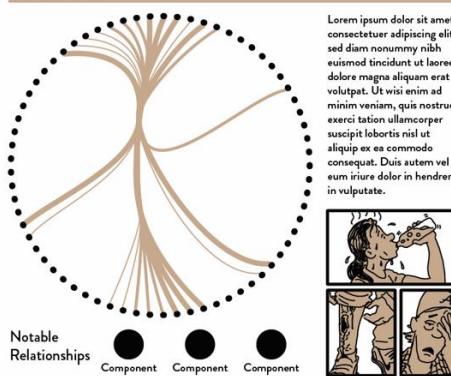
Cannabinoid



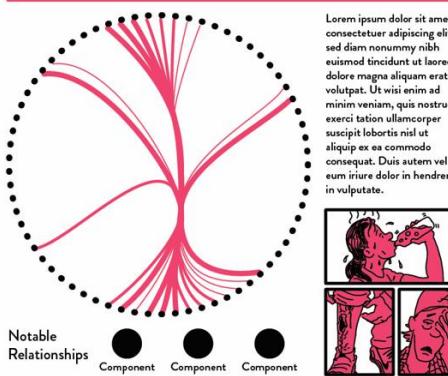
Opioid



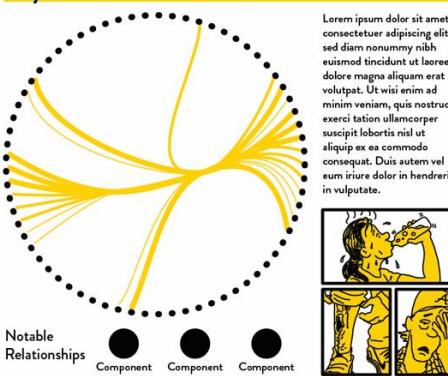
Sedative



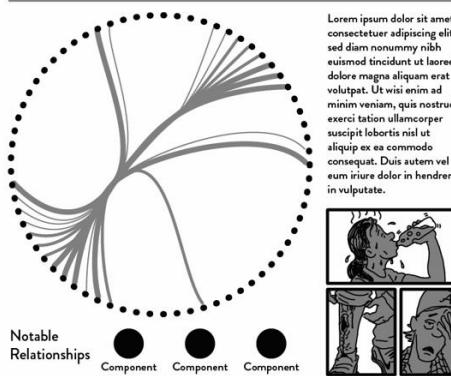
Stimulant



Psychedelic



Other

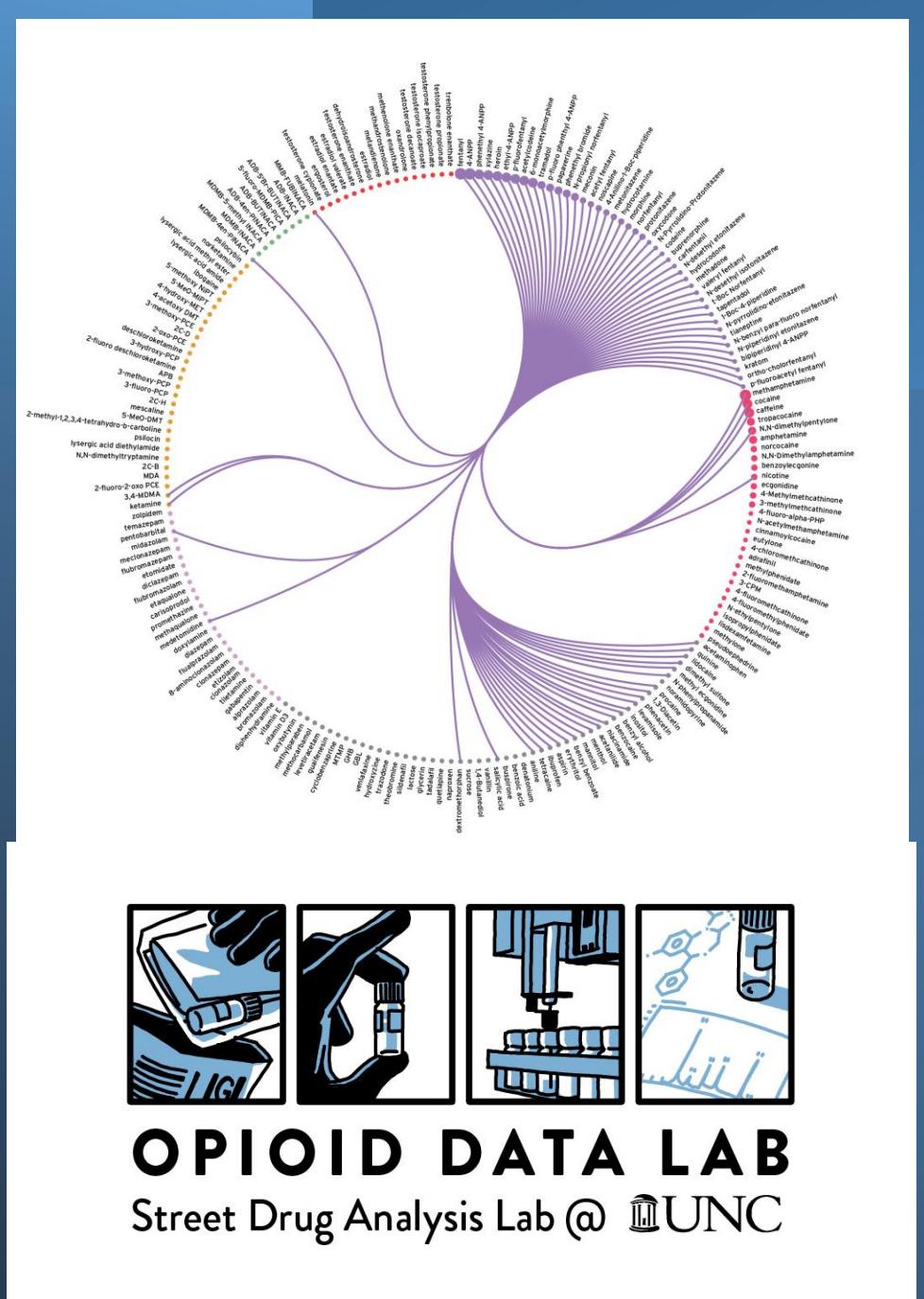


Component Categories



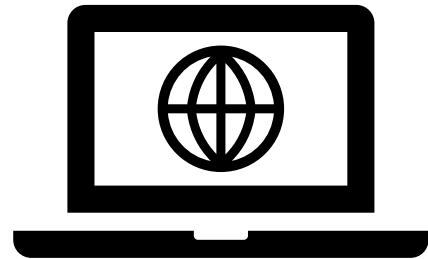
OPIOD DATA LAB
Street Drug Analysis Lab @ UNC

The poster outline & graphics were created
by Brittain Peck, our incredible graphic designer!
[@brittainpeck](https://www.instagram.com/brittainpeck)



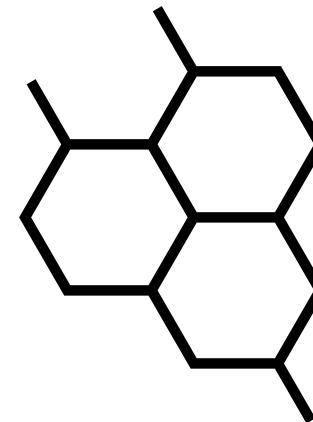
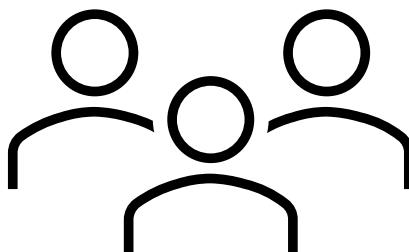
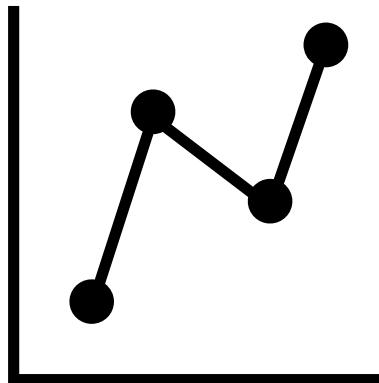
Where we can take this...

- D3.js allows for dynamic & interactive user experiences
- Viz can be hosted on our lab website
- Central location for the audience to dive deeper into data nuances



Takeaways

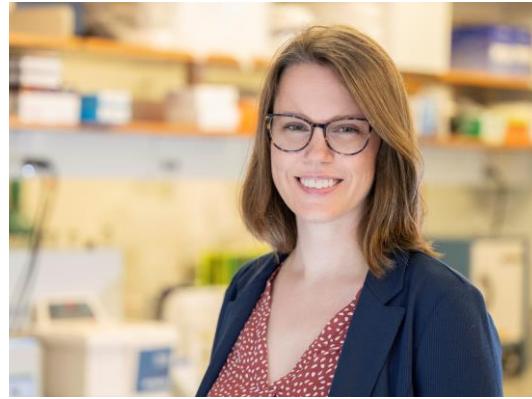
- The drug supply is vast, but it's knowable
- Data techniques can shorten the knowledge gap and provide community partners with effective, real-time solutions.
- Art and data viz can draw audiences into start conversations



Our Chemical Dictionary Team!



Nabarun Dasgupta,
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Pharmaco-epidemiologist



Erin Tracy, MS
Chemist @ IPRC



Nathaniel Erskine, MD



Meredith Niess, MD, MPH



Anuja Panthari, MPH Candidate

"Love is a research value." - LV

Shelby
Bridgette
Shay
Tushar
William
David
Natalie

Anuja
Erin N.
Elijah
Bryn
Adams
Matt **



BRITAIN
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