



Field-Based Drug Supply Surveillance Tools: Frequently Asked Questions

Introduction

The unregulated drug supply in the United States is complex and constantly changing. A decade ago, heroin was common in many parts of the country. Today, fentanyl and its analogues are ubiquitous. Sedatives like xylazine and medetomidine have shown up in different areas and additional synthetic opioids like nitazenes are also appearing.

To effectively prevent overdose and save lives, it is critical to understand as early as possible what substances are circulating. Timely information about drug composition can help to inform personal choices as well as effective emergency response and treatment approaches.

Recognizing this challenge, some state and local governments are using opioid settlement funds to support drug supply surveillance using tools that can be deployed in communities. Most often, this looks like purchasing handheld drug identification devices for local law enforcement agencies. Communities have also used funds to purchase and distribute drug test strips and more rarely for community-based (i.e. point-of-care) drug checking services.

As decision-makers consider investing opioid settlement dollars into devices and programs, the key question is not only whether a tool can detect substances, but whether the way it is deployed meaningfully contributes to overdose prevention and [lives saved](#).

Some tools are used primarily in a law enforcement context. Typically, jurisdictions justify the purchase of those tools as contributing to public safety, but there are no studies attempting to link the use of drug detection technologies in policing to reductions in overdose or opioid-related harms, and [professionals have debunked](#) claims of police officers being harmed by touching drugs in the field. Rather, a substantial body of research suggests that increased drug enforcement and criminal justice involvement can [unintentionally increase overdose risk](#) and [other health harms](#). Studies have consistently found that arrests and incarceration are associated with a higher risk of relapse and [overdose following release](#), and that police activity can deter

people from [seeking harm reduction services](#) or [calling emergency medical services](#) when an overdose occurs. Disrupting drug markets through drug seizures can also destabilize the drug supply, leading to greater unpredictability in potency and composition and [significant increases in the risk for fatal overdoses](#).

Conversely, [numerous studies](#) have found that deploying drug detection tools within community-based programs leads to [behavior changes](#) that mitigate the risk of overdose, including discarding drugs, reducing drug doses, using more slowly or with someone else around, and keeping naloxone nearby. Beyond individual behavior change, point-of-care drug checking programs often support broader public health efforts by sharing real-time drug trend data with public health agencies, informing treatment providers about common local adulterants, and [enabling early detection](#) of particularly dangerous substances circulating in the drug supply.

With these considerations in mind, decisions about how to allocate settlement dollars for drug supply surveillance methods carry significant consequences. The sections below outline the strengths, limitations, costs, and evidence behind several commonly discussed tools, with the goal of helping jurisdictions prioritize investments that most directly support people at highest risk of overdose.

Drug Test Strips

What are they?

Single-use immunoassay strips, more colloquially known as drug test strips and popularized by products that check for fentanyl or xylazine, are small paper strips that are used to check if a specific substance is present in a drug sample. They are relatively low cost, easy to distribute, and take minimal training to be used by laypersons. Common immunoassay test strip distributors and manufacturers include BTNX, AssureTech, DanceSafe, WHMP, and Wise Batch.

How do they work?

While instructions may vary slightly by brand, most test strips work in the same way. The user dissolves a tiny amount of a drug sample in one to two teaspoons of water, dips the strip into the liquid for 10-15 seconds, and lays it flat for a few minutes before reading the results. The test strip displays results by showing a number of lines – typically two lines means negative (the substance was not detected) and one line means positive (the substance was detected).

Test strips produce only binary results, providing no information about the concentration of a substance, the presence of multiple substances, or differences between analogues. Because of this, they are most useful in situations where a population is actively trying to avoid a particular drug, such as a person who uses stimulants seeking to ensure their supply does not contain fentanyl or a person who uses opioids trying to avoid xylazine. They can also be useful to monitor for the local emergence of new substances seen elsewhere or when rapid screening is needed in low-resource settings.

What does the evidence say?

Research has investigated the utility of several types of immunoassay test strips for drug checking applications.

The earliest drug test strips were designed to test urine for drug presence, and harm reduction programs distributed them to people who use drugs to test their drug samples as an off-label use. The first drug test strip popularized for layperson use was the fentanyl test strip (FTS), and [research confirms](#) that FTSs detect the presence of contaminants in drug samples with high accuracy. They are also effective at detecting the presence of some but not all fentanyl analogs..

[One study](#) looked at seven distinct types of urine immunoassay test strips – amphetamine, benzodiazepine, cocaine, methamphetamine, nitazene, opiate, and xylazine – and found that they gave consistent results and detected even very small amounts of each substance. However, nearly all of the tests sometimes gave a positive reading for substances other than the specific drug they were meant to detect, leading to inaccurate results. Additionally, [a recent study](#) assessed the performance of BTNX medetomidine strips and found they were an effective tool in detecting medetomidine even in trace amounts within a sample.

While drug test strips are generally simple to use, it is imperative that users [prepare the sample as directed](#) because an over-concentration of drugs can produce false positives, while too much water can lead to false negatives. Specific adulterants may also lead to false positives.

What is the cost?

Most drug test strips are priced around \$1 to \$2 per strip for individual sale or in small packs, and can be even cheaper when bought in bulk. Many new companies have come to market selling even cheaper products, but there is [no official oversight or quality control](#) in place for manufacturers of test strips. Drug checking experts advise only buying strips that manufacturers validated by comparing results with more precise drug checking technology. Drug Checking For The People, an initiative of Remedy Alliance/For the People, hosts [Test Strips “Office Hours”](#) where they offer guidance on which strips to purchase and how best to use them.

Handheld Devices

What are they?

Handheld drug identification devices, often referred to as handheld spectrometers, are portable tools designed to analyze loose solid or liquid substances to identify their chemical contents. They are most commonly designed for and [used by law enforcement](#) during traffic stops or other enforcement actions to test unknown substances in the field, and police typically use the results to [inform an immediate action](#) such as making an arrest. Well-known examples of these devices include TruNarc, MX908, and Amplifi ID.

How do they work?

Individual brands of handheld drug identification devices rely on different underlying technologies, but they generally operate in a similar way. An operator scans a substance, the device captures a chemical signature, and then compares that signal against a limited built-in chemical reference library to generate a rapid determination of the most likely substance present.

There is no standard protocol for how these handheld devices work internally. The devices generate a simplified output, such as “fentanyl detected,” without transparency about confidence levels or how the conclusion was reached. Accordingly, operators cannot independently verify the results or assess their accuracy. [Further](#), the software used to analyze the data and generate criteria for sample identification are often proprietary, and most device manufacturers do not fully disclose them. Only limited studies have evaluated the performance and accuracy of these devices.

For data from handheld spectrometers to be considered accurate enough to be suitable as court evidence, the [Scientific Working Group for the Analysis of Seized Drugs](#) has determined that the devices must meet dedicated validation requirements and produce reviewable data. Yet most devices used in the U.S. do not meet this standard. Consequently, trained drug checking technicians encourage programs to do an [independent lab verification](#) to test if the device is accurate enough to use for public health purposes. Some community harm reduction programs that purchased handheld devices have disclosed that they found them so ineffective that they stopped using them entirely.

Additionally, it's not clear how frequently manufacturers update the machine's internal reference library (the compendium of substances it is equipped to detect), a serious drawback with a quickly changing drug supply. The United Nations Office on Drugs and Crime has produced [guidance](#) that clearly states that handheld devices should only be used as a preliminary screening tool and should always be complemented with analysis using a confirmatory technique performed by a laboratory.

What does the evidence say?

Different brands and technologies of handheld devices vary in their accuracy and usability for detecting substances in the drug supply, and the true error rate for most devices is unknown.

[One study](#) found that Raman spectrometers could accurately detect when fentanyl was *not* in a sample, but did not do as well in detecting when fentanyl was present. In today's drug supply, it is not uncommon for a drug sample to contain upwards of a dozen substances, but Raman spectrometers are [known to](#) have difficulty in identifying distinct substances within complex mixtures containing more than three components because overlapping chemical signatures are difficult to resolve. [One study](#) observed that the accuracy of handheld spectrometers dropped to 67% on complex, highly adulterated mixtures. Furthermore, according to a [workshop report summary](#) written by the National Institute of Standards and Technology, law enforcement communities acknowledge that they often receive incomplete data from their field-based drug detection tools.

By relying solely on the output of handheld drug identification devices, police may make under-informed decisions about arrests. This risk is exacerbated when field

detection tools are incorporated into legal decision making, often without confirmatory safeguards. A [survey](#) by University of Pennsylvania's Quattrone Center for the Fair Administration of Justice found that 89% of prosecutors allow guilty pleas without confirmatory testing (i.e., follow-up lab testing to verify that a field test accurately detected an illegal drug). In addition, 46% of U.S. drug labs reported that they do not conduct confirmatory testing if a defendant pleads guilty. Because [90 to 95 percent of federal and state court cases end in plea deals](#), many drug possession charges may rest on unconfirmed results from handheld drug detection devices.

What is the cost?

The price of handheld drug spectrometers varies significantly based on the technology used, detection sensitivity, and the size of the drug library. Raman Spectrometers average between \$12,000 and \$45,000. A single MX908 Handheld Mass Spectrometer can cost upwards of \$97,000. And because the results of field testing require confirmatory testing, there are additional costs for sending samples to crime laboratories. Arrests based on false positives that later get thrown out also consume excess government resources.

Compact FTIR Machines

What are they?

Fourier Transform Infrared (FTIR) spectrometers are analytical instruments that can test a wide range of drugs, including opioids and stimulants. While some FTIR systems are large benchtop units designed for laboratory settings, compact FTIR machines are increasingly used for point-of-care drug checking as part of [community-based harm reduction efforts](#) where people can bring drug residue (for example from a plastic bag that held the drug) to get real time information about the components of a sample. These compact versions are lightweight, about the size of a toaster oven, and are portable – but do require a stable surface for optimal performance. The most commonly known compact FTIRs are the Alpha II from Bruker and Nicolet iS20 from Thermo Fisher Scientific.

How do they work?

These machines can [determine](#) the myriad contents in a tiny sample (less than a grain of rice). Trained drug checking technicians carefully prepare a sample for testing and the machine shines infrared light on the sample to see how the light is absorbed.

Different chemical bonds absorb different parts of the light, creating a unique chemical fingerprint in the form of a spectrum. The machine quickly produces a readout of the spectra of the drugs detected, and trained technicians interpret those spectra and compare them to reference libraries to derive information about main components and mixtures in the sample.

An important part of FTIR reliability is operator skill and reference library quality. Trained drug checking technicians must properly prepare drug samples and interpret results with regularly updated spectral reference libraries. When operated in this way, the machines can reliably and accurately identify major ingredients and [provide results in under 10 minutes](#).

Increasingly, harm reduction programs are [training employees as drug checking technicians](#) so they can perform this type of “citizen science.” There is a national [community of practice](#) to support new drug checking technicians and to share open source reference libraries that are constantly updated. In some cases, when technicians at harm reduction organizations have seen previously unknown substances in the drug supply, they have worked with the libraries to identify these novel substances and quickly update the reference library for all to use.

What does the evidence say?

[Research](#) shows that FTIR machines are highly accurate in identifying drugs in pure or highly concentrated samples. However, they become significantly less accurate when used for samples with complex mixtures, and [a recent study](#) found that several technologies missed detecting substances that accounted for less than 5% of the sample. [Another](#) found that when testing samples of fentanyl and its analogues, true positive results were highly accurate, but the rate of false negatives was nearly 30%. For comprehensive results, evaluators therefore emphasize that it is best practice to [pair FTIR testing with immunoassay test strips](#) for drug classes of interest, which is already a well-established practice followed by community drug checkers throughout North America.

When used within community-based drug checking programs, FTIRs reduce overdose risk by giving people who use drugs timely, actionable information about what is actually in their substances. This information [supports more informed decision-making](#), such as avoiding contaminated or unusually potent batches, using

smaller amounts, using in the presence of others who can respond in an emergency, or seeking medical or harm reduction support.

Beyond individual behavior change, drug checking programs also support broader public health efforts by sharing real-time drug trend data with public health agencies, informing treatment providers about common local adulterants, and [enabling early detection](#) of particularly dangerous substances circulating in the drug supply.

What is the cost?

The cost of buying a Bruker Alpha FTIR depends on the model, features, and included accessories, but obtaining the instrument, case, required software, and spectral libraries typically costs between \$50,000-\$65,000. A Thermo Scientific Nicolet iS20 costs around \$40,000 for a base model with the option to purchase additional components and accessories, but prices can vary significantly based on the dealer, region, and specific laboratory requirements; experts recommend requesting a quote directly from the manufacturer for the most accurate, up-to-date pricing. Some FTIR companies offer a discount for harm reduction programs.

Other Drug Surveillance Tools

In addition to drug test strips, handheld spectrometers, and compact FTIR machines, officials may use a range of other drug supply surveillance tools to monitor trends. These include technologies such as [RaySecur](#) mail scanners that screen packages for suspicious substances, wastewater testing to detect drugs and their breakdown products (metabolites) that people excrete into the sewer system, post-mortem toxicology testing conducted by [medical examiners and coroners](#) who investigate the causes of overdose deaths, and emergency department data that capture overdose presentations. Highly sophisticated laboratory-based technologies also exist, such as gas chromatography, liquid chromatography mass spectrometry, or quadrupole time-of-flight (LC-MS, GC-MS and QTOF), which are used to identify substances with a high degree of sensitivity and specificity, and can quantify the amount of various substances in a sample. While each of these tools can provide useful information about the evolving drug supply, they share important limitations: most generate delayed, aggregate data, and none inherently deliver information directly to people who use drugs in real time. As a result, their ability to reduce immediate overdose risk is indirect and dependent on how quickly and transparently data are shared.

Advanced laboratory techniques can play a powerful supportive role when intentionally integrated into community based harm reduction programs. For example, researchers at the University of North Carolina (UNC) [Street Drug Analysis Lab](#), the [Center for Forensic Science Research and Education](#) (CSFRE), and the [National Institute for Science and Technology](#) (NIST) have demonstrated how rigorous laboratory testing can be paired with community-based drug checking to provide confirmatory analysis, identify novel adulterants, and return actionable information to harm reduction programs and the people they serve. In this model, sophisticated laboratory science strengthens community-facing services.

Conclusion

Drug surveillance tools vary widely in purpose, cost, accuracy, and impact, and all have limitations. When evaluating these options, decision-makers should consider not only whether a technology can detect substances, but whether its use will meaningfully reduce overdose risk, provide information that can empower people who use drugs to make healthier choices, and strengthen public health infrastructure.

While community-based drug checking is not a standalone solution to the overdose crisis, it is increasingly recognized as [a core harm reduction strategy](#) within a comprehensive public health response. By contrast, investment into law enforcement technologies designed to facilitate arrests stands in tension with the primary purpose of opioid settlement funds, which is to remediate opioid-related harms and prevent overdose deaths. Investments made with settlement funds should prioritize evidence-based public health interventions that save lives over expanded punitive drug enforcement.

Additional Resources

Johns Hopkins Opioid Principles – [Strengthening Public Health Surveillance of Illicit Drug Supplies through the Power of Community Drug Checking Programs](#)

Pew Charitable Trusts - [Drug Checking Equipment Can Reduce Overdose Deaths](#)

The Network for Public Health Law - [Legality of Drug Checking Equipment in the United States](#) (last updated August 2024)

Remedy Alliance / For the People - [Drug Checking For The People](#)

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