

Surveillance Efforts to Track Drug Market Changes in Philadelphia, PA

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Overview

The Center for Forensic Science Research and Education (CFSRE) formed a partnership with the Philadelphia Department of Public Health (PDPH) in 2018 to develop and support a drug checking surveillance program across the city of Philadelphia. The scope of this program includes many different drug materials observed in the city, including opioid powders, counterfeit tablets, methamphetamine crystals, cocaine powders and rocks, synthetic cannabinoid (K2) plant materials, psychedelics, and more.

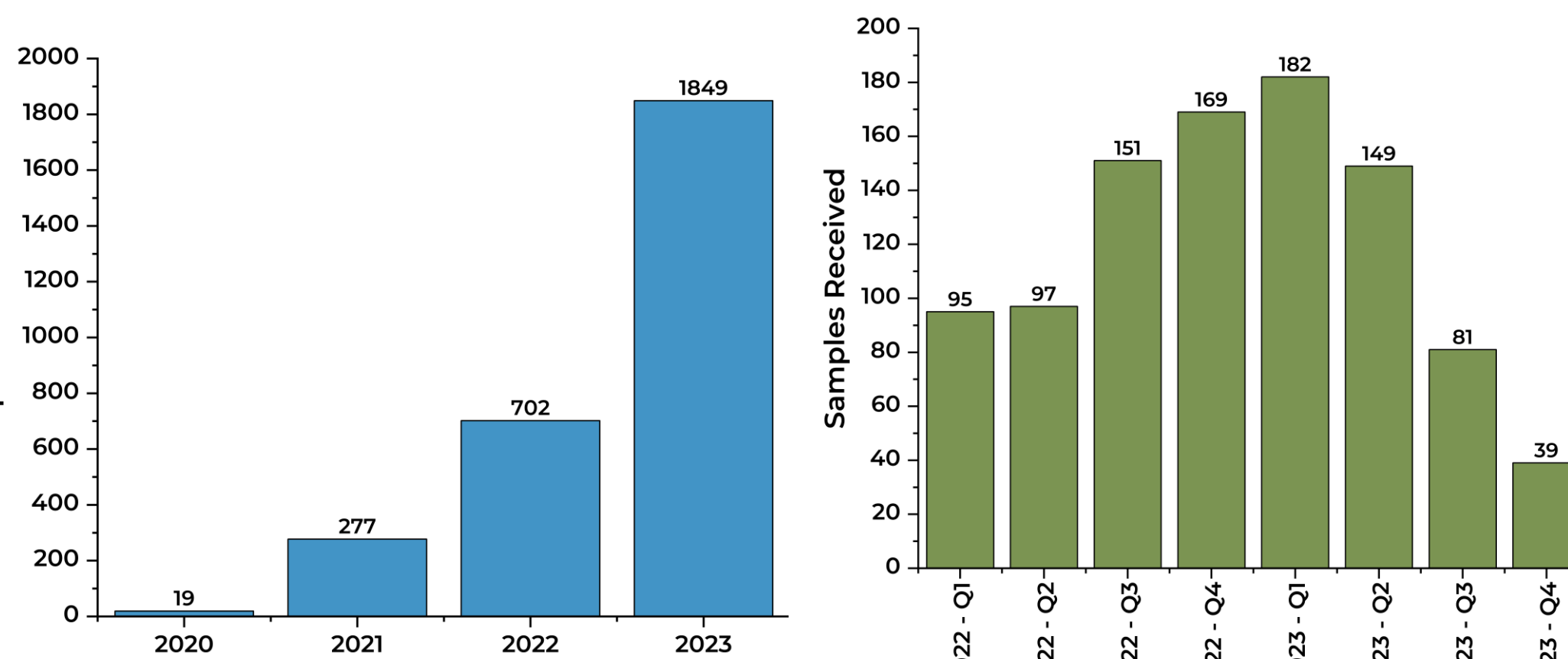


Figure 1 & Figure 2: Progression of samples received by the CFSRE drug checking surveillance program from all collaborators from 2020-2023 (Left) and from Philadelphia since 2022 (Right).

Objectives

- 1) **Near real-time monitoring** of the comprehensive drug supply in Philadelphia with the purpose of informing public health and safety agencies, forensic science, and the community.
- 2) **Qualitative analysis** to identify active drugs, adulterants, and **novel psychoactive substances (NPS)** to better understand the composition of drug samples and alert on important observations.
- 3) **Quantitative analysis** for a deeper understanding of drug purity and correlation of drug amount to adverse drug effects.



Photo 1 (Left): A typical Philadelphia "dope" sample in a glassine bag. The "Snoopy" stamp is an example of how dope dealers may distinguish theirs from other street dealers' product.



Photo 2 (Right): A typical Philadelphia "dope" white powder sample, but dope may be other colors as well - such as tan or purple.

Methods

In 2023, **1,849 drug material samples (Philadelphia, n=451)** were received and analyzed. Samples were documented, photographed, and aliquoted for qualitative analysis by **GC-MS** and **LC-QTOF-MS**. Samples with sufficient mass were quantitatively analyzed by GC-MS. The quantitative method was developed and validated to **detect** and **quantify** fentanyl, methamphetamine, levamisole, lidocaine, xylazine, cocaine, para-fluorofentanyl, and 4-ANPP.

Qualitative Results

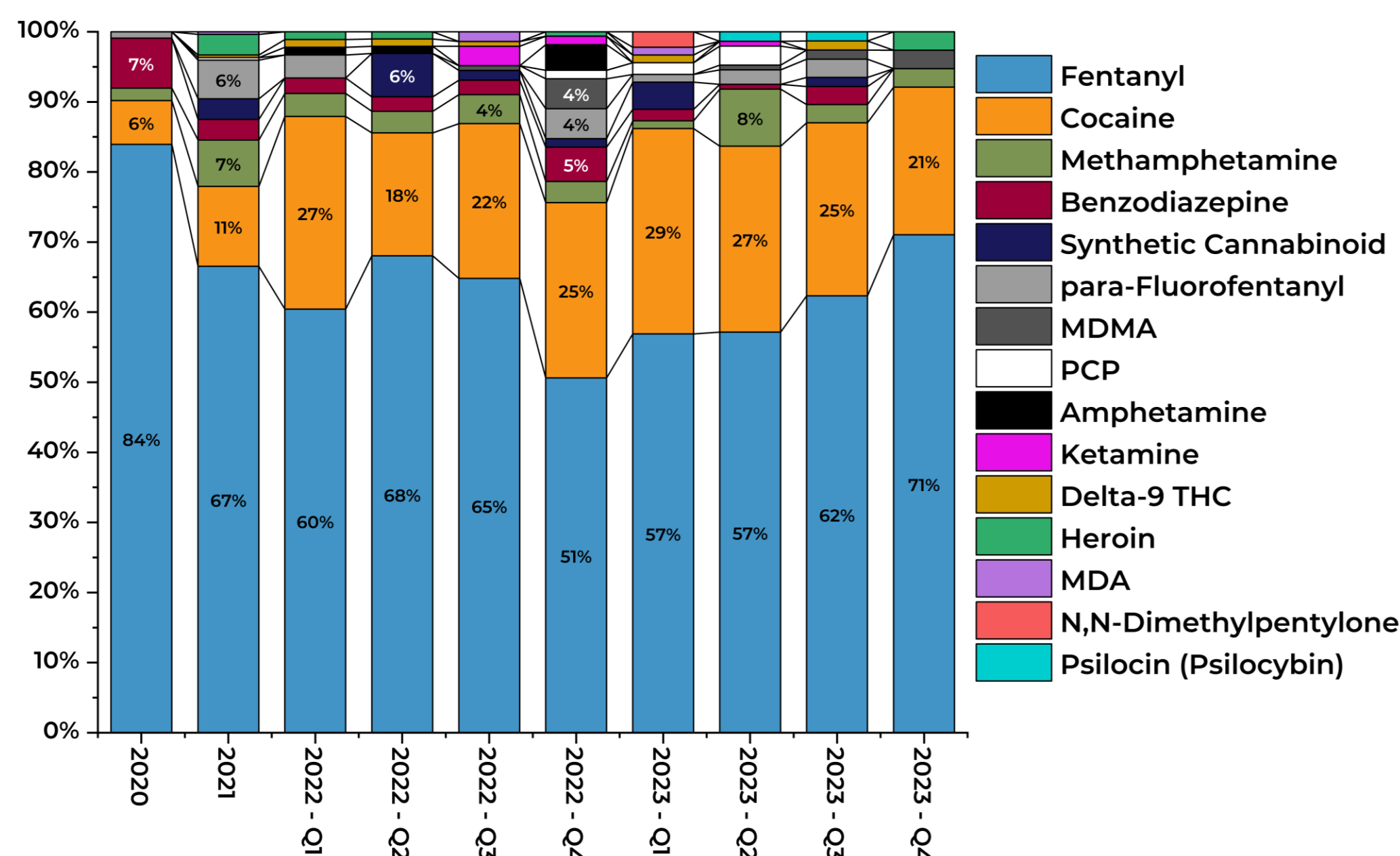


Figure 3: Prevalence of the primary component found in Philadelphia drug checking samples from 2020-2023. Primary component of a sample is identified based on the highest peak area.

Over half (**62%**) of all drug samples submitted in 2023 contained **fentanyl** as the primary component (Figure 3). In Philadelphia, fentanyl is frequently and increasingly adulterated with the veterinary sedative, **xylazine**. Approximately **97%** of fentanyl samples contained xylazine in 2023, with xylazine frequently as the main component.

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Drug Co-Occurrence

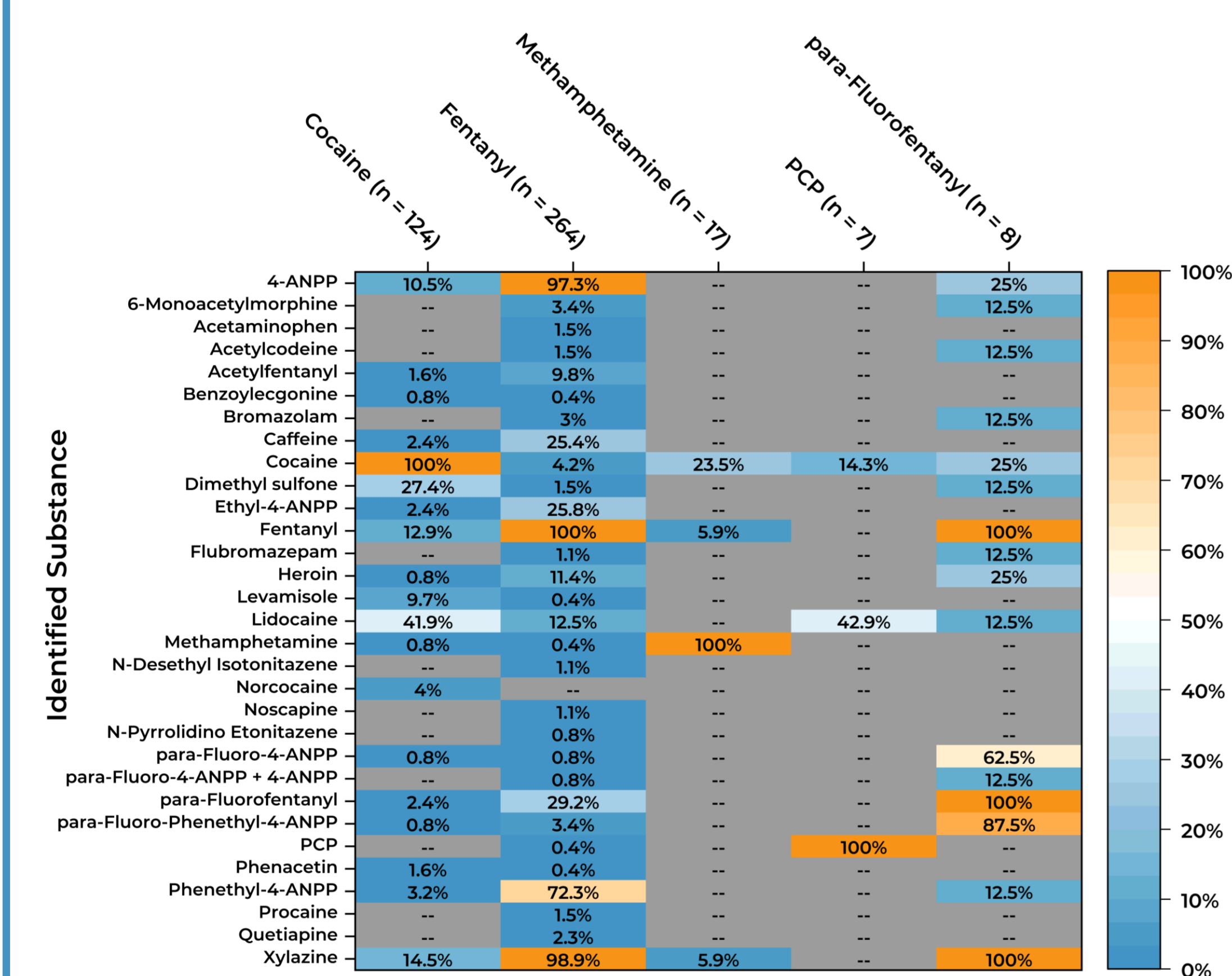


Figure 4: Heat map showing the frequency of substance co-occurrence. 2023 Philadelphia drug samples were filtered by their primary drug component (x axis, n>5) and cross-referenced to other detected substances (y axis).

In 2023, fentanyl samples contained **30** different co-detected substances. **Fentanyl** samples nearly always contained detectable **xylazine** (98.9%) and **4-ANPP** (97.3%). **Fentanyl** samples were frequently detected with **para-fluorofentanyl** (29.2%) however, **para-fluorofentanyl** samples were always in combination with **fentanyl** (100%). Lidocaine (41.9%) and dimethyl sulfone (27.4%) were the two most common substances found in **cocaine** samples. Lidocaine was found in other sample types as well such as, PCP, fentanyl, and para-fluorofentanyl. **Methamphetamine** was infrequently adulterated (Figure 4). Samples containing only one primary substance identified were **psilocin** (n=3), **MDMA** (n=3), **LSD** (n=1), **alprazolam** (n=1), and **acetaminophen** (n=1). Four samples contained **bromazolam** as the primary drug substance with one also containing xylazine. Similarly, four samples contained **N,N-dimethylpentylone** as the primary drug with one also containing **ADB-BINACA**.

Quantitative Results

The **average concentration of fentanyl** was **13%** in "dope" samples collected in Philadelphia from 2022-2023 (Figure 5); however, high variability in concentration was observed. The **maximum concentration of fentanyl** was **53%**. The **average concentration of xylazine** was **40%** across the same "dope" samples (Figure 6) and the **maximum concentration of xylazine** was **77%**. The average xylazine concentration has steadily **increased** over time, while the average fentanyl concentration has remained steady. In the second half of 2023, the **average concentration of xylazine** in "dope" samples was **54%**. Notably, the **average concentration of cocaine** was **49%** in "coke" and "crack" samples. Samples containing cocaine as the primary drug are found to also contain (average concentrations): lidocaine (21%), xylazine (10%), methamphetamine (6%), and fentanyl (3%). Finally, the **average concentration of methamphetamine** was **61%**.

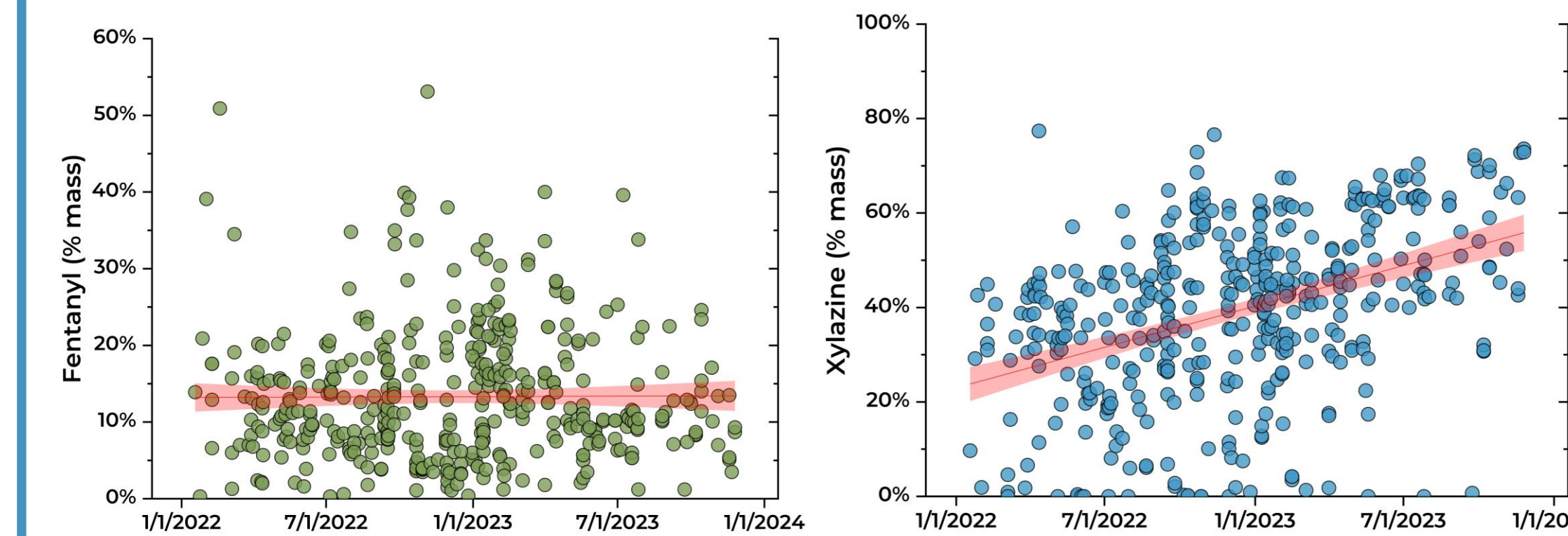


Figure 5 & Figure 6: Distribution of fentanyl (Left) and xylazine (Right) concentrations, by percent mass, in Philadelphia "dope" samples collected from 2022-2023.

Discussion & Conclusion

Our drug checking surveillance showed that **Philadelphia, PA**, has a **diverse** and **evolving** drug market in which **fentanyl** dominates the opioid supply. Fentanyl-containing drug samples are commonly observed with **multiple** substances and of particular interest, xylazine. **Xylazine** prevalence remains high, and concentrations have steadily increased since 2022 and appear to still be trending greater into 2024. The data accumulated from samples in Philadelphia illustrates the significance of the dynamic composition and complex concentration trends. Overall, CFSRE and PDPH's collaborative monitoring, comprehensive testing, and inclusive reporting of the drug supply provides essential information regarding composition variations and purity which ultimately aide efforts to combat the opioid epidemic in near real-time.