

Enhancing Harm Reduction Services in Health Departments

Fentanyl Test Strips and Other Drug Checking Equipment



NATIONAL
COUNCIL
for Mental
Wellbeing

April 2023

Acknowledgments

The National Council for Mental Wellbeing developed this brief with support from the Centers for Disease Control and Prevention. The project team would like to thank the key informants who devoted their time, expertise and resources to inform this brief. A complete list of key informants can be found in [Appendix A: Key Informants](#).

Project Team

KC Wu, MPH

Director
National Council for Mental Wellbeing

Anne Siegler, DrPH

Consultant
Anne Siegler, Inc.

Shannon Mace, JD, MPH

Former Senior Advisor
National Council for Mental Wellbeing

Margaret Jaco Manecke, MSSW, PMP

Director
National Council for Mental Wellbeing

Suggested Citation: Wu, K. C., Siegler, A., Mace, S., & Manecke, M. J. National Council for Mental Wellbeing. (2023). Enhancing Harm Reduction Services in Health Departments: Fentanyl Test Strips and Other Drug Checking Equipment.

This publication was supported by the Centers for Disease Control and Prevention (CDC) of the U.S. Department of Health and Human Services (HHS) as part of a financial assistance award totaling \$248,980 with 100% funded by CDC/HHS. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement by, CDC/HHS or the U.S. Government.

Table of Contents

ACKNOWLEDGMENTS	2
COMMONLY USED ACRONYMS	4
GLOSSARY OF TERMS	5
EXECUTIVE SUMMARY	6
BACKGROUND	7
Methods.....	7
What is Drug Checking?.....	7
Brief History of Drug Checking.....	8
TYPES OF DRUG CHECKING EQUIPMENT	9
Fentanyl Test Strips.....	10
Fourier-transform Infrared Spectroscopy.....	10
Gas Chromatography Mass Spectrometry.....	10
EVIDENCE FOR DRUG CHECKING	12
Acceptability of Drug Checking.....	12
Use of Drug Checking Equipment.....	12
Behavior Change as a Result of Drug Checking.....	13
STRATEGIES TO SUPPORT AND EXPAND DRUG CHECKING FOR HARM REDUCTION	13
Integrate Fentanyl Test Strips in Overdose Education and Naloxone Distribution.....	14
Partner with Harm Reduction Organizations to Provide Drug Checking Services and Education.....	15
Implement Effective Data Collection, Interpretation and Communication Strategies.....	19
IMPLEMENTATION CHALLENGES	25
Training and Technical Assistance.....	25
Legality Considerations.....	25
Federal Funding and Support.....	26
APPENDIX A. KEY INFORMANTS	27
APPENDIX B. SCENARIOS FOR FURTHER ANALYSIS USING GC-MS	28
APPENDIX C. testRI LOCAL DRUG SAMPLE TESTING UPDATE	29
APPENDIX D. RESOURCES	31
APPENDIX E. REFERENCES	33

Commonly Used Acronyms

Acronym	Meaning
CBO	community-based organization
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus disease 2019
DIMS	Drug Information and Monitoring System
FTIR	Fourier-transform infrared spectroscopy
FTS	fentanyl test strips
GC-MS	gas chromatography mass spectrometry
HHS	U.S. Department of Health and Human Services
HPMS	high-pressure mass spectrometry
HIV	human immunodeficiency virus
OEND	overdose education and naloxone distribution
PWUD	people who use drugs
SAMHSA	Substance Abuse and Mental Health Services Administration
SSP	syringe services program
TEDI	Trans European Drug Information network

Glossary of Terms

Term	Meaning
Adulterant¹	A substance that has been mixed with or replaces (in whole or in part) the intended substance, which may reduce the quality or strength of the intended substance or create other unintended effects.
Analog²	A substance that is physically or chemically similar to another substance.
Drug precursor³	A substance that is the primary compound or chemical intermediary used in the manufacture of a controlled substance.
Drug metabolite⁴	A substance that is produced from a drug during metabolic processes (e.g., digestion, other bodily chemical processes) or that remains after the drug is broken down in the body.
Drug paraphernalia⁵	Any equipment, product or material that is intended or designed for use with a controlled substance, including, but not limited to, manufacturing, concealing, preparing or introducing into the human body (e.g., injecting, ingesting, inhaling).
Low barrier	Limited or no requirements needed for an individual to access services.
Sensitivity⁶	A test's ability to accurately yield a positive result when a sample is positive, also known as a "true positive" result. A highly sensitive test will have few instances of inaccurately yielding a negative result when a sample is actually positive, also known as a "false negative" result.
Specificity⁷	A test's ability to accurately yield a negative result when a sample is negative, also known as a "true negative" result. A highly specific test will have few instances of inaccurately yielding a positive result when a sample is actually negative, also known as a "false positive" result.

¹Legal Information Institute, Cornell Law School. (n.d.). 21 U.S. Code 351 – Adulterated drugs and devices. <https://www.law.cornell.edu/uscode/text/21/351>

²National Cancer Institute. (n.d.). Analog. <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/analog>

³Legal Information Institute, Cornell Law School. (n.d.). 21 U.S. Code 802 – Definitions. <https://www.law.cornell.edu/uscode/text/21/802#23>

⁴Legal Information Institute, Cornell Law School. (n.d.). 21 U.S. Code 863 – Drug paraphernalia. <https://www.law.cornell.edu/uscode/text/21/863>

⁵New York State Department of Health. (1999, April). Disease Screening – Statistics Teaching Tools. <https://www.health.ny.gov/diseases/chronic/discreen.htm>

⁶New York State Department of Health. (1999, April). Disease Screening – Statistics Teaching Tools. <https://www.health.ny.gov/diseases/chronic/discreen.htm>

⁷New York State Department of Health. (1999, April). Disease Screening – Statistics Teaching Tools. <https://www.health.ny.gov/diseases/chronic/discreen.htm>

Executive Summary

In recent years, illicit fentanyl has emerged as a key driver of the overdose crisis in the U.S., with 64% of fatal overdoses involving illicit fentanyl and its analogs. As illicit fentanyl grows more ubiquitous in the broader drug supply, extending beyond the opioid supply, a greater number of people who use drugs (PWUD) are at risk of overdose, including people who smoke or snort opioids and people who use non-opioids. Other adulterants like xylazine and benzodiazepines are also increasingly involved in overdoses, and the trends regarding adulterants in local drug supplies vary from one community to the next.

With increasing rates of overdoses involving fentanyl and other adulterants, the federal landscape has shifted in support of fentanyl test strips (FTS) as a strategy to prevent overdose. Beyond preventing overdose, FTS and advanced drug checking equipment can also be implemented to better understand the drug supply and tailor harm reduction messaging to local PWUD populations, as well as harm reduction services more broadly.

To identify how FTS and drug checking can be implemented for harm reduction purposes within health departments, the National Council for Mental Wellbeing, with support from the Centers for Disease Control and Prevention (CDC), conducted a literature review and 11 key informant interviews with staff from organizations that have implemented or are in the process of implementing drug checking services. The information gathered identified 1) three types of drug checking equipment that are most commonly used in harm reduction settings and 2) strategies that local and state health departments and their community-based harm reduction partners can implement to expand access to FTS and drug checking services.

The most commonly used drug checking equipment for harm reduction include FTS, Fourier-transform infrared spectroscopy (FTIR) and gas chromatography mass spectrometry (GC-MS). FTS are the most inexpensive and easy-to-use equipment, enabling many local and state health departments to purchase and distribute these tests to PWUD and partner harm reduction organizations. FTIR and GC-MS, while more expensive and requiring extensive training to use, provide more detailed qualitative and quantitative information about a drug's composition.

Given the ever-changing drug supply and increased risk of overdose for PWUD, along with recent increased federal support for and availability of FTS, health departments and their harm reduction partners are increasingly implementing more comprehensive drug checking services to better understand their local drug supply and improve drug user health. Strategies that health departments can implement include:

- Integrating FTS into overdose education and naloxone distribution, in particular expanding distribution to reach all PWUD populations, including people who do not inject or use opioids.
- Partnering with harm reduction organizations to provide drug checking services and education.
- Implementing effective data collection, analysis and communication strategies.

As FTS and other drug checking services continue to expand nationwide, several implementation challenges remain. While technical assistance for FTS implementation is readily available, training capacity for and expertise on advanced drug checking remains limited to a handful of programs. Additionally, with such vast variability in drug paraphernalia laws across the country, legality considerations differ greatly by location, requiring each program to understand their jurisdiction's unique laws and policies. Finally, funding and sustainability remain a challenge, particularly for programs implementing multiple types of drug checking equipment.

Background

As the U.S. continues to experience a growing overdose crisis, illicit fentanyl has emerged as a key driver of fatal overdose in recent years. Provisional data show there were over 107,000 drug overdose deaths in the 12-month period ending in June 2022, with 64% of deaths involving synthetic opioids such as fentanyl.¹ Fentanyl-related overdose deaths increased significantly in the midwestern, southern and western regions of the U.S., reflecting the ever-changing drug supply and distribution patterns.² People who use opioids are not the sole group at risk of fentanyl-related overdose. Fentanyl was present in more stimulant-related overdose deaths than opioid-related overdose deaths (42.7% vs. 25.4%). Additionally, among fentanyl-related overdose deaths, while injection was the most common route of drug use (24.5%), other methods, such as snorting, smoking or ingesting substances, comprised 27.1% of overdose deaths. This highlights a need to expand fentanyl education and harm reduction messaging to include people who use drugs (PWUD) through non-injection routes, and people who use drugs other than opioids (e.g., stimulants, MDMA) and who may therefore be less knowledgeable about the presence of fentanyl in the drug supply and its associated risks.

While illicit fentanyl is the most well-known adulterant in public health spheres, it is important to acknowledge that other adulterants, such as xylazine, benzodiazepines and gabapentin,^{3,4,5} have increasingly contributed to overdose rates as well. Drug supplies vary widely across the country; therefore, jurisdictions need to understand the unique variations in their drug supply to tailor both public health communications and harm reduction counseling for PWUD.

Methods

To inform this brief, National Council project staff conducted a mixed-methods review, including key informant interviews and a literature review. Manuscripts were reviewed if their content applied to drug checking in the context of harm reduction. Due to the limited availability of peer-reviewed literature related to drug checking based in the U.S., international research was included as well. Web-based content was also gathered, including webinars, educational videos, implementation guides and reports.

Between April and June 2022, project staff conducted key informant interviews with 11 employees of 10 organizations that provide harm reduction services (**Appendix A: Key Informants**). Represented organizations are located in eight states, including California, Florida, Massachusetts, Michigan, North Carolina, Pennsylvania, Rhode Island and Washington, as well as the District of Columbia and British Columbia, Canada. Key informants represented organizations that have implemented drug checking services or have developed a concrete plan to do so and are in the early stages of implementation. To facilitate the interviews, a semi-structured interview guide was developed. Interviews took place using Zoom videoconferencing software and were approximately one hour in duration. Interviews were recorded and transcribed with the consent of the participants. A \$75 electronic gift card was provided to each key informant for completing the interview.

What is Drug Checking?

As illicit fentanyl and other adulterants in the drug supply grow in prevalence, drug checking has emerged as an increasingly common harm reduction strategy and overdose prevention tool in the U.S., empowering PWUD to test their drugs before use and make informed decisions to change their use behavior.^{6,7} Depending on the drug checking equipment used, drug checking provides qualitative and/or quantitative information about a drug's composition, such as whether adulterants are present, what substances may be present and how much of a substance is present. Drug checking programs should not only provide test results to participants, but also tailor harm reduction messaging that meets participants' stage of readiness to reduce substance use-related risks.

In practice, drug checking is also used as a confirmatory tool after a substance has been used or as a method to engage PWUD in other harm reduction services. For example, if an individual consistently buys drugs from the same seller but suddenly has one drug use experience that feels different than normal, they may want to test a sample of the drug from that seller to know what substances were present.⁸ This information can help inform the larger PWUD community about new or emerging adulterants in the local drug supply and how to decrease their overdose risk. This messaging about the drug supply may spread through word of mouth among PWUD or through formal communication channels from drug checking programs, such as social media blasts, flyers and handouts, or publicly available, de-identified data. The provision of drug checking services, whether distributed in kits or

provided on-site, can also help connect PWUD to other harm reduction services, such as naloxone and overdose education, safer use supplies, HIV/HCV testing, safe sex kits and referral to substance use treatment or other services.^{9,10,11}



Some people are really interested in knowing what [drugs/adulterants] they have in advance, and some people are only interested when their very predictable experience is different than what it normally is. [The purpose of drug checking] is definitely going to be both.”

- Maya Doe-Simkins, Co-director, Remedy Alliance/For the People



A lot of people bring in materials after they've used because part of this is the problem of not having a place to safely test prior to using drugs i.e., OPS [overdose prevention sites] or SSPs [syringe services programs] that don't have that capacity legally in this country, so the idea of a ton of preventative drug checking in this regard is challenging. ... We can do a lot more on the prevention front if we had those kinds of tools, but we don't. ... But fentanyl test strips, as we've been experimenting with just on the laboratory side continuing to look at utility, are great.”

- Anonymous key informant

With such a quickly changing drug market, engaging a wider audience in drug checking is critical to help build stronger systems to prevent and respond to overdose, as well as provide more quantitative and qualitative information about each community's unique drug supply. Engaging PWUD, both those who do and do not use opioids, is key. Given the increasing risk of exposure to fentanyl, engaging those who do not use opioids is especially important, as they may not receive regular fentanyl education and may be less knowledgeable of corresponding prevention and risk reduction strategies.¹² Friends and family of PWUD may also consider seeking drug checking services on behalf of an individual. It is important to remember that while drug checking can be used as a proactive overdose prevention tool in some circumstances, it may not always occur before drug use. Drug checking can also provide important data about the local drug supply. Alongside an array of services, drug checking is another strategy that harm reduction providers can implement to reduce harm for their participants.

Outside of harm reduction settings, bodily specimens such as urine or blood may be tested for the presence of drugs, as opposed to analyzing the composition of a substance. For purposes of this brief, we are referring to directly testing a substance itself and not an individual's use of a substance.

Brief History of Drug Checking

Europe

Drug checking as a formal harm reduction strategy has been in practice for approximately three decades. In Europe, in 1992, the Netherlands Ministry of Health funded Europe's first drug checking system, the Drug Information and Monitoring System (DIMS), to monitor drug composition and adulterants in the drug supply and better coordinate existing smaller drug checking initiatives.^{13,14}

Since its inception, DIMS has grown to 31 drug checking facilities across 29 cities, typically housed in institutes for addiction treatment and drug prevention and funded by local government.¹⁵ Other European countries followed suit soon after with their own on-site drug checking programs, including Spain's Energy Control and France's SINTES (National Detection System of Drugs and Toxic Substances). Mobile drug checking programs in Austria and Switzerland emerged as well, both funded by their respective local governments. As of 2017, drug checking programs are operating in 13 European countries, and 20 total countries around the world.¹⁶

To align these potentially disparate drug checking programs, the Trans European Drug Information network (TEDI) was established in 2011 as an international database to monitor drug trends across Europe and support public health and harm reduction programs.¹⁷ TEDI provides guidance on key components of drug checking services, including having an explicit goal of reducing harm by collecting and analyzing samples from the public, returning results directly to the service user, involving exchange of information between service users and providers and providing tailored information about risk to service users.¹⁸ Currently, 13 European countries participate in the network.

Nightclubs and Music Festivals

In the U.S., drug checking has historically primarily centered around the nightclub and music festival scenes, with a focus on MDMA. Founded in 1998, DanceSafe was the first organization to openly provide drug checking services and drug education through a nonjudgmental, harm reduction-based approach¹⁹ with the goals of better understanding atypical user experiences and addressing misinformation around drugs.²⁰ Through numerous local chapters and the national organization,²¹ DanceSafe offers free drug checking services on-site at events (when allowed by venues and event promoters), information about safer drug use, resources like water and earplugs to protect participants' health and unbiased counseling to empower participants to make informed decisions about their drug use.²² Neither staff nor participants have been arrested for providing or using drug checking services at events. In fact, some chapters have positive relationships with local first responders and communicate with each other at events to relay information about drug composition and user experiences.²³

DanceSafe is the only nonprofit manufacturer of drug checking kits. These kits, which are applicable for different substances, including MDMA, cocaine, LSD and fentanyl, are available on-site at events and online. DanceSafe also established the first and only publicly accessible lab testing service, [DrugsData](#) (formerly EcstasyData), where individuals can mail in a sample for a fee and receive a full report on its composition. The site is now managed by the Erowid Project.²⁴

Forensic Drug Testing

Outside of harm reduction, drug checking in the U.S. has been implemented for different purposes within the criminal legal system. Law enforcement and crime labs conduct drug testing and analysis to help inform drug-related cases, including law enforcement operations, judicial proceedings and development of drug enforcement initiatives and policies.^{25,26} Some forensic labs have begun to establish data sharing partnerships with public health agencies as well to help inform their drug surveillance activities and overdose response programming.

Types of Drug Checking Equipment

A wide range of drug checking equipment exists, though historically most types of equipment have not been implemented in harm reduction settings. This brief will discuss three types of drug checking technology that have been commonly implemented and adapted for harm reduction purposes: fentanyl test strips (FTS), Fourier-transform infrared spectroscopy (FTIR) and gas chromatography mass spectrometry (GC-MS).

Fentanyl Test Strips

FTS are the most common, accessible, easy-to-use and inexpensive form of drug checking technology in harm reduction settings. By dipping small strips of immunoassay paper into a sample of the drug, FTS can be used to detect the presence of fentanyl and fentanyl analogs, similar to how home pregnancy and COVID-19 tests work. FTS can be used to test many different types of substances, including injectable liquids, powders and pills, and results are available within about five minutes. Compared to other drug checking technologies, FTS have the highest sensitivity and can detect the smallest amounts of fentanyl. For this reason, and its ease of use and affordability, FTS are commonly and easily implemented in harm reduction and public health settings.^{27,28,29,30}

While FTS are a critical harm reduction tool, they do have a few limitations. FTS only test for the presence or absence of fentanyl and its analogs and do not differentiate between fentanyl and analogs, nor can they detect other drug types, such as xylazine. Additionally, FTS do not measure fentanyl concentration; results only show its presence or absence in the sample. In a drug market where fentanyl is ubiquitous and the only difference between products is the concentration, FTS may be of limited use for individuals seeking more detailed drug composition information.

Fourier-transform Infrared Spectroscopy

FTIR uses infrared light to scan drug samples and observe their chemical properties. Results are produced within minutes and can be compared against reference libraries to ascertain the composition of the sample. Unlike FTS, FTIR has the capacity to identify multiple drug types within a sample, including active drugs, analogs and cuts or adulterants. Since the sample is examined using infrared light, it is not destroyed and can be returned to the owner.

However, FTIR requires resource-intensive start-up costs. The equipment is expensive, costing up to \$40,000, and does not include the cost of access to reference libraries, which can be purchased from the machine manufacturer and some online databases for sample composition comparison. Advanced technical training is also needed to interpret the results. In some settings, use of the FTIR is possible through partnerships between harm reduction programs and academic or healthcare institutions that have already purchased the equipment and/or access to reference libraries.

While FTIR can identify discrete components in a sample, it cannot detect the presence of substances that make up less than 5% of the sample, which is often the concentration for highly potent substances like fentanyl, thereby yielding lower sensitivity rates compared to FTS. A benefit of FTIR is that it can be used on very small samples of drugs, about the size of a grain of rice; however, results may not be representative of the entire sample if the composition is not evenly distributed.

Gas Chromatography Mass Spectrometry

GC-MS, like FTIR, is a highly versatile technology that can detect and identify many different substances in one sample. Like FTIR, GC-MS can provide both quantitative and qualitative information about component substances, which can help staff tailor harm reduction messaging. Unlike FTS and FTIR, which can be used at the “point-of-care,” GC-MS must be performed in a laboratory, and results can take up to two weeks. Samples also cannot be returned to participants, though GC-MS requires very little of a sample to identify components. It also does not depend on a reference library like the FTIR, which means that GC-MS can be more adaptable to a quickly changing drug supply. GC-MS requires significant upfront costs, as the equipment is expensive, costing over \$50,000,³¹ and highly trained laboratory technicians are needed for operations. Some labs, such as the Erowid Project or academic labs, accept samples for testing for a fee of up to \$175 per sample. Exact cost may depend on factors such as geographic location and type of organization submitting a sample.^{32,33,34}

GC-MS has historically been considered the gold standard in drug checking and is used as confirmatory testing after initial testing is completed using FTS or FTIR. In acknowledging some of the limitations of GC-MS, the field is moving away from using GC-MS as “confirmatory testing” and instead describing it as “secondary testing” or as conducting “further analysis” (see [Appendix B. Scenarios for Further Analysis Using GC-MS](#)).

Table 1. Comparison of Drug Checking Equipment to Support Harm Reduction and Overdose Response.

	Average cost	Time required for results	Can be done in the field	Expertise/training needed to use	Substances that can be detected	Able to detect concentration of substance(s)	Can be used by harm reduction program participants themselves
Test strips (e.g., fentanyl, benzodiazepines, xylazine)	\$1-3 per strip (each strip can only be used once)	Minutes	Yes	None to minimal	Varied (see manufacturer for availability)	No	Yes
Fourier-transform infrared spectroscopy	>\$40,000 (machine, reference libraries and laptop)	Minutes	Yes	Advanced practice	Any	Yes	No
Gas chromatography mass spectrometry	>\$50,000 (machine, laboratory standards and dedicated staff)	Minutes to weeks	No	Extensive training	Any	Yes	No

Several other drug checking technologies have been adapted for harm reduction purposes; however, they are not discussed in this brief based on information gathered through key informants and the literature on the difficulty implementing and using the technologies.

Examples include:

- **Raman spectroscopy** is typically used in law and drug enforcement settings, particularly the handheld TruNarc device, which uses a “point and shoot” method that allows a person to analyze a substance without having it in their possession, reducing risk related to drug possession laws.³⁵ While qualitative analysis (i.e., what substances are detected in a sample) is generally accurate, the Raman’s ability to conduct quantitative analysis (i.e., how much of a substance is detected in a sample) is limited and not necessarily suitable for harm reduction settings given its association with law and drug enforcement.
- **High-pressure mass spectrometry (HPMS)** was implemented by early drug checking programs for its portability and simplicity in reading results. However, HPMS has previously delivered inconsistent results that did not always align with results from other drug checking equipment, and its use has therefore been discontinued.^{36,37}
- **Reagent/colorimetric test kits** are typically used in party settings to test and provide qualitative analysis on substances sold as MDMA, cocaine or other party drugs.³⁸ These test kits do not provide quantitative information about drug composition and may be less efficient than other drug checking equipment as multiple tests are needed to test for different substances.

Evidence for Drug Checking

As drug checking services become more prevalent in the U.S., a growing body of evidence is emerging regarding their acceptability, feasibility and effectiveness, complementing decades of research in various European and other countries. This section summarizes recent research on the use of drug checking in the PWUD community and aggregates findings according to focus on 1) individuals' willingness to accept drug checking, 2) how individuals use drug checking, including ease of use, correct use and understanding of results and 3) any changes in behavior associated with drug checking results.

It is important to note that findings differ depending on both the population using the drug checking equipment as well as the type of equipment used. The majority of published research has been done on the use of FTS, with other types of drug checking much less widely studied. Where possible, differences in the literature are acknowledged.



[Drug checking] is a great thing. I know that it's a great addition, that's for sure. I know it's saved one life already, so it's paid for itself in my eyes."

- Don Jackson, SSP Director, North Carolina Survivors Union

Acceptability of Drug Checking

Across a variety of populations, drug checking is widely accepted. Most studies reviewed focused exclusively on FTS, while populations included injection drug users, stimulant users, people who sell drugs, people who engage in sex work and young adults. Studies found that the majority of PWUD accept FTS when offered³⁹ and report wanting to use the tests.⁴⁰ Studies of PWUD found that these individuals have positive perceptions of FTS as a tool to reduce harm and prevent overdose.⁴¹ A study of people who sell drugs found similar motivations to PWUD for use of drug checking equipment.⁴² Providing training on use of FTS and interpretation of results was associated with an increase in acceptance of the tests.⁴³

Use of Drug Checking Equipment

In pilot studies that followed recipients of FTS, over half of participants who received FTS reported using at least one test strip during the study period,^{44,45,46,47,48} with up to 81% of participants using FTS prior to drug use.^{41,44} Findings on test strip utility and ease of use were mixed. Participants of some studies reported that use of FTS was straightforward and helpful,⁴⁹ with one study finding 98% of participants were confident in their ability to use FTS.⁵⁰ Other studies, however, found that FTS results could be unclear and may require additional training in reading and interpretation.⁵¹ Some noted that the utility of FTS was limited for certain populations, particularly people who use opioids, due to the ubiquity of fentanyl in parts of the drug supply. This suggests that in these situations, alternate drug checking technologies that enable the user to understand concentration and contamination, rather than just presence or absence of a substance, may be needed to provide sufficient information on drug composition.⁵²

For other types of drug checking equipment, one study found substantial limitations to the use of each kind.⁵³ An early drug checking program found that HPMS was relatively easy to use when the equipment ran smoothly and results were easily interpreted, but the equipment frequently overheated, clogged or gave implausible results that contradicted results from other drug checking equipment. Given this, HPMS was not adopted by any other drug checking programs based on our research and discussions with key informants. FTIR required extensive hands-on training to use and interpret results. Both HPMS and FTIR are costly. The utility of GC-MS in point-of-care drug checking was limited due to its lag time of at least two weeks, though it was a helpful tool for drug checking technicians to identify substances not found through other tests, cross-reference results and improve their interpretation skills.

Behavior Change as a Result of Drug Checking

Many studies have examined the relationship between drug checking and risk reduction behavior change, though no systematic review has been conducted to date. Most studies found drug checking was associated with some change in drug using behavior. While most PWUD report that they would still use a drug after a positive FTS result,⁵⁴ some reported that they would take harm reduction precautions, such as using a smaller amount than originally intended, injecting more slowly, testing a shot, snorting instead of injecting, using or taking turns with another person or asking someone to check on them after use and keeping naloxone handy.^{55,56,57,58,59} Frequency of use of practices to reduce harm due to information gained from drug checking varied widely. Some authors argued that counseling and education should accompany drug checking in order for such testing to effectively result in behavior change, which could explain some of the variation.⁶⁰ Additionally, differences in intended purpose could also explain the variation found in behavior change rates. People use drug checking technologies for differing purposes, some to confirm the presence of a substance because they want to use it and others because they want to avoid it.⁶¹ Some other noted uses of FTS include to avoid using fentanyl prior to important commitments (e.g., doctor's appointments, court) to reduce the risk of missing the obligation and to negotiate purchases with people who sell drugs.⁶² It is important to note these studies presume drug checking occurs before use; in reality, drug checking often takes place after use to provide information about what an individual's "normal" dose contains or to explain an unexpected effect.

Strategies to Support and Expand Drug Checking for Harm Reduction

Drug checking services will vary by jurisdiction, depending on resource availability, policies and laws, community support and other factors, but several key considerations and strategies can be applied broadly.

- Services should be PWUD-centered and harm reduction-based first and foremost. Other components (e.g., data collection for public health surveillance, research) should not come at the cost of access to services.
- Data collection, analysis and communication should be reality-informed, with an understanding of the drug supply, culture and knowledge in a specific community.
- Maintaining PWUD anonymity, data sharing should be real-time, specific (e.g., dates and geography), meaningful and actionable.
- When possible, multiple testing methods should be used to gain a more comprehensive understanding of the drug supply, as each type of equipment has its strengths and limitations.

The University of North Carolina Injury Prevention Research Center and the North Carolina Survivors Union identified scenarios when further analysis using GC-MS may be needed alongside FTS and FTIR. This list can be found in [Appendix B](#).



The more we in mainstream medicine and public health are involved, the more we're going to stifle the innovation that needs to happen on the ground. ... If we turn this into a research study about, 'wanting to do a survey and surveillance of drug supply,' that's not as relevant as drug user unions answering the question of, 'is our black tar supply contaminated with fentanyl and what kind of prevention messages do we need to do?' So really it's a different paradigm."

- Nabarun Dasgupta, Senior Scientist and Innovation Fellow, University of North Carolina, Chapel Hill



One of the things that makes us unique is that we have always been a multi-instrument approach. A lot of the projects in the United States and also in Canada are focused on [FTIR] in combination with [FTS], but we started our project out of a belief that we still don't know which instruments are able to do which parts of drug checking the best as an overdose response.”

- Bruce Wallace, Co-lead, Vancouver Island Drug Checking Project

Integrate Fentanyl Test Strips in Overdose Education and Naloxone Distribution

In recent years, FTS have gained recognition within the harm reduction community as fentanyl is increasingly detected in drug supplies nationwide. However, drug paraphernalia laws in over half of 50 states and the District of Columbia prohibit possession, distribution and use of FTS or other drug checking equipment,⁶³ which can pose a substantial barrier for organizations and PWUD due to fear of criminal penalties. However, many jurisdictions are moving to remove FTS from drug paraphernalia laws,⁶⁴ though variations in allowances under paraphernalia laws, such as exemptions for SSPs, continue to exist.⁶⁵ The Legislative Analysis and Public Policy Association developed a [summary of state-by-state drug paraphernalia laws](#) (updated as of April 2022).

In 2021, the purchase and distribution of FTS, as well as related data collection and analysis and training activities, became allowable under federal funding from the U.S. Department of Health and Human Services (HHS), including the Centers for Disease Control and Prevention (CDC) and the Substance Abuse and Mental Health Services Administration (SAMHSA).^{66,67} Examples of allowable costs are included below.

- Purchasing of FTS for drug checking.
- Distribution and promotion of FTS.
- Collection of data on FTS access, use and findings to inform program improvements.
- Training staff and PWUD on proper use and interpretation.
- Analyzing and interpreting data from mass spectrometry to improve programs and provide information to partners.

Since FTS are inexpensive and relatively easy to use, distribution efforts should be expanded through their inclusion as a standard item in harm reduction kits, including safer injection, smoking and sex kits, in order to increase outreach and engagement with all PWUD and not solely injection users. When possible, supplies like sterile water and test containers needed to use FTS should be provided as well. FTS should also be integrated in overdose education and naloxone distribution (OEND), which typically does not include drug checking strategies, so harm reduction providers can share risk reduction strategies with PWUD in the event of a positive test result. Some PWUD may use FTS themselves, while others may conduct drug checking for their friends or play a role in secondary exchange distributing FTS to their community,^{68,69} demonstrating a need to distribute multiple strips at a time to each individual. PWUD may obtain small amounts of drugs from different suppliers, similarly indicating a need to distribute multiple strips to individuals who request them. For programs that offer advanced drug checking services, harm reduction kits and OEND should also provide information about accessing these advanced services.

When distributing FTS, demonstrating how they are used can be beneficial for participants. If staff capacity is limited, instructions for use should be provided and written in plain language to ensure participants are following best practices. When describing amounts needed for testing drugs, use measurements in combination with a physical frame of reference. It is more likely that individuals will understand how to test a quantity of their substance that is the size of a grain of rice compared to 10 milligrams. While individualized counseling after conducting drug checking is preferred, this is not always feasible with FTS use, so harm

reduction messaging and resources should be provided along with FTS. Sample guidance for participants about using FTS is included in **Appendix D. Resources**.

People who use opioids, particularly by injecting, may be most familiar with FTS, but people who snort or smoke opioids, or who use non-opioids, should also receive FTS and OEND, as well as people who engage in sex work and others who may be at risk of overdose. FTS can be a useful tool to engage a wide variety of people and connect them to additional harm reduction services. As fentanyl and other adulterants are increasingly found in stimulants and other non-opioids, there is a growing need to expand OEND efforts to people who use non-opioids so these individuals can better recognize and respond to opioid overdoses. Additionally, programs can work with community partners located in areas frequented by PWUD, such as public libraries or community health clinics, to expand FTS distribution beyond health departments and harm reduction organizations.



Most of the folks who say they're street opioid users, heroin users, already know about fentanyl, so they're teaching us about the changing drug market more than we're teaching them about what to do. It's the folks [who] are using meth and cocaine that we do a little bit more, 'Were you aware of this?' As we see shifts in the market, we're starting to see some xylazine here and lots of iso [synthetic opioid], so we make sure folks are aware that now you need eight boxes of Narcan, not two, and talk to folks about reversing an overdose for iso in pacing applications of Narcan and how to do that, and dispel the myth that you can overdose from somebody's breath."

- Tim Santamour, Director of Outreach and Networking, Florida Harm Reduction Collective

Partner with Harm Reduction Organizations to Provide Drug Checking Services and Education

A key component of centering PWUD in drug checking work is partnering with harm reduction organizations, including drug user unions, at every stage of planning, implementation, evaluation and communication. While drug checking data can be used to inform public health surveillance, the primary goal of drug checking should be to serve PWUD, and therefore programs should be created and implemented in partnership with PWUD.

Center Lived and Living Experiences

Drug checking is most effective as a collaborative learning process that combines quantitative drug data with qualitative experience information to paint a more comprehensive picture of the drug supply. While public health experts may bring more resources, including scientific background and research experience, harm reduction organizations and PWUD bring their experiential knowledge that helps ensure a drug checking program is reality-informed, rather than solely based on public health surveillance and analytic inferences. In some communities, harm reduction organizations may even learn of new drugs in the local supply from their participants before drug overdose data are made publicly available, further demonstrating the need to involve PWUD in understanding the drug supply.

Additionally, harm reduction organizations have trusted relationships with PWUD in their community and the best understanding of what their participants' needs are. This is essential to inform program planning, data collection and communication strategies, so that drug checking services appropriately respond to participant needs. Housing drug checking services within harm reduction organizations, to the extent possible, helps ensure low- or no-barrier access to these services for existing participants. As a trusted site, such organizations may be better suited to expand outreach to new participants as well.



Thinking about the location of your drug checking program, the closer to the ground, the closer to the folks who use drugs, the easier the access is, the better. That's why we chose SSPs [as partners] to start out."

- Yarelix Estrada, New York City Department of Health, Advanced Technology Drug Checking Services [webinar](#)

When collaborating with PWUD, it is critical to build respectful, equal partnerships where their voices and input are valued as much as that of any other partner. Advanced drug checking services are a unique area where technical or scientific knowledge around using equipment or analyzing data is not necessarily enough. A program's success will depend not only on having the funding, equipment and capacity for conducting testing and data analysis, but also on outreach and being able to share actionable, meaningful information. As such, the experiential knowledge of harm reduction organizations and PWUD play a critical role in the planning, implementation and evaluation of drug checking services.



We have intentionally partnered with community-based organizations for implementing drug checking programs. Community-based organizations often have long-standing and trusted relationships with people who use drugs. People may be more trusting of community-based settings as opposed to sites connected to government systems, due to some of the historical trauma that communities have faced."

- Thea Oliphant-Wells, Harm Reduction and Fentanyl Testing Program Manager, Seattle-King County Public Health

Provide Comprehensive and Continual Training

As a growing number of jurisdictions across the country adopt drug checking programs, comprehensive training is needed for staff who will be supporting service provision. While intensive training is typically not needed for FTS, staff should learn how to use the test strips and interpret results, as well as how to instruct participants to do so. Staff should also be trained in how to communicate results and meaningful harm reduction messaging to participants, whether their organization is providing FTS or advanced drug checking services. Regardless of type of drug checking services offered, all staff should be trained on collecting samples, using drug checking equipment, interpreting results and communicating results and harm reduction messaging to participants.

Training multiple staff members to have operational knowledge (including collecting samples, using equipment and interpreting results) is especially important for advanced drug checking programs. When it comes to operating advanced equipment, the ideal training includes theoretical and hands-on experiential learning. For example, the British Columbia Centre for Substance Use (BCCSU) offers a [joint 7-part webinar series and hands-on technician training](#) to FTIR trainees in British Columbia, while anyone outside of the region can access the webinar series only. Currently no similar training models exist in the U.S., and there are a limited number of individuals who can provide technician training specific to harm reduction. Medical examiners and forensic chemists may be a good starting point, as they do similar work while conducting autopsies and in crime labs; however, these "traditional" drug checking settings or equipment manufacturers may not have the right experience to provide training tailored for harm reduction purposes. The federally funded Overdose Data to Action (OD2A) Technical Assistance Center provides free training to OD2A recipients on FTIR implementation and community drug checking program operations, while the National Harm

Reduction Technical Assistance Center provides publicly accessible expertise and resources on FTS but is limited in its ability to offer support on advanced drug checking. Knowledge of the illicit drug supply is critical to interpreting results and ensuring meaningful information is shared, reiterating the need to center lived experience and train these individuals to operate drug checking programs.



“[Learning to use advanced drug checking equipment] is not hard to do, but it takes a while to do. It’s better to invest in training a harm reductionist who operates at a syringe service program in drug checking than it is to train a chemist in drug culture. And it’s just a tiny slice of chemistry, it’s not like you have to learn everything about chemistry.”

- Maya Doe-Simkins, Co-director, Remedy Alliance/For the People

After the initial technician training for use of advanced drug checking equipment is complete, programs can implement a “soft opening” to practice interpreting results with real samples from the community before formally implementing drug checking services. Continual training of new and existing staff is critical to support effective program implementation, as drug checking knowledge and experience is constantly evolving. Additionally, every organization will inevitably experience staff turnover or absences, so training should be provided to as many staff as possible to ensure day-to-day operational efficiency and overall program sustainability.

The Role of the Health Department

While harm reduction organizations often have stronger relationships with PWUD, and therefore may be more suited to directly provide drug checking services, health departments can play an important role by providing project management and supporting operational capacity, particularly around advanced drug checking. Health departments generally have the infrastructure to coordinate between partners, enabling expanded access to FTS through various community distribution sites, including not only harm reduction organizations but also public libraries, social service agencies and substance use treatment centers, among others. Health departments may also be able to provide funding to community-based organizations to purchase FTS, and in some cases may even be the main distributor of FTS. A harm reduction coordinator can serve as a project manager within the health department while staying connected to the community to better understand and advocate for community needs. Strong project management at the outset is critical to ensure proper processes are in place related to partner engagement, financial management, training and quality improvement, among other considerations, as well as to center the needs of PWUD.

Drug checking programs may involve diverse partners who do not work together regularly, including harm reduction organizations, first responders, academia and even law enforcement. Health departments can help build relationships and convene partners, as these departments often have existing relationships through various public health initiatives, such as standing meetings discussing overdose data and drug surveillance. Building relationships across stakeholder groups not only involves relevant partners in information sharing, but also combines the collective resources of each partner to enhance drug checking services, particularly for advanced drug checking. For example, a small harm reduction organization may not have the funding to purchase a GC-MS, but health department staff could transport de-identified samples on their behalf to a lab that already has the equipment and expertise to conduct further analysis. Since illicit substances cannot be transported via mail without a DEA registration or exemption due to the Controlled Substances Act, programs in rural areas may need to rely on partnerships with law enforcement, who may be more well-resourced, or other innovative strategies to transport drugs. For example, the Opioid Data Lab’s mail-in drug checking program chemically alters substances so that they are no longer considered controlled substances from a DEA standpoint and are legal to mail. For programs using an FTIR, research institutions and bureaus of investigation could share the reference libraries used when analyzing drug samples. While such groups may not be traditional partners that harm reduction organizations engage with, health departments can help build a strong network of diverse partners to provide effective drug checking services.



Example from the Field: Massachusetts Drug Supply Data Stream

The [Massachusetts Drug Supply Data Stream](#) (MADDS) – a statewide drug checking program established in 2019 to better understand the local drug supply and inform harm reduction, public health and public safety responses – is a collaboration of people with lived experience of substance use, community-based harm reduction organizations and the state public health department. MADDS is funded by the CDC and SAMHSA through the Massachusetts Department of Public Health and leverages the statewide harm reduction and overdose prevention program infrastructure, along with researchers at the Brandeis Opioid Policy Research Collaborative, to support its drug checking mission. Permissions from local police departments, community health centers, district attorneys and local municipalities were organized as formal memorandums of understanding in each community hosting drug checking services to ensure that all partners clearly understood the project goals and processes. For example, one county’s district attorney confirmed that nobody would be prosecuted for contributing samples or conducting drug checking. In designing data collection and reporting procedures, partners prioritized participants’ anonymity and safety and other harm reduction program preferences. The needs of other partners were also considered: local municipality and public safety valued timely, local-level reports with actionable steps, and state public health aimed to provide actionable information to the public without contributing to misinformation or community fear. This collaborative planning process ensured everyone’s voices were heard and valued to create an effective drug checking program that works for everyone.

MADDS sites analyze samples donated to harm reduction organizations and partnering police departments. The community programs conduct drug checking on-site using FTS and FTIR, as well as off-site using GC-MS through [DrugsData](#) and the Center for Forensic Science Research and Education. Samples include remnant drugs and drug residue from packaging and paraphernalia. Individual results are reported directly to the harm reduction organization to share with the individual who submitted the sample, while aggregate results are shared with both harm reduction organizations and the public. Aggregate data and statewide trends are also reviewed with the Massachusetts Department of Public Health to inform communications plans and strategic responses. In its first year of operation, MADDS collected 426 samples across six communities, four of which included samples from both harm reduction organizations and police departments. Fentanyl was found in 47.1% of samples, while xylazine was increasingly identified in samples over the course of the year at all six sites.⁷⁰ This understanding of the local drug supply has enabled public health to provide clear and accurate information to the public, public safety and first responders to better respond to overdoses, and community partners to better address and support their participants’ health concerns and wellbeing.

Health departments may also have the capacity to build data teams and support data collection, analysis and evaluation efforts. Data sharing agreements should be in place between any partners receiving data, and health departments can help shepherd the agreement processes. While participant identifiers should remain solely in the hands of harm reduction organizations, a local health department data team can use de-identified data to better understand the community (e.g., participant demographics, types of drugs used, trends in the drug supply) and effectiveness of provided services (e.g., differences in equipment, time to report results). The health department team may also lead the development of monthly or annual data reports, provide updates to relevant stakeholders and participate in decision-making around public health alerts.

Due to the controversial nature of drug checking in some jurisdictions, health departments should consult legal counsel before implementing and engaging in certain drug checking services. In the example of transporting samples for further analysis, health department staff may be able to take on this responsibility instead of harm reduction organization staff to minimize risk of law enforcement exposure, particularly when samples are taken to state crime labs or other law enforcement agencies. While harm reduction organizations and PWUD are not strangers to law enforcement interactions, health departments tend to be targeted less by law enforcement while conducting overdose prevention and response initiatives. As such, health departments taking ownership of tasks like this may serve the dual purpose of implementing drug checking activities and shielding harm reduction organizations from potential legal ramifications or retraumatizing experiences. By ensuring the physical and emotional safety of all involved partners, especially harm reduction and PWUD, services can continue to be implemented effectively.



Example from the Field: testRI

Toxicological and Ethnographic Drug Surveillance Testing Rhode Island (testRI) is a two-year drug checking program and research study operating under the Prevent Overdose Rhode Island initiative, a collaboration between the Governor’s Overdose Prevention and Intervention Task Force, the Rhode Island Department of Health (RIDOH), the Rhode Island Department of Behavioral Healthcare, Developmental Disabilities, and Hospitals (BHDDH) and Brown University School of Public Health.⁷¹ Drug residue samples are anonymously collected by donation at several community-based organizations, and can be donated using baggies, cookers, pipes or syringes.⁷² Researchers at Brown University test samples using liquid chromatography mass spectrometry (LC-MS), a process similar to GC-MS, and results are reported online on the [program’s website](#), [StreetCheck.org](#) and [social media](#), as well as through alerts via the RIDOH email listserv and directly to community partners. Reported results include where a sample was collected, what was tested, what the sample was sold as (if available) and what substances were found. The program’s website also provides brief descriptions explaining what each substance is and its effects when used, and links to safer drug use resources (see [Appendix C. testRI Local Drug Sample Testing Update](#)).

Implement Effective Data Collection, Analysis and Communication Strategies

Data Collection

In harm reduction settings, data collection should be low-barrier and protect participant confidentiality. Low-barrier data collection allows staff to focus on providing quality services and helping participants receive needed services in a timely manner, without lengthy intake or assessment processes. While data collection is critical to understanding trends in the drug supply, participant experiences with services, and overall program effectiveness, it should not be so burdensome that it deters participants from accessing services.^{73,74} Participants should be well-informed about the drug checking services provided. Programs that offer multiple drug checking modalities should share information about the strengths and limitations of each technology to allow participants to make informed decisions about how they would like to test their samples. Organizations should also ensure compliance with federal regulations governing substance use disorder information (e.g., 42 CFR Part 2). A national technical

assistance center, [Focus: PHI](#), offers resources, tools and individualized technical assistance to organizations related to privacy and confidentiality compliance concerns.

In addition to being low-barrier and adhering to federal regulations, data collection should maintain participant confidentiality, particularly when data may be shared with partners outside of harm reduction organizations or health departments. Some drug checking programs may partner with law enforcement or crime labs to submit samples for advanced drug checking. In these cases, it is even more critical to protect participant confidentiality and ensure that no personal information is shared when samples are delivered. Participants should be made aware that samples can be sent to crime labs with no identifying information and should have the option to decline further analysis or any other testing method if they are not comfortable with this component of testing.

Ideally, data collection should be left to community-based harm reduction organizations, who often already have their own low-barrier processes for collecting and de-identifying participant data. Organizations then have the autonomy to share relevant data with health department and other partners as needed, while maintaining their participants' anonymity.



Example from the Field: StreetCheck

[StreetCheck](#) is a free web-based platform and mobile app that facilitates drug checking programming by streamlining sample collection at community drug checking programs, providing easily understandable results and sending timely reminders of key messages and information.⁷⁵ Funded by the CDC and Massachusetts Department of Public Health,⁷⁶ StreetCheck was developed collaboratively by the Opioid Policy Research Collective at Brandeis University, MADDs, Massachusetts community-based harm reduction programs and partners from the North Carolina Survivors Union and University of North Carolina. Since its inception, StreetCheck has expanded beyond Massachusetts to support growing harm reduction programs in states across the country, including Connecticut, Maine, New York, Rhode Island, Vermont, Washington and Wisconsin.

Programs can customize the app's tools based on their community's needs and what drug checking services are offered, including managing and tracking what information and resources are provided to participants if and when results are shared. In addition to standardized procedures and anonymous data collection, StreetCheck offers a secure, password-protected companion website with interactive tools for programs to view data and explore trends.⁷⁷ In Massachusetts, samples may be submitted for free drug checking to harm reduction organizations operating as part of MADDs; outside of Massachusetts, the team can connect individuals with their local drug checking program or resources.

Data Interpretation

Most harm reduction programs distributing only FTS do not conduct drug checking on-site and may not have comprehensive test result data outside of qualitative information reported by participants. However, valuable insights can be gained from supply distribution data, including how many FTS were distributed, where, and to whom, and usage by demographics or geographic data, to ensure services are reaching the intended population and to inform quality improvement efforts.

For advanced drug checking programs, staff need to have sufficient training to not only operate equipment effectively but also interpret results accurately. The ideal drug checking technician will have both a strong chemistry background and knowledge of the local drug supply, though there are a limited number of people with this combination of expertise. Many programs may rely on existing drug checking experts from other fields, such as medical examiners or crime labs, for support in learning to interpret results. However, these experts may not have the drug supply knowledge needed to interpret results specifically for harm reduction settings. For example, a report may show a number of drugs where one is a fentanyl precursor and the other is a metabolite. To the untrained eye, it may seem that there are new and dangerous opioids in the drug supply, warranting a public health alert. In reality, these are not discrete substances — and there is in fact existing information about the drug — so appropriate harm reduction messaging should be shared rather than an urgent and false alert.



I was watching a presentation with the chief medical examiner for a large city, and they were talking about how drugs these days are so complicated and have all these components, and they showed a table that had the different drugs that were found in post-mortem test reports. And there was one line that said 4-ANPP and one line that said acetyl fentanyl. And the implication was that each new line is a new, scary opioid, but 4-ANPP and acetyl fentanyl are practically speaking sort of the same thing. One's a metabolite of the other, one's a precursor to the other, so they did not start out as discrete substances. Kind of like heroin getting metabolized into 6-MAM and morphine, those two substances are the result of someone consuming [a single] substance. The fact that the chief medical examiner, who's also a toxicologist, didn't quite realize that or chose not to explain [this] is kind of problematic. We need our technicians to know that this might look like a really intense sample with all these different opioid components, but here's why the results show so many components and this is what you might be able to expect from this substance."

- Maya Doe-Simkins, Co-director, Remedy Alliance/For the People

When possible, having an experienced harm reduction-based technician provide support in the early stages of program rollout can help to enhance interpretation skills beyond non-harm reduction-based training. The “soft opening” model can also help technicians to practice and develop knowledge of the local drug supply before officially opening services to the public. With such varied adulterants and analogs in the drug supply, drug checking technicians need to be trained to analyze results logically in the context of their community to relay meaningful information to participants and the public.



Example from the Field: Seattle-King County Public Health

Seattle-King County Public Health is in the process of implementing drug checking programs with two community-based harm reduction organizations using FTS and FTIR. As part of the FTIR technician training, the primary and volunteer drug checking technicians completed the BCCSU online training and are gaining practical experience by using the FTIR to test real samples for several months prior to program implementation. Samples are first collected from participants on an ad hoc basis, as the drug checking program has not yet been officially rolled out. The technicians then all practice and learn together, testing the same samples on each machine to compare whether each technician gets the same results. Being able to practice on the machines themselves and apply the learnings from the online training has been invaluable to the overall technician training process and ensuring that these technicians feel prepared to provide drug checking services to their participants once the program does go live.

Communication

When communicating drug checking results and drug data broadly, it is critical to not only share accurate and meaningful information, but also actionable steps PWUD can use to reduce harm.

Individual Communications

Harm reduction messaging has long included strategies for safer use, including not using alone, carrying naloxone and using less often or in smaller amounts. These standard strategies are useful reminders to share with participants, and tailored counseling following receipt of drug checking results should also be provided when possible. For commonly seen adulterants, counseling may include information about how the drug interacts with a person's body or other substances they may use, what the effects are and how to mitigate risks. For less well-documented substances, peer education and collaborative learning are incredibly valuable. Recommended strategies for participants may include asking sellers if they themselves have tested or personally used that batch and if so, what the experience was like, as well as asking others who may buy from the same seller. Not only can experiential descriptions from the PWUD community help an individual the next time they use, but this qualitative data can also inform future public health messaging, research and initiatives.

Additionally, it is important to be as accurate and realistic as possible when messaging results. The drug supply is ever-changing, and with many varieties of adulterants, even advanced drug checking technologies may not always produce accurate results or results may be interpreted incorrectly. As a best practice, avoid using definitive statements, such as “this does/does not contain XYZ.” Each equipment has its own limitations around sensitivity and specificity, and some substances may look like another substance in the results and give false positives, or samples tested may not be representative of the entire drug purchased. For example, DanceSafe qualifies that their reagent test kits can only “detect the presence of certain drugs” but do not provide information about the potency or purity of a sample;⁷⁸ similarly, their volunteers are trained to inform participants that **“this test indicated there is XYZ in the sample,”** rather than definitively saying a substance is present.⁷⁹

When sharing results, participant privacy and safety must be protected. If results are provided on paper, use language that does not include any identifying information that could link back to a specific individual should someone else see the results. Not only could it be a privacy violation if the paper results were seen by someone else, but it could also put the participant at risk for arrest if seen by a law enforcement officer. A handout for common substances is a simple way to provide information to participants, and can also be easily duplicated, reducing burden on staff to create educational materials. Programs providing advanced drug checking services that have the technological infrastructure may also upload test results into an online database, where participants can privately look up results using a unique identifier or QR code that is provided when the sample is submitted for testing. The University of North Carolina (UNC) Street Drug Analysis Lab developed a public [online database](#) where de-identified drug checking results are uploaded after testing using GC-MS; results can be searched using the sample identification number, location the sample was sent from or type of drug, and include education about the substance(s) identified and harm reduction messaging.

Public Communications

Public health alerts are an essential communication strategy for health departments to disseminate and amplify pertinent health information. However, when it comes to drug-related alerts, health departments need to be careful to share only the newest, most urgent and meaningful information, so as to not amplify messaging that may cause both undue alarm and message fatigue. Drug supplies may vary greatly between different communities, even within one county, so it is important to avoid making generalized statements when communicating drug checking findings more broadly. Considerations for how information should be shared include:

- Be timely and specific to geographic location.
- Provide new and meaningful information about the drug supply without causing unnecessary panic.
- Include actionable guidance.

A sample protocol for issuing public health alerts from Seattle-King County Public Health is included in [Appendix D. Resources](#).



Example from the Field: Massachusetts Drug Supply Data Stream

In over 400 samples MADDs collected from community-based harm reduction organizations and Massachusetts police departments in 2020, it identified fentanyl, xylazine and numerous other adulterants, such as 4-fluorofentanyl, a fentanyl analog with higher toxicity. Rather than developing a public health alert about this analog, since the harm reduction messaging would be similar to that of fentanyl, the MADDs team worked with community partners to develop an alert that effectively provided information without creating fear about a new adulterant. This [community drug supply alert](#) instead promoted actionable harm reduction messaging and provided clear information about the toxicity of 4-fluorofentanyl to inform public safety and first responder overdose response.



We are very judicious about when we send out alerts. We send alerts when there is a concerning new drug trend, a new substance, a spike in a particular geographic or other demographic community, or any indication of something that could be more dangerous. We really don't want to send alerts out all the time, or the alerts can lose importance."

- Thea Oliphant-Wells, Harm Reduction and Fentanyl Testing Program Manager, Seattle-King County Public Health



If we're testing a certain pill, like an M30 [oxycodone pills that have been known to sometimes be adulterated in certain communities], and we find fentanyl in it, we'll shoot out a note saying, 'Hey there's these pills in this certain market in the [location redacted] that are testing positive for fentanyl.' Mostly we do little social media blasts if surprising things come up. If something's being sold as heroin and it's testing positive for fentanyl, we're not blasting those because we don't want to slam people's inboxes since that's so frequent now."

- Tim Santamour, Director of Outreach and Networking, Florida Harm Reduction Collective

Besides public health alerts, other forms of communication such as flyers and social media blasts can be used to share broader messaging or less urgent or dangerous findings from drug checking data. For example, when there is a spike in fentanyl-related overdoses, social media can be used to raise awareness about the toxic drug supply broadly and share harm reduction messaging. Since fentanyl is not a new occurrence in many communities, a spike in overdoses may not warrant a public health alert, but instead a reminder about testing drugs, not using alone and other harm reduction strategies. Using alternative communication strategies for less urgent messaging allows public health alerts to be reserved for sharing the most critical information.



HIPS DC [@hipsdc]. (2022, April 11). *We often don't know what folks are overdosing – which is less helpful but ... maybe some warning is better than no warning???* [Photo]. Instagram. <https://www.instagram.com/p/CcN4lZ4uX-W/?hl=en>



We provide as much information to facilitate people's safer drug use and personal harm reduction, rather than trying to alert people about all the dangerous drugs out there."

- Bruce Wallace, Co-lead, Vancouver Island Drug Checking Project

Outside of being leveraged to develop public health communications, drug checking data can be used to identify what makes up a “normal” drug supply in the community, including not only drug composition but also PWUD experiences. Understanding the local drug supply can help inform more tailored guidance for PWUD, which may be more useful for individuals’ decision-making, rather than knowing the exact components of their drugs. Knowledge of usual trends can also make it easier to identify when new and potentially dangerous adulterants enter the “normal” supply and recognize when it is appropriate to use more urgent public health alerts rather than broad communications.

Implementation Challenges

As drug checking services become more prevalent in jurisdictions across the country, several implementation challenges remain in building out and expanding services, including training and technical assistance, legality considerations and federal funding and support.

Training and Technical Assistance

Few drug checking programs have the experience, expertise and infrastructure to not only provide advanced drug checking services, but also provide training to new sites. Those programs that do have this knowledge and capacity have relied on support from external partners. As mentioned above, BCCSU has provided training and guidance for many, and the North America-based group Alliance for Collaborative Drug Checking manages a Slack channel to support drug checking technicians (although this channel is only available to technicians specifically, not other drug checking support staff). Some established programs have provided training to select newer programs; however, this is dependent on the new program's capacity to cover the cost of travel and training (typically around two to three days), as well as staffing to ensure other usual services are able to continue uninterrupted during trainees' absence.

Among new and existing drug checking programs, the idea of a national technical assistance center has been raised to increase access to comprehensive training for advanced drug checking, expand subject matter expertise across the country and reduce the burden on the few individuals currently able to provide training. Currently, the OD2A Technical Assistance Center only provides advanced drug checking implementation support to health departments receiving OD2A funds. The CDC also recently established the [National Harm Reduction Technical Assistance Center \(NHRTAC\)](#), which responds to a broad range of harm reduction technical assistance requests. As of the publication date, NHRTAC can provide support related to implementation of FTS and is planning to expand in the future to include technical assistance/training for advanced drug checking consultation services.

Legality Considerations

Drug paraphernalia laws differ in every state, and drug checking equipment and services often fall into a legal gray area. Health departments in jurisdictions where drug checking falls into such a gray area may be hesitant to implement drug checking services under advisement from their legal department. Partnering with harm reduction organizations can be key to avoiding or overcoming this legality barrier and thereby ensuring communities have access to necessary overdose prevention services. The OD2A Technical Assistance Center can also provide legal information and resources tailored to specific jurisdictions.



You need to have an organization that has a certain amount of appetite for risk or operating in the grey area. There are numerous health departments in this country right now who are sitting on a machine that they're not allowed to touch because their legal department can't figure out, can't wrap their head around how to get comfortable with it legally. So, my emphatic encouragement, especially when I talk to people from health departments, is, at minimum, partner – with equal decision-making capacity – with community-based organizations, or, at best, give them the machine and let them figure it out, because community-based syringe services programs have a comfort level and experience with operating in the grey areas that health departments just don't.”

- Maya Doe-Simkins, Co-director, Remedy Alliance/For the People

Even in areas with strict paraphernalia or drug checking laws, not all jurisdictions actively enforce such laws, as reflected by no reports of participants being arrested for possessing FTS or staff operating drug checking equipment being similarly arrested for possessing illicit substances. Based on the literature and key informant interviews conducted to inform this guide, risk of arrest for possessing FTS is similarly not a major concern for most harm reduction participants, as possession of illicit substances is typically the activity more likely to catch the attention of law enforcement. Though key informants reported no known accounts of arrests for carrying FTS at this time, this remains a concern in many jurisdictions. To navigate these possession restrictions, many harm reduction sites will frame drug checking services as testing residue (rather than drugs) to emphasize that there is no possession of substantial amounts of substances that could later be used.

In contrast some jurisdictions have revised their legislation to explicitly support drug checking – the most effective way to implement and expand drug checking services without fear of law enforcement involvement. In Illinois, the Overdose Prevention and Harm Reduction Act, enacted in 2019, requires that “access to on-site drug adulterant testing supplies such as reagents, test strips, or quantification instruments that provide critical real-time information on the composition of substances obtained for consumption” be a legally allowable activity for SSPs. The legislation also requires that “no employee or volunteer of or participant in a program ... be charged with or prosecuted for possession of ... drug adulterant testing supplies ... [and] any residual amounts of controlled substances used in the course of testing.” Similarly, [legislation in North Carolina](#) decriminalizes possession and use of drug checking equipment by both participants and organizations providing drug checking services.

Federal Funding and Support

With the recent change to include FTS as an allowable purchase under CDC and SAMHSA funding, there has been a clear shift in the federal perspective in support of drug checking. FTS can be implemented easily compared to advanced drug checking services and can be used to engage a wider range of people at risk of overdose, including people who do not inject drugs and people who use stimulants. Further research into innovative uses of FTS is needed to better understand how programs can continue expanding distribution and implementation. However, key informants noted that the ubiquity of fentanyl and other adulterants, such as xylazine, in drug markets across the country may warrant additional federal funding and support for advanced drug checking services in harm reduction settings to complement the use of FTS and provide more detailed drug analyses. Investment in both service provision and research will be critical to increase access to drug checking services across the country and to better understand the strengths, limitations and uses of the different advanced drug checking technologies. Additionally, rather than focusing solely on stopping fentanyl and other adulterants from entering the drug supply, there needs to be a greater emphasis on supporting drug checking for harm reduction specifically as a tool for preventing overdose and supporting the safety and wellbeing of PWUD.

Appendix A. Key Informants

<p>Brad Finegood, MA, LMHC Strategic Advisor Seattle-King County Public Health</p>	<p>Bruce Wallace, PhD, MSW Co-lead; Associate Professor Vancouver Island Drug Checking Project; University of Victoria School of Social Work</p>
<p>Corey Davis, JD, MSPH Deputy Director Network for Public Health Law – Harm Reduction Legal Project</p>	<p>Don Jackson SSP Director North Carolina Survivors Union</p>
<p>Maya Doe-Simkins, MPH Co-director Remedy Alliance/For the People</p>	<p>Megan Reed, PhD, MPH Research Assistant Professor Thomas Jefferson University</p>
<p>Nabarun Dasgupta, PhD, MPH Senior Scientist; Innovation Fellow University of North Carolina, Chapel Hill</p>	<p>Rae Elkasabany FTIR Program Coordinator; DC Chapter Head DanceSafe</p>
<p>Thea Oliphant-Wells, MSW Harm Reduction and Fentanyl Testing Program Manager Seattle-King County Public Health</p>	<p>Tim Santamour Director of Outreach and Networking Florida Harm Reduction Collective</p>
<p>Traci Green, PhD, MSc Director; Professor Brandeis University and the COBRE on Opioids and Overdose at Rhode Island Hospital</p>	

Appendix B. Scenarios for Further Analysis Using GC-MS

The University of North Carolina Injury Prevention Research Center and North Carolina Survivors Union jointly provide a range of drug checking services to PWUD in North Carolina using FTS, FTIR and GC-MS. In the first six months of their program operations, approximately 50% of FTIR samples were sent for further analysis with GC-MS. As drug checking technicians gained experience, this leveled out to approximately 20% of samples. Using learnings from this experience, the team identified scenarios when further analysis with the GC-MS may be needed after initial testing with FTS and/or FTIR; other programs may implement different approaches to determine when further analysis is needed. These scenarios include:

- When fentanyl is identified as positive on FTS but negative on FTIR.
- When there are no detectable opioid matches on heroin samples.
- When there are low FTIR match scores for active ingredients.
- When drug mixtures contain four or more substances.
- When a new drug is identified for the first time (e.g., a PCP analog).
- For quality assurance of FTIR spectra.
- To better understand synthesis methods (e.g., P2P methamphetamine).
- For subset validation for research publication.
- When testing liquid drugs. *
- When testing most pills. *
- When testing organic substances (e.g., cannabis, mushrooms).
- For gold-standard quantification (e.g., fentanyl quantification).

*It is possible to test and analyze using FTIR but can be difficult.

Appendix C. testRI Local Drug Sample Testing Update⁸⁰



LOCAL DRUG SAMPLE TESTING UPDATE

Legend: (O) Opioids (B) Benzodiazepines
 (S) Stimulants (C) Cannabinoids
 (A) Other (H) Hallucinogen/
 Active Cut Dissociative

testRI is a two-year study to find out what is in the drug supply in Rhode Island and how changes to the supply are impacting people who use drugs in our community. We are testing used equipment, like pipes and syringes, that are collected from the community or donated by individuals or local organizations. Samples are tested using advanced confirmatory toxicology testing (LC-QTOF-MS).

Data below are from two samples collected in March from Providence.

*Data here only represent a sample of the local drug supply in Rhode Island. Because of that, the samples we have collected and tested may not represent the broader drug supply in the state. Samples are also not being tested in relation to overdose so outcomes from use, like overdose, are unknown.

Sample date & origin

Sold as (name or appearance):

What we found:

* indicated substances that make up most of a sample

March 2023
Providence



Fentanyl
(baggie with the white powder)

Fentanyl* (O) Methamphetamine (S)
 Xylazine (A) Caffeine (A)
 Cocaine (S) Buyrylfentanyl (O)
 Acetylfentanyl (O) Beta-hydroxyfentanyl (O)
 Quinine (A)
 Para-fluorofentanyl (O)

March 2023
Providence



MDMA
(clear crystal)

MDMA* (H)
 MDDMA (H)
 Ketamine (H)
 Cocaine (S)
 Methamphetamine (S)

Why does this matter?

In March 2023 we tested a sample sold as fentanyl that contained fentanyl, fentanyl analogs, and xylazine.

Naloxone will reverse the effects of fentanyl, fentanyl analogs and other opioids, but has not been documented to reverse xylazine effects. In all of our testing thus far, xylazine has only been present with fentanyl. Give naloxone if you suspect an overdose.

The drug supply is volatile and continuously changing. The mixing of drugs with or without the knowledge of people who are using drugs creates higher risk for overdose.

See back page for more info about each substance.

For more info visit: testri.org

What we found:

Cocaine is a stimulant that can cause elevated blood pressure and fast heart rate. In overdose it can cause heart problems, seizure, stroke, and muscle and/or kidney injury.

Fentanyl is a highly potent opioid with high risk for overdose. In overdose it can cause problems with breathing and unresponsiveness.

Fentanyl analogs are drugs that have a similar chemical structure to fentanyl. Potency estimates of illicitly manufactured fentanyl analogs are most often based on limited data as most have not been approved for use or studied in humans. Because of the toxicity of these drugs, lack of familiarity, inconsistent dose, and mixing into drugs which often already include fentanyl, overdose risk is high. Fentanyl analogs in overdose can cause problems breathing and unresponsiveness. Naloxone will work to reverse overdose from fentanyl and fentanyl analogs. Fentanyl analogs found in these samples:

Acetylfentanyl

Beta-hydroxyfentanyl

Butyrylfentanyl

Para-fluorofentanyl

Ketamine is an anesthetic that is similar to PCP. Ketamine is often used for its hallucinogenic effects. Ketamine can cause hallucinations, confusion, abnormal behavior, nausea or vomiting, and hypertension. Depending on the dose, it can also cause breathing changes, sedation, abnormal heart rate, seizures or abnormal heart rhythm. Chronic use has been associated with bladder and urinary tract problems.

MDMA (3,4-Methylenedioxymethamphetamine) is a hallucinogenic amphetamine. Adverse effects include dizziness, hyperactivity, decreased appetite, pupillary dilation, headache, anxiety, and disorientation. Rare severe toxic effects include low sodium, seizures, elevated body temperature, and muscle and kidney injury.

MDDMA (3,4-Methylenedioxy-N,N-dimethylamphetamine) is a hallucinogenic amphetamine, similar to MDMA. Data on adverse effects are limited, but likely similar to MDMA and other hallucinogenic amphetamines.

Methamphetamine is a stimulant. Risks include heart problems (e.g., abnormal heart rhythm or rate, heart attack, heart failure), high blood pressure, hallucinations, psychosis, and kidney and/or muscle injury.

Quinine is a common cutting agent in heroin/fentanyl. It is a drug used for the treatment of malaria. At amounts typically found in drug samples, the risks are low. At very high doses, risks include kidney damage, ringing in the ears, nausea, vomiting, diarrhea, platelet problems and hypotension (if injected), and heart problems.

Xylazine is a veterinary sedative. Xylazine is a long-acting and sedating medication, but it is not an opioid. Especially if combined with other sedating medications it can cause unresponsiveness, low blood pressure, a slowed heart rate, and decreased breathing. Xylazine use has been associated with skin ulcers and infection. Chronic use can also lead to dependence and a withdrawal syndrome that can cause irritability, anxiety, and dysphoria.

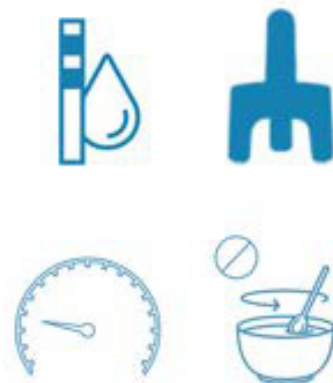
How to reduce risk

Because the drug supply is always changing, it can be hard to know what you are buying. Testing your drugs first with fentanyl test strips can be a good first step.

Having naloxone (Narcan) with you is always important so you can respond to an overdose. It is also important to try not to use alone so someone can help you if you experience an overdose.

Start slow and go slow. Using a little bit of your drug at a time can be helpful to test the strength and keep track of your doses.

Try to avoid mixing depressants or downers, like benzos, opioids, and alcohol when you use. Mixing these can increase your risk of an overdose.



Appendix D. Resources

Title	Source	Date Published	Description
<u>Drug Checking as a Harm Reduction Intervention</u>	BCCSU	2017	Provides an overview of existing drug checking technologies and usages across several countries as a harm reduction intervention. Includes a sample resource for drug sample submissions.
<u>Manuals and Guidelines</u>	BCCSU	2022	Collection of drug checking manuals, guidelines and standard operating procedures, including technician training, data entry guidance and reporting results to participants.
<u>Drug Checking Operational Technician Manual Version 2</u>	BCCSU	2022	Provides instruction on drug checking procedures used by the BCCSU drug checking project, guidance on harm reduction messaging and sample language and tools that can be adapted for use.
<u>Drug Checking Shadowing Guide for Supervising Technicians</u>	BCCSU	2021	Provides a framework for supervising drug checking technicians to oversee new trainees.
<u>Drug Checking Trainee Shadowing Guide Checklist</u>	BCCSU	2021	Provides a checklist of tasks to become proficient in during drug checking technician training.
<u>How to Use a Fentanyl Test Strip</u>	Cook County Department of Public Health	2021	Printable instructions for using FTS and interpreting results, including a referral to community partner for individuals seeking advanced drug checking services.
<u>How to Test Your Drugs Using Fentanyl Test Strips</u>	NYC Health	n.d.	Printable instructions for using FTS and interpreting results, including guidance for testing non-opioids.

Appendix D. Resources

Title	Source	Date Published	Description
<u>Instructions and Data Collection Card for Mail-in Drug Checking</u>	University of North Carolina (UNC), Injury Prevention Research Center	2022	Printable instructions that detail how to prepare samples for mail-in drug checking and includes brief, anonymous data collection form.
<u>Drug Checking Test Kit</u>	UNC Opioid Data Lab	2021	3-minute video demonstrating the mail-in drug checking kit.
<u>Public Health Drug Checking in North Carolina</u>	UNC Opioid Data Lab	2021	1.5-minute video providing an overview of the drug checking program and briefly demonstrating how to use FTS, FTIR and GC-MS.
<u>Guidelines/ Protocol for Responding to Drug Overdoses</u>	Seattle-King County Public Health	2020	Sample protocol for developing public communications related to drug overdose data, including criteria for using public health alerts and other communication strategies.
<u>Fentanyl Test Strips: Updates from the Field</u>	NASTAD	2022	1-hour recorded webinar discussing how FTS can be used for drug checking, strategies for minimizing user error, and common myths and misunderstandings around FTS.
<u>Advanced Technology Drug Checking Services</u>	NASTAD	2022	1-hour recorded webinar discussing how advanced drug checking technologies can be used, considerations for training and communicating results and lessons learned from real-world programs.
<u>42 CFR Part 2</u>	Focus: PHI	2022	Technical assistance center providing information and resources about compliance with privacy and confidentiality regulations.

Appendix E. References

1. Ahmad, F. B., Cisewski, J. A., Rossen, L. M., & Sutton, P. (2022). Provisional drug overdose death counts. National Center for Health Statistics. <https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm>
2. O'Donnell, J., Tanz, L. J., Gladden, R. M., Davis, N. L., & Bitting, J. (2021). Trends in and characteristics of drug overdose deaths involving illicitly manufactured fentanyls – United States, 2019–2020. *Morbidity and Mortality Weekly Report (MMWR)*, 70(50), 1740–1746. <http://dx.doi.org/10.15585/mmwr.mm7050e3>
3. Mattson, C. L., Chowdhury, F., & Gilson, T. P. (2022). Trends in gabapentin detection and involvement in drug overdose deaths – 23 States and the District of Columbia, 2019–2020. *MMWR*, 71(19), 664–666. <http://dx.doi.org/10.15585/mmwr.mm7119a3>
4. Liu, S., O'Donnell, J., Gladden, R. M., McGlone, L., & Chowdhury, F. (2021). Trends in nonfatal and fatal overdoses involving benzodiazepines – 38 States and the District of Columbia, 2019–2020. *MMWR*, 70(34), 1136–1141. <http://dx.doi.org/10.15585/mmwr.mm7034a2>
5. Singh, V. M., Browne, T., & Montgomery, J. (2019). The emerging role of toxic adulterants in street drugs in the US illicit opioid crisis. *Public Health Reports*, 135(1), 6–10. <https://doi.org/10.1177%2F0033354919887741>
6. Carroll, J. J., Mackin, S., Schmidt, C., McKenzie, M., & Green, T. C. (2022). The Bronze Age of drug checking: Barriers and facilitators to implementing advanced drug checking amidst police violence and COVID-19. *Harm Reduction Journal*, 19, 9. <https://doi.org/10.1186/s12954-022-00590-z>
7. Drug Policy Alliance. (2022). Drug checking. <https://drugpolicy.org/issues/drug-checking>
8. Key informant interview.
9. Park, J. N., Frankel, S., Morris, M., Dieni, O., Fahey-Morrison, L., Luta, M., Hunt, D., Long, J., & Sherman S. G. (2021). Evaluation of fentanyl test strip distribution in two Mid-Atlantic syringe services programs. *International Journal of Drug Policy*, 94, 103196. <https://doi.org/10.1016/j.drugpo.2021.103196>
10. Karch, L., Tobias, S., Schmidt, C., Doe-Simkins, M., Carter, N., Salisbury-Afshar, E., & Carlberg-Racich, S. (2021). Results from a mobile drug checking pilot program using three technologies in Chicago, IL, USA. *Drug and Alcohol Dependence*, 228, 108976. <https://doi.org/10.1016/j.drugalcdep.2021.108976>
11. Peiper, N. C., Clarke, S. D., Vincent, L. B., Ciccarone, D., Kral, A. H., & Zibbell, J. E. (2019). Fentanyl test strips as an opioid overdose prevention strategy: Findings from a syringe services program in the southeastern United States. *International Journal of Drug Policy*, 63, 122–128. <https://doi.org/10.1016/j.drugpo.2018.08.007>
12. Larnder, A., Burek, P., Wallace, B., & Hore, D. K. (2021). Third party drug checking: Accessing harm reduction services on the behalf of others. *Harm Reduction Journal*, 18, 99. <https://doi.org/10.1186/s12954-021-00545-w>
13. Brunt, T. (2017). Drug Checking as a Harm Reduction Tool for Recreational Drug Users: Opportunities and Challenges. Background Paper Commissioned by the EMCDDA for Health and Social Responses to Drug Problems: A European Guide. European Monitoring Centre for Drugs and Drug Addiction. https://www.emcdda.europa.eu/system/files/attachments/6339/EuropeanResponsesGuide2017_BackgroundPaper-Drug-checking-harm-reduction_o.pdf
14. Smit-Rigter, L., & van der Gouwe, D. (2019). The drugs information and monitoring system (DIMS): Factsheet on drug checking in the Netherlands. Trimbos Institute. <https://www.trimbos.nl/wp-content/uploads/sites/31/2021/09/afi677-the-drugs-information-and-monitoring-system-dims.pdf>
15. Ibid.
16. Barratt, M. J., Kowalski, M., Maier, L. J., & Ritter, A. (2018). Global review of drug checking services operating in 2017. Drug Policy Modelling Program Bulletin No. 24. Sydney, Australia: National Drug and Alcohol Research Centre, UNSW Sydney. <https://ndarc.med.unsw.edu.au/sites/default/files/ndarc/resources/Global%20review%20of%20drug%20checking%20services%20operating%20in%202017.pdf>
17. Trans European Drug Information (TEDI). (2022). About TEDI. <https://www.tedinetwork.org/about/>
18. TEDI. (2022). Drug checking: What a drug checking service is. <https://www.tedinetwork.org/drug-checking/>

19. DanceSafe. (2022). About Us. <https://dancesafe.org/about-us/>
20. Key informant interview.
21. DanceSafe. (2022). Local Chapters. <https://dancesafe.org/get-involved/local-chapters/>
22. Gomez, M. (2015, June 30). Electric forest shuts down DanceSafe—But we have a bigger problem to tackle. DanceSafe. <https://dancesafe.org/dancesafe-was-shut-down/>
23. Key informant interview.
24. DanceSafe. (2022). Drug Checking. <https://dancesafe.org/drug-checking/>
25. Diversion Control Division. (2022). National Forensic Laboratory Information System: NFLIS-Drug 2021 Mid-year Report. U.S. Department of Justice, U.S. Drug Enforcement Administration. <https://www.nflis.deadiversion.usdoj.gov/nflisdata/docs/13915NFLISDrugMidYear2021.pdf>
26. Grabenauer, M., Bollinger, K., McGrath, J., & Roper-Miller, J. (2022). Model strategies for field drug testing programs. U.S. Department of Justice, National Institute of Justice, Office of Investigative and Forensic Sciences. Forensic Technology Center of Excellence. [Model Strategies for Field Drug Testing Programs | Office of Justice Programs \(ojp.gov\)](https://www.ojp.gov/forensic-technology-center/excellence/model-strategies-for-field-drug-testing-programs)
27. Tilhou, A. S., Birstler, J., Baltés, A., Salisbury-Afshar, E., Malicki, J., Chen, G., & Brown, R. (2022). Characteristics and context of fentanyl test strip use among syringe service clients in southern Wisconsin. *Harm Reduction Journal*, 19, 142. <https://doi.org/10.1186/s12954-022-00720-7>
28. Park, Frankel, Morris, Dieni, Fahey-Morrison, Luta, Hunt, Long, & Sherman, *International Journal of Drug Policy*, 94, 103196. <https://doi.org/10.1016/j.drugpo.2021.103196>
29. Green, T. C., Park, J. N., Gilbert, M., McKenzie, M., Struth, E., Lucas, R., Clarke, W., & Sherman, S. G. (2020). An assessment of the limits of detection, sensitivity and specificity of three devices for public health-based drug checking of fentanyl in street-acquired samples. *International Journal of Drug Policy*, 77, 102661. <https://doi.org/10.1016/j.drugpo.2020.102661>
30. Peiper, Clarke, Vincent, Ciccarone, Kral, & Zibbell, *International Journal of Drug Policy*, 122-128. <https://doi.org/10.1016/j.drugpo.2018.08.007>
31. Forensic Technology Center of Excellence. (2018). Landscape study of field portable devices for chemical and presumptive drug testing. U.S. Department of Justice, National Institute of Justice, Office of Investigative and Forensic Sciences. <https://forensiccoe.org/landscape-study-of-field-portable-devices-for-presumptive-drug-testing/>
32. Key informant interview.
33. DrugsData.org. (2020). Send in a sample for lab testing. https://www.drugsdata.org/send_sample.php
34. Harvard Center for Mass Spectrometry. (2022, June 9). Rates. <https://massspec.fas.harvard.edu/pages/rates>
35. Harper, L., Powell, J., & Pijl, E. M. (2017). An overview of forensic drug testing methods and their suitability for harm reduction point-of-care services. *Harm Reduction Journal*, 14, 52. <https://doi.org/10.1186/s12954-017-0179-5>
36. Karch, L., Tobias, S., Schmidt, C., Doe-Simkins, M., Carter, N., Salisbury-Afshar, E., & Carlberg-Racich, S. (2021). Results from a mobile drug checking pilot program using three technologies in Chicago, IL, USA. *Drug and Alcohol Dependence*, 228, 108976. <https://doi.org/10.1016/j.drugalcdep.2021.108976>
37. Key informant interview.
38. DanceSafe. (2022). Complete set of all 9 reagents. <https://dancesafe.org/product/complete-set-of-all-9-testing-kits/>
39. Park, Frankel, Morris, Dieni, Fahey-Morrison, Luta, Hunt, Long, & Sherman, *International Journal of Drug Policy*, 103196. <https://doi.org/10.1016/j.drugpo.2021.103196>
40. Krieger, M. S., Goedel, W. C., Buxton, J. A., Lysyshyn, M., Bernstein, E., Sherman, S. G., Rich, J. D., Hadland, S. E., Green, T. C., & Marshall, B. D. L. (2018). Use of rapid fentanyl test strips among young adults who use drugs. *International Journal of Drug Policy*, 61, 52-58. <https://doi.org/10.1016/j.drugpo.2018.09.009>

41. Reed, M. K., Roth, A. M., Tabb, L. P., Groves, A. K., & Lankenau, S. E. (2021). "I probably got a minute": Perceptions of fentanyl test strip use among people who use stimulants. *International Journal of Drug Policy*, 92, 103147. <https://doi.org/10.1016/j.drugpo.2021.103147>
42. Betsos, A., Valleriani, J., Boyd, J., Bardwell, G., Kerr, T., & McNeil, R. (2021). "I couldn't live with killing one of my friends or anybody": A rapid ethnographic study of drug sellers' use of drug checking. *International Journal of Drug Policy*, 87, 102845. <https://doi.org/10.1016/j.drugpo.2020.102845>
43. Weicker, N. P., Owczarzak, J., Urquhart, G., Park, J. N., Rouhani, S., Ling, R., Morris, M., & Sherman, S. G. (2020). Agency in the fentanyl era: Exploring the utility of fentanyl test strips in an opaque drug market. *International Journal of Drug Policy*, 84, 102900. <https://doi.org/10.1016/j.drugpo.2020.102900>
44. Park, J. N., Tomko, C., Silberzahn, B. E., Haney, K., Marshall, B. D. L., & Sherman, S. G. (2020). A fentanyl test strip intervention to reduce overdose risk among female sex workers who use drugs in Baltimore: Results from a pilot study. *Addictive Behaviors*, 110, 106529. <https://doi.org/10.1016/j.addbeh.2020.106529>
45. Park, Frankel, Morris, Dieni, Fahey-Morrison, Luta, Hunt, Long, & Sherman, *International Journal of Drug Policy*, 103196. <https://doi.org/10.1016/j.drugpo.2021.103196>
46. Goldman, J. E., Wayne, K. M., Periera, K. A., Krieger, M. S., Yedinak, J. L., & Marshall, B. D. L. (2019). Perspectives on rapid fentanyl test strips as a harm reduction practice among young adults who use drugs: A qualitative study. *Harm Reduction Journal*, 16, 3. <https://doi.org/10.1186/s12954-018-0276-0>
47. Peiper, Clarke, Vincent, Ciccarone, Kral, & Zibbell, *International Journal of Drug Policy*, 122-128. <https://doi.org/10.1016/j.drugpo.2018.08.007>
48. Krieger, Goedel, Buxton, Lysyshyn, Bernstein, Sherman, Rich, Hadland, Green, & Marshall, *International Journal of Drug Policy*, 52-58. <https://doi.org/10.1016/j.drugpo.2018.09.009>
49. Goldman, Wayne, Periera, Krieger, Yedinak, & Marshall, *Harm Reduction Journal*, 3. <https://doi.org/10.1186/s12954-018-0276-0>
50. Krieger, Goedel, Buxton, Lysyshyn, Bernstein, Sherman, Rich, Hadland, Green, & Marshall, *International Journal of Drug Policy*, 52-58. <https://doi.org/10.1016/j.drugpo.2018.09.009>
51. Park, Frankel, Morris, Dieni, Fahey-Morrison, Luta, Hunt, Long, & Sherman, *International Journal of Drug Policy*, 103196. <https://doi.org/10.1016/j.drugpo.2021.103196>
52. Weicker, Owczarzak, Urquhart, Park, Rouhani, Ling, Morris, & Sherman, *International Journal of Drug Policy*, 102900. <https://doi.org/10.1016/j.drugpo.2020.102900>
53. Carroll, Mackin, Schmidt, McKenzie, & Green, *Harm Reduction Journal*, 9. <https://doi.org/10.1186/s12954-022-00590-z>
54. Weicker, Owczarzak, Urquhart, Park, Rouhani, Ling, Morris, & Sherman, *International Journal of Drug Policy*, 102900. <https://doi.org/10.1016/j.drugpo.2020.102900>
55. Park, Tomko, Silberzahn, Haney, Marshall, & Sherman, *Addictive Behaviors*, 106529. <https://doi.org/10.1016/j.addbeh.2020.106529>
56. Park, Frankel, Morris, Dieni, Fahey-Morrison, Luta, Hunt, Long, & Sherman, *International Journal of Drug Policy*, 103196. <https://doi.org/10.1016/j.drugpo.2021.103196>
57. Peiper, Clarke, Vincent, Ciccarone, Kral, & Zibbell, *International Journal of Drug Policy*, 122-128. <https://doi.org/10.1016/j.drugpo.2018.08.007>
58. Goldman, Wayne, Periera, Krieger, Yedinak, & Marshall, *Harm Reduction Journal*, 3. <https://doi.org/10.1186/s12954-018-0276-0>
59. Krieger, Goedel, Buxton, Lysyshyn, Bernstein, Sherman, Rich, Hadland, Green, & Marshall, *International Journal of Drug Policy*, 52-58. <https://doi.org/10.1016/j.drugpo.2018.09.009>
60. Zibbell, J. E., Peiper, N. C., Duhart Clarke, S. E., Salazar, Z. R., Vincent, L. B., Kral, A. H., & Feinberg, J. (2021). Consumer discernment of fentanyl in illicit opioids confirmed by fentanyl test strips: Lessons from a syringe services program in North Carolina. *International Journal of Drug Policy*, 93, 103128. <https://doi.org/10.1016/j.drugpo.2021.103128>

61. Weicker, Owczarzak, Urquhart, Park, Rouhani, Ling, Morris, & Sherman, *International Journal of Drug Policy*, 102900. <https://doi.org/10.1016/j.drugpo.2020.102900>
62. Ibid.
63. Davis, C. S., Lieberman, A. J., & O’Kelley-Bangsberg, M. (2022). Legality of drug checking equipment in the United States: A systematic legal analysis. *Drug and Alcohol Dependence*, 234, 109425. <https://doi.org/10.1016/j.drugalcdep.2022.109425>
64. Liberman, A. (2020, April 8). Removing legal barriers to drug checking can help reduce drug-related harm. *The Network for Public Health Law*. <https://www.networkforphl.org/news-insights/removing-legal-barriers-to-drug-testing-can-help-reduce-drug-related-harm/>
65. Davis, Lieberman, & O’Kelley-Bangsberg, *Drug and Alcohol Dependence*, 109425. <https://doi.org/10.1016/j.drugalcdep.2022.109425>
66. SAMHSA. (2021, April 7). Federal grantees may now use funds to purchase fentanyl test strips. <https://www.samhsa.gov/newsroom/press-announcements/202104070200>
67. Overdose Data to Action (OD2A), Centers for Disease Control and Prevention. (2022, February). OD2A and Harm Reduction.
68. Reed, M. K., Salcedo, V. J., Guth, A., & Rising, K. L. (2022). “If I had them, I would use them every time”: Perspectives on fentanyl test strip use from people who use drugs. *Journal of Substance Abuse Treatment*, 108790. <https://doi.org/10.1016/j.jsat.2022.108790>
69. Krieger, Goedel, Buxton, Lysyshyn, Bernstein, Sherman, Rich, Hadland, Green, & Marshall, *International Journal of Drug Policy*, 52-58. <https://doi.org/10.1016/j.drugpo.2018.09.009>
70. Green, T. C., Olson, R., Jarczyk, C., Erowid, E., Erowid, F., Thyssen, S., Wightman, R., del Pozo, B., Michelson, L., Consigli, A., Reilly, B., & Ruiz, S. (2022). Implementation and Uptake of the Massachusetts Drug Supply Data Stream: A Statewide Public Health–Public Safety Partnership Drug Checking Program. *Journal of Public Health Management and Practice*, 28(6), S347–S354. <https://doi.org/10.1097%2FPHH.0000000000001581>
71. Prevent Overdose RI. (2022). Local drug supply. <https://preventoverdoseri.org/local-drug-supply/>
72. testRI. (2022). Get Involved. <https://sites.brown.edu/testri/sample-page-2/>
73. Javed, Z., Burk, K., Facente, S., Pegram, L., Ali, A., & Asher, A. (2020). Syringe services programs: A technical package of effective strategies and approaches for planning, design, and implementation. U.S. Department of Health and Human Services, National Center for HIV/AIDS, Viral Hepatitis, STD and TB Prevention, Centers for Disease Control and Prevention. <https://www.cdc.gov/ssp/docs/SSP-Technical-Package.pdf>
74. City of Boston. (2021). Boston Harm Reduction Toolkit. <https://www.rizema.org/wp-content/uploads/2021/09/CoB-Harm-Reduction-Toolkit.pdf>
75. Brandeis University, The Heller School for Social Policy and Management. (2022). StreetCheck: Community Drug Checking App. <https://heller.brandeis.edu/opioid-policy/community-resources/street-check/index.html>
76. StreetCheck. (2023). Massachusetts Drug Supply Data Stream. <https://www.info.streetcheck.org/general-8>
77. Opioid Data Lab. (2022). StreetCheck: Drug Checking App. <https://www.opioiddata.org/studies/street-check-drug-checking-app>
78. DanceSafe. (2022). Drug Checking Kit Instructions. <https://dancesafe.org/testing-kit-instructions/>
79. Key informant interview.
80. testRI. (2023, April). Local drug sample testing update. <https://preventoverdoseri.org/wp-content/uploads/2023/04/providencemarch-compressed.pdf>

