NIST Researchers Develop New Tools to Combat Fentanyl and Other Synthetic Drugs

Background

- More than 107,000 people died of drug overdoses in the United States in 2021 – the highest annual death toll ever recorded.
- This spike in deaths is being driven by fentanyl, a synthetic opioid that mimics the effects of heroin but is far more potent.
- To mount an effective response, public health and law enforcement authorities need to detect and identify fentanyl and related compounds quickly, reliably and safely.
- This is a particular challenge because fentanyl is hazardous to handle, hard to detect and difficult to identify in the lab.
- The need for better laboratory methods is an often-overlooked aspect in the fight against illegal drugs.

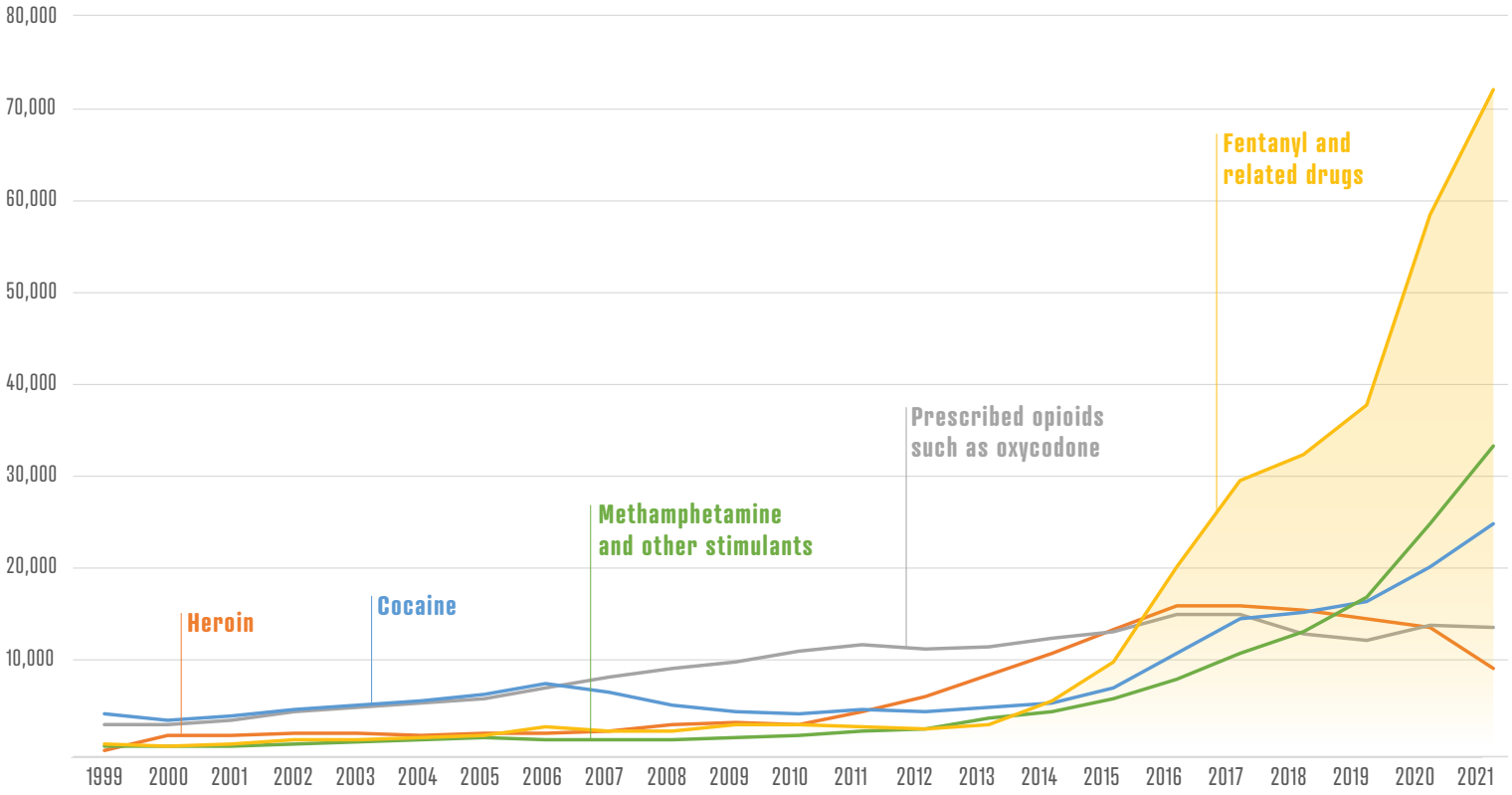
What NIST is doing to help

As the nation's chemical measurements laboratory, NIST is developing new tools and methods to help public health and law enforcement agencies combat fentanyl and other synthetic drugs. Our efforts, part of NIST's Forensic Science Research Program, are strategically focused on three areas where new technology can have the greatest impact.

1. Monitoring the illicit drug supply
2. Safe handling in the field and the lab
3. Rapid identification of new substances
4. Stopping fentanyl before it enters the country

More details on p. 2.

Drug overdose deaths in the United States by drug category.
Based on data from the U.S. Centers for Disease Control and Prevention.



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1. Monitoring the illicit drug supply

New compounds constantly appear in the illegal drug supply, creating new and often unknown risks. NIST is working to monitor these changes so that law enforcement and public health authorities can respond more quickly to emerging threats. NIST researchers are:

- Analyzing residues from illegally purchased drugs to determine the chemical compounds the drugs contain.
- Monitoring the prevalence of xylazine, fentanyl, fentanyl analogues, and other drugs in the illegal drug supply.
- Sharing the data with public health authorities, who use it in harm reduction efforts that involve education and outreach to people who use drugs.

2. Safe handling in the field and the lab

Traditional evidence handling and drug testing methods pose a risk of accidental exposure via inhalation, which can be dangerous or deadly. NIST researchers have:

- Validated new methods for identifying the contents of suspicious packages without opening them, which reduces the risk of accidental exposure.
- Developed new laboratory workflows that separate hazardous substances for special handling, which speeds up workflow without compromising safety or reliability.
- Developed protocols for minimizing the spread of drug residues in laboratories. These residues increase the risk of workplace exposure and can compromise laboratory measurements.
- Published validation protocols so other labs can implement these solutions across the nation and at scale.

3. Rapid identification of new substances

New fentanyl variants, or analogues, can be far more potent and deadly than the original. They can also be difficult to detect and identify using traditional laboratory methods. NIST researchers are:

- Developing new software that can help forensic chemists identify novel fentanyl analogues.
- Adding new "molecular fingerprints" to chemical identification databases.
- Providing quality control for the SWGDRUG databases that forensic chemists use to identify novel substances.
- Built a global online platform where law enforcement and forensic chemists share data on new drug analogues.

4. Stopping fentanyl before it enters the country

Most fentanyl used illegally in the U.S. originates in China and arrives directly by international post and delivery services or overland via Mexico. NIST researchers have:

- Investigated new methods for high-throughput, hands-off screening of packages at postal inspection facilities.
- Tested chemical detection technologies for screening vehicles at border crossings.
- Developed an "artificial dog nose" that can boost the detection capabilities of chemical sensors.
- Developed new ways to safely train dogs to detect fentanyl and other substances without risk of exposure during training.

NIST is developing these new methods in collaboration with forensic laboratories and law enforcement and public health agencies and is committed to helping them successfully integrate these solutions into their operations. NIST is also addressing measurement challenges of other drugs such as xylazine; cannabinoids and cathinones; and complex mixtures of synthetic opioids with cocaine, heroin and methamphetamine. For more information, visit www.NIST.gov/opioids.