

Source Attribution of Fentanyl via Multivariate Metals Analysis

Summary

Fentanyl is a synthetic opioid and has been a major contributor to fatal and non-fatal overdoses in the United States. This opioid has been found to be diverted from legitimate pharmaceutical supplies or illicitly manufactured. In 2023, the Department of Homeland Security announced the next phase of its campaign to target and prevent fentanyl and precursor chemicals from entering the United States. We will measure metals in seized drug samples provided by the Drug Enforcement Agency and conduct multivariate statistical analysis. This method will contribute to an analytical strategy to assign and source the samples.

Problem Statement

The Operation Artemis campaign investigated the fentanyl supply chain (including pharmaceutical sources) and interdict items required in the chemical synthesis of fentanyl. This operation has led to indictments against foreign-based manufacturing companies and employees for fentanyl trafficking. Unfortunately, the scale of the manufacturing has proven difficult to assess and contain, especially with regards to precursors.

Approach

Seized illicit fentanyl samples are often identified and profiled by analyzing their organic constituents. Analyzing their metals content—that is, the inorganic constituents—can yield more comprehensive and greater insight into the source of the sample. The qualitative and quantitative profile of metals in a seized drug sample can be used to determine how, and potentially where, the samples were produced. We will determine several metals and metalloids (including some isotopes) in our samples by employing inductively coupled plasma optical emission or mass spectrometry. We will use the information to develop a metals database including seizure metadata, as appropriate. We will create a multivariate statistical model to visualize the data in order to interpret it more clearly.

Anticipated Impact for DHS

Our research will develop a model that uses the metals analysis information from seized samples to differentiate between pharmaceutical and illicit manufactured fentanyl irrespective of form (citrate or hydrochloride). In addition, this research will use isotopic ratios of selected metals in the seized samples for same batch identification and correlation using multivariate analysis. Collectively, these data sets and statistical analyses will help DHS target criminal drug networks, both within the United States and transnationally, by providing a more comprehensive

assessment of seized samples. In addition, these data will inform law enforcement about dynamic patterns of criminal activities in pharmaceutical companies.