



PURPOSE

Samples seized from the Southwest border ports of entry by Customs and Border Protection (CBP) were studied by the Center for Forensic Science Research and Education (CFSRE) using advanced qualitative and quantitative testing methods at our state-of-the-art facility in Horsham, PA. This testing provides information related to understanding the health risks involved from variable drug potency and adulteration in the illicit fentanyl supply.

BACKGROUND

Seized powders suspected of containing fentanyl were analyzed at CFSRE qualitatively by gas chromatography mass spectrometry (GC/MS) and quantitatively by liquid chromatography tandem mass spectrometry (LC/MS/MS). Select drugs and adulterants identified in the samples were quantified to determine the purity. Thirty-three samples seized between 2020 and 2023 were analyzed originating from seven ports of entry designated as AZ-POE 1 and 2, TX-POE 1-3, and CA-POE 1-2.

Average Fentanyl Purity in Powder Exhibits (n=33)

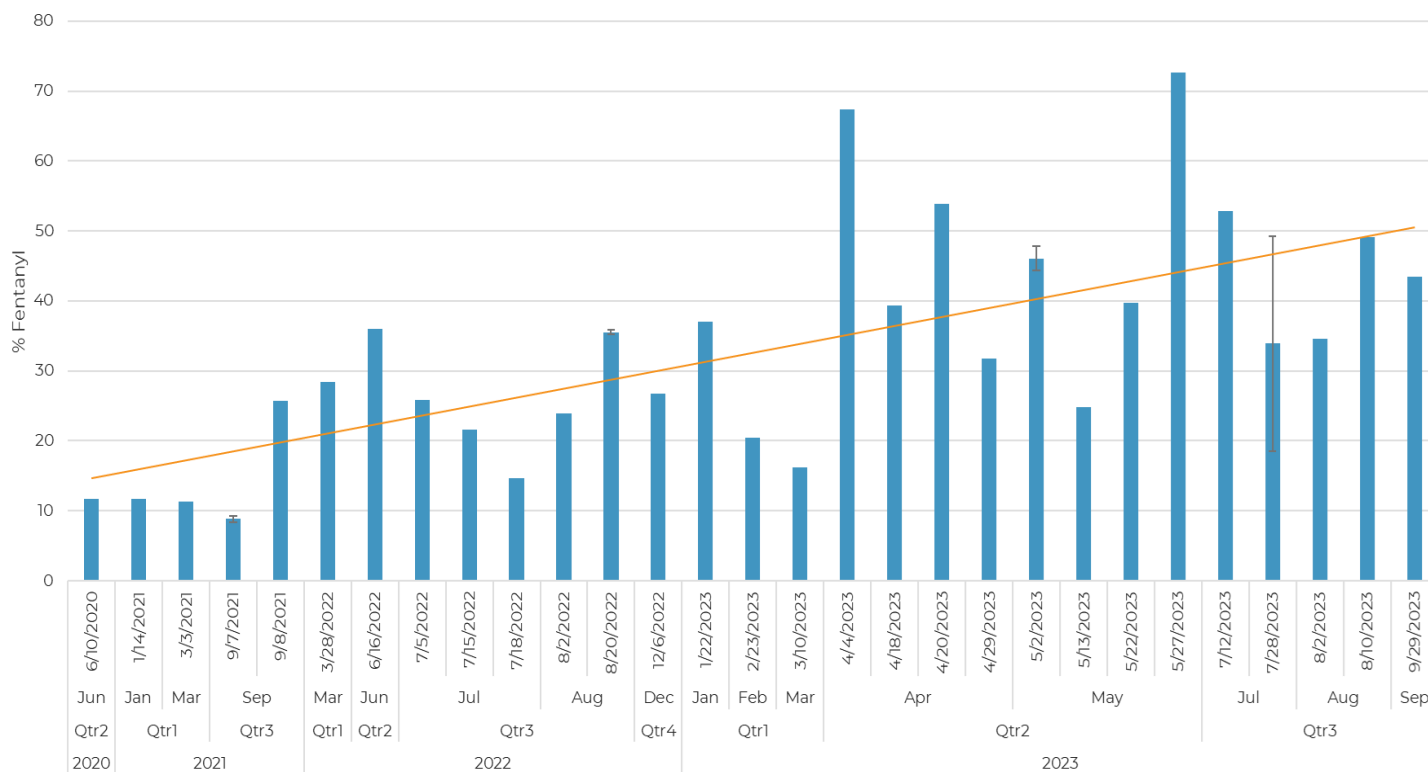


Figure 1. Average fentanyl purity (percent fentanyl) over time in 33 powdered exhibits.

A total of thirty-three samples were identified as fentanyl and two were identified as para-fluorofentanyl. The average amount of fentanyl is plotted in Figure 1. All of the samples from 2020-2022 originated from AZ-POE 1 with the exception of a single sample from AZ-POE 2. Samples that were seized in 2023 came primarily from CA-POE 1 (n=7), with four from CA-POE 2, three from AZ-POE 1, and one from TX-POE 1-3, and AZ-POE 2. The average purity of fentanyl powders was 11% in 2020 (n=1), 13% ±7.1% in 2021 (n=5), 27% ±7.2% in 2022 (n=9), and 49% ±15% (n=18) in 2023, indicating a general upward trend in potency of bulk powders over the four year period.

In addition to the fentanyl seizures, two powdered samples were identified to be primarily para-fluorofentanyl. One sample was seized in 2021 and was 15% para-fluorofentanyl. The other was seized in 2022 and contained 16% para-fluorofentanyl. Both of these exhibits contained a small amount of fentanyl (0.15% and 1.3%, respectively).

Since the exhibits only partially consisted of fentanyl or para-fluorofentanyl, the remainder of the bulk of the powder was evaluated to determine what other substances had been cut with the drug as a bulking agent. This information can be helpful in determining whether exhibits seized independently might be related to one another, or whether they might contain potentially toxic materials impacting public health. The powder samples were, in most cases, diluted with sugar/sugar alcohol (n=26). The majority of samples were cut with mannitol, although other sugars identified included meso/myo-inositol, lactose, glucose, and fructose. One sample, which had a high fentanyl purity (72%), was not diluted with sugar. Most samples contained a single sugar. Three samples contained a mixture of two sugars. These mixtures were mannitol and meso/myo-inositol (n=2, 28% and 44% fentanyl) and lactose and meso/myo-inositol (n=1, 11% fentanyl). One sample (35% fentanyl) contained four sugars: mannitol, glucose, meso/myo-inositol, and fructose. These combinations can comprise a portion of the “signature” of the drug exhibit.

Sugar/Sugar Alcohol	Number of Identifications
Mannitol	23
Meso/Myo-inositol	4
Lactose	3
Glucose	1
Fructose	1
Negative	1

The majority of the powder samples were relatively pure and did not contain additional active compounds, however one sample with 11% fentanyl contained the unscheduled opioid tramadol at 23%; a 21% fentanyl sample contained 3.2% xylazine and metamizole; a 16% fentanyl sample contained 20% xylazine, and a 31% fentanyl sample contained trace amounts of xylazine.



Figure 2. Fentanyl powder exhibits ranged in color from white and off-white to shades of green, blue, and purple based most likely on the addition of dyes. The color of the powder did not appear related to the purity of the fentanyl or to the adulterants and diluents identified. Identification of dye profiles may be an additional area of study for the Sentinel project.

In contrast to counterfeit opioid tablets, which are in their final dosage form when they come across the border and have a fixed and more predictable dose for the user, these powder exhibits will likely be further adulterated as they travel through the supply chain and before they reach consumers. This will result in a more variable potency in powders than in counterfeit tablets. Tablet samples tested at CFSRE exhibited more consistent purity/potency over the same time period, containing on average around 2 mg of fentanyl per tablet, although even with these, highly potent rogue batches of tablets with as much as 5 mg of fentanyl were encountered in our study. Overall, the data in purity of fentanyl powders being seized at the US Southwest border indicates a consistent upward trend in the potency of the powder coming across the border.

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