Drug Checking Programs in the United States and Internationally: Environmental Scan Summary

September 17, 2021

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Submitted to:

Office of the Assistant Secretary for Planning and Evaluation
U.S. Department of Health and Human Services
200 Independence Ave., SW
Washington, DC 20201
Government Task Lead: Jessica White and Teresa Manocchio
Contract Number: HHSP233201500035I/HHSP23337015T

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I. Introduction

A. The overdose crisis in the United States

The United States faces a national overdose crisis that has had a devastating impact on public health and Americans' social and economic well-being. In 2019, about 70,630 people died in the United States because of drug overdoses, and these numbers have only accelerated during the COVID-19 pandemic (Centers for Disease Control and Prevention 2020). The primary driver of the rapid increase in overdose deaths is illicitly manufactured fentanyl, a synthetic opioid that is 50 to 100 times more potent than morphine and has become more common in the illicit drug supply in the United States (Centers for Disease Control and Prevention 2020). For example, an examination of the illicit drug market using crime lab data from Ohio's Bureau of Criminal Investigation from 2009 to 2018 corroborates that the presence of fentanyl and its analogs strongly correlates with increases in overdose deaths. (Rosenblum et al. 2020).

The overdose crisis, including the increased availability of fentanyl on the drug market, is a rapidly evolving crisis influenced by many factors (Foglia et al. 2021; Rosenblum et al. 2020). Fentanyl, which has been discovered mixed into supplies of stimulants such as cocaine, is frequently pressed into counterfeit tablets and sold as prescription pharmaceuticals to consumers who might assume they are purchasing legitimate prescription pharmaceuticals (Foglia et al. 2021). The unintentional use of fentanyl has resulted in an increase in drug overdose deaths across the country (Foglia et al., 2021). The rise in overdose deaths reinforces the importance of ensuring that those most at risk of overdose have access to effective prevention and response measures, including harm reduction strategies. This shifting dynamic of the overdose crisis, particularly the increasing risk of overdose because of fentanyl-contaminated drugs, necessitates new approaches such as drug checking services that place a greater emphasis on harm reduction.

B. The concept of drug checking

Drug checking services are well established in Europe and, to a lesser extent, in North America (FORECAST 2018; Leece 2017). Drug checking services analyze drug samples and provide information to people who use drugs about the chemical composition of the drugs they are taking. These services are provided in various settings, including anonymously at safe consumption sites, at mobile services provided on site at events, and through distribution of test strips for personal use (Barry, 2018; FORECAST 2018). By helping people understand the contents of their drugs, drug checking services can reduce morbidity and mortality associated with drug use, including illicit fentanyl. Fentanyl drug checking lets people know whether fentanyl is present in a substance before they use it (Leece 2017; Maghsoudi et al., 2021). A growing body of evidence has shown that drug checking services can alter behavioral intention and, to a lesser extent, has demonstrated their impact on the behavior of people who use drugs (Maghsoudi et al. 2021). Drug checking services, often coupled with tailored harm reduction advice, can facilitate outreach to people who use drugs and help them access substance use disorder treatment. When aggregated, data from drug checking services can provide important information about local drug supplies to inform policymaking and public health surveillance (FORECAST 2018; Maghsoudi et al., 2021). Drug checking services have been effective in detecting adulterants and novel psychoactive compounds in the drug supply (Barry 2018; Leece 2017).

The level of technology and costs involved in drug testing methods vary. Simple, low-cost testing methods include liquid reagent tests and thin layer chromatography kits. More advanced laboratory

techniques include gas chromatography/mass spectrometry, high-performance liquid chromatography, and nuclear magnetic resonance techniques (Leece 2017; Strike and Watson 2019). This brief will describe drug checking programs that use a variety of tests, with fentanyl test strips (FTS) being the predominant testing methodology.

C. Purpose of the environmental scan and methodology

The Office of the Assistant Secretary for Planning and Evaluation (ASPE) contracted with Mathematica to conduct an environmental scan of drug checking programs to address the following policy questions:

- What is the landscape of drug checking as a harm reduction approach in the United States and internationally?
- In particular, what is the landscape of drug checking for fentanyl?
- Have drug checking programs been evaluated for their impact on health outcomes, and, if so, what are the findings?
- To what extent are existing drug checking programs coupled with other services, such as syringe access programs, naloxone distribution, or counseling?

Through the environmental scan, ASPE seeks to better understand drug checking programs implemented in the United States and other countries and inform potential opportunities for studying fentanyl drug checking as a harm reduction strategy.

This report presents a review and synthesis of approaches and strategies adopted by drug checking programs and existing evidence on their effectiveness in changing drug use attitudes, behavior, and health outcomes. Our review includes studies of drug checking programs across a variety of settings in the United States and internationally. We prioritize studies of drug checking programs that are specific to fentanyl, are coupled with other harm reduction services, and include early evaluation of program effectiveness. At the end of the document, we discuss the implications of the existing evidence for future initiatives and further research on drug checking programs.

II. Methods for the Environmental Scan

To identify promising drug checking programs, we reviewed recent studies of programs that aimed to provide drug checking services, documenting key program features, the research methods by which they were evaluated, and the main study findings. We also summarize our approach to identifying the studies we reviewed and then explain the information we extracted from each study and how we did so.

We searched peer-reviewed manuscripts and gray literature to identify articles that discuss drug checking programs in the United States and internationally. We limited the search to studies published in the past 10 years. We systematically searched five bibliographic databases: APA PsycINFO, CINAHL, Cochrane, MEDLINE (Ovid), and Scopus. We searched for key words such as "drug checking programs" and "fentanyl checking." Our search of the gray literature included websites of specialty societies and relevant organizations. We also used Harvard's Think Tank Search to capture websites of institutions that generate public policy research, analysis, and activity.

Two analysts and a researcher screened the search results for relevancy and selected a subset of 35 articles for in-depth review. The articles included reviews, articles on the implementation and effectiveness of drug checking programs, and articles describing drug checking strategies. The selected studies include drug checking programs implemented across a variety of settings and use a range of research designs. We excluded articles not written in English from our review. We developed methods together with ASPE that provided input on inclusion and exclusion criteria.

We imported the shortlisted articles into a Microsoft Excel spreadsheet for further review. The three reviewers independently reviewed the full text of the selected articles, extracting data from them using a template the team designed. Information extracted included year of publication, where the intervention took place, the number of participants, the intervention type and description, the outcome measures, the effectiveness of the intervention, and the implication of the program or study.

III. Synthesis of Drug Checking Programs and Evaluations

In this section, we synthesize the information we extracted from the selected articles. First, we describe the drug checking programs provided in different settings. We then present findings on program outcomes and the effectiveness of drug checking services. Finally, we summarize the implications of the existing evidence for future research.

A. Overview of drug checking programs in different settings

Drug checking programs have been conducted in various settings throughout the United States and internationally. Programs have been conducted at point-of-care sites—usually harm reduction service sites, such as supervised injection facilities and syringe service programs—and through mobile services offered at events such as music festivals. In either setting, people who use drugs can drop off samples for testing and retrieve the results immediately, either at the site or online remotely. Recently, several drug checking programs have been conducted outside the point of care, including those that distribute and train people who use drugs on how to use drug checking test strips themselves (FORECAST 2018; Maghsoudi et al., 2021).

Key observations

- Drug checking programs were conducted in various settings (such as music festivals, syringe service programs, and safe injection sites), and outside point-of-care sites through use of test strips.
- Across all settings, studies aimed to assess drug checking as a harm reduction intervention by evaluating behavioral responses to drug testing results, including drug disposal, drug dose reduction, and adoption of other overdose risk reduction behaviors.
- Almost all programs combined drug checking with other harm reduction services, regardless of the program setting.

1. Drug checking at music festivals

Music festivals and parties are an ideal place to conduct drug checking programs because of the high prevalence of substance use at these events. Drug checking at music festivals was first implemented in Europe and recently adopted by Canada and the United States (Palamar et al. 2021; Maghsoudi et al. 2021). For example, one drug checking program took place at the Shambhala music festival, the longest running electronic musical dance festival in Canada, in partnership with the AIDS Network Outreach & Support Society (Mema et al. 2018a). The BC Centre on Substance Use, in partnership with community-based partners and local health authorities, implemented another program at three outdoor festivals and Vancouver Pride (McCrae et al. 2019). Studies associated with these events examined types of contaminated substances and assessed the results of the drug checking program, including whether or not substances were discarded by clients after learning the results of the tests (McCrae et al. 2019; Mema et al. 2018a). Programs offered at music festivals were provided under a temporary structure in a centralized, highly visible location. The program made itself known to potential clients through service promotion, and knowledge of the program spread among potential clients by word of mouth (Mema et al. 2018; McCrae et al., 2019a). These drug checking programs utilized different technologies to test substances, including Raman spectroscopy, FTS, colorimetric reagents, gas chromatography mass spectrometer, and Fourier Transform Infrared spectroscopy (McCrae et al. 2019; Mema et al. 2018a). Program staff asked all clients about their expectations of the drug test results beforehand, and afterward,

they posted the results in real time on an electronic screen along with harm reduction tips (Mema et al. 2018a). Alternatively, they provided the results immediately, and a volunteer harm reduction worker discussed the results and any health risks of using the substance with the clients (McCrae et al. 2019). To track substance disposal after the test, staff provided an amnesty bin and observed and recorded whether clients discarded their substances (Mema et al. 2018a). The presence of unusual or concerning substances was posted outside the tent and reported to harm reduction groups and regional health authorities (McCrae et al. 2019). Drug checking programs at music festivals are often coupled with other harm reduction services. For example, a study of the drug checking program at the Shambhala music festival specifically mentions that 200 guests received naloxone training and 100 naloxone kits were distributed (Mema et al. 2018a).

2. Point-of-care drug checking services at sites offering other harm reduction strategies

Offering drug checking at other harm reduction service sites provides an opportunity to further engage people at the point of care. These sites serve a vulnerable population that is a key target for drug checking programs and harm reduction more broadly. Such settings offer a rare opportunity to engage clients and deliver a combination of harm reduction services. In the United States, drug checking programs have been conducted at syringe service programs (Park et al. 2021). In Canada, programs have been tested at safe injection facilities along with other harm reduction services offered at these sites (Tupper et al. 2018; Mema et al. 2018b; Karamouzian et al. 2018). The technologies used for drug checking in these studies were primarily FTS. Some sites also used Fourier transform infrared spectrometer, while novel psychoactive benzodiazepines were tested using a benzodiazepine test strip.

Drug checking services conducted at these point-of-care service sites provide important information about behavioral responses to test results, such as drug dose reduction, drug disposal, and other harm reduction practices, as well as overall drug test use and type of contaminated substances. For example, a program in Canada expanded on existing harm reduction services at safe injection facilities and overdose prevention sites and included a drug test for substances other than fentanyl, one of the very few studies to do so (Laing et al. 2021). A study of the program described the number and type of novel psychoactive benzodiazepines in a sample from a community drug checking program during the time of an outbreak of novel psychoactive benzodiazepines. Another point-of-care drug checking program in Canada collected information on overdoses to assess the relationship between drug checking and overdose (Karamouzian et al. 2018). A noteworthy benefit of conducting programs at harm reduction sites is engaging hard-to-reach and vulnerable populations, including people who inject drugs and people who use drugs in urban or rural settings.

3. Outreach to drug users outside the point-of-care testing sites

Recently, drug checking programs in the United States have focused on reaching the population outside points of care through the distribution of self-use drug tests. For example, FTS served as an outside-the-point-of-care drug test intervention in two U.S. studies, one in Rhode Island focusing on young adults (Krieger et al. 2018) and another in Baltimore City focusing on female sex workers (Park et al. 2020). These programs collected important information to assess change in frequency of substance use, overdose risk behaviors, and future use of FTS. Test strips were distributed to clients along with training on the use of the test strips and other harm reduction services, such as distribution of naloxone kits.

B. Program outcomes and evidence of success

The most common outcome measures examined in studies of drug checking programs were attitudes and behaviors related to the use of the analyzed substance. One study also examined the association between drug checking services and overdose (Karamouzian et al. 2018).

Key observations

- The use of drug checking has been shown to positively influence intended and, to a lesser extent, actual drug use behaviors, such as discarding current drug supply and changing overall drug use behaviors, including keeping naloxone nearby and using with someone else.
- Changes in drug use behavior were most often seen among people who received a positive fentanyl test and had previously been unaware their opioid was contaminated with fentanyl or questionable substances.
- Few studies reported program impacts on health outcomes. A program in Canada implemented at a safe injection facility found that a positive test result was associated with intended dose reduction, which in turn led to lower odds of overdose.

1. Attitude change and intended use

Overall, drug checking services were consistently associated with positive attitude change and intention not to use the tested substance, particularly if the drug tested positive for fentanyl or results were inconsistent with expectation. For example, a drug checking program provided at a supervised injection service site in Vancouver, Canada, found 36.3 percent of participants reported planning to reduce their drug dose. Receiving a positive drug test was associated with an intent to reduce drug dose compared to clients with a negative test result (Karamouzian et al., 2018). Similarly, an Australian study also found that people who use drugs at festivals and events were more likely to reduce their intended use if they were surprised by the testing results. Yet the positive impact on attitude and intended use might not translate into actual drug use behavior. The presence of drug contamination might not be enough to motivate someone to dispose of the substance even if their attitude changed for the better. Therefore, educating patients on the importance of behavior change is critical for prompting them to actually initiate behaviors that would lower health risks associated with substance use (Mema et al. 2018b).

2. Actual drug use behavior change

Overall, studies found a positive association between positive drug test results and disposal of the tested substance, but the size of this effect varied across studies. For example, one study at a Canadian music festival found that participants were more likely to dispose of substances after receiving positive testing results (Mema et al. 2018a). Several other studies, however, reported that although some participants disposed of the drug after confirmation of harmful drug contamination, most proceeded to use the substance, including some participants who used and injected more slowly and in smaller doses. At a drug checking program provided at a Canadian supervised injection facility, only 11 percent of participants reported planning to dispose of the substance, and 36.3 percent reported planning to reduce their use (Karamouzian et al. 2018). Similarly, a cross-sectional survey of people who inject drugs who used FTS in San Francisco found that among participants who received positive results, 26.5 percent disposed of the tested substance, 30.1 percent reduced their use, and 43.4 percent did not change their use of the drug (Oh et al. 2020).

In alignment with the findings on drug disposal, drug checking services were also associated with changes in overall drug use behaviors. A community-based program in Baltimore focusing on female sex workers found post-test reductions in frequency of substance use and drug injection, use of benzodiazepines, and solitary drug use (Park et al. 2020). Consistent with this finding, a drug checking program provided at a safe syringe program site in the southeastern United States found that 63 percent of the FTS results were positive, and those who received a positive test had five times higher odds of changing their drug use behavior than those who did not receive a positive test result (Peiper et al. 2019). Another study collected information from clients who received FTS from two large syringe services programs in Baltimore and Delaware (Park et al. 2021). About 23 percent of participants in Baltimore who used FTS and 69 percent of those in Delaware adopted risk reduction behaviors, including using less of the substance than originally intended, using the substance more slowly, injecting a test shot, and asking someone to check on them. Other positive behaviors demonstrated included interest in sharing information about and distributing FTS to acquaintances who were at high risk of exposure (Goldman et al. 2019).

Although additional information on harm reduction practices was available and integrated into many programs, few studies evaluated information-seeking behaviors among participants who sought to implement new harm reduction practices and avoid substance use harms, including risk of overdose. Because of the low frequency of drug disposal after positive test results in several studies, understanding the information-seeking behaviors of those who use contaminated substances could help explain the discordance between susceptibility to overdose and a lack of risk reduction behaviors and drug disposal.

3. Link to other health outcomes

Although understanding the effectiveness and impact of drug checking programs on health outcomes is essential, few studies evaluated health outcomes such as overdose and mortality. We found one study conducted at a safe injection facility in Canada that assessed overdose as an outcome of drug checking (Karamouzian et al. 2018). When tests were conducted after consumption, clients whose substances tested positive were almost five times more likely to have overdosed than those whose substances tested negative. This association was not statistically significant when the test was conducted before consumption, which suggests the adoption of harm reduction strategies might have reduced overdose risk. In addition, positive test results were associated with intention to reduce the dose used, which in turn led to lower odds of overdose.

C. Stakeholders' perspective of drug checking services

Various studies have been conducted among people who use drugs to capture their perspectives about drug checking services—particularly their interest and willingness to use drug checking—and factors influencing use. These studies are a mix of quantitative and qualitative studies conducted in a variety of settings among populations such as young adults, party goers, people with a history of incarceration, people with HIV, drug sellers, and sex workers.

Key observation

- Studies have shown that drug users were generally willing to use FTS, indicating their acceptability as a harm reduction intervention.
- Most drug users were concerned about fentanyl and other questionable substances in their drug supply and were interested in more information.

- People who use drugs perceived criminalization, stigma, anonymity/data privacy, and accessibility issues as barriers to using drug checking services.
- Stakeholders who provided harm reduction services supported the concept of drug checking programs but highlighted concerns about their legality.

1. Perspectives from people who use drugs

Studies have shown an overall willingness among people who use drugs to use FTS (Betzler et al. 2021; Krieger et al. 2019; Kennedy et al. 2018; McKnight and Jarlais 2018). One study found that more than 90 percent of participants indicated a willingness to use rapid test strips regardless of having ever overdosed, implying that rapid fentanyl testing is an acceptable harm reduction intervention among young drug users (Krieger et al. 2019). Another study that examined the perceptions of FTS among young adults found that most of the participants found the strips easy to use and useful (Goldman et al. 2019).

FTS-based interventions have the potential to reduce overdose risk among high-risk populations. A study that assessed FTS awareness among female sex workers in Baltimore who used opioids found that most women who received FTS reported using them (84 percent) and almost all (96 percent) reported being likely to use FTS in the future (Park et al. 2021). Another study that examined the acceptability of FTS among people who use drugs who had a history of incarceration and were living with HIV demonstrated that FTS was a desired harm reduction strategy as participants believed they were vulnerable to fentanyl contamination (Reed et al. 2021). The perspectives of drug sellers have also been documented in the literature. Research shows that drug sellers used the information from drug testing to reduce fentanyl overdose risks; drug testing was one of several tools they used to modify the potency of the fentanyl they sold to minimize risk and maintain client trust (Betsos et al. 2021).

2. Perspectives from stakeholders who provide harm reduction services

The notion of drug checking has also been largely accepted by stakeholders who provide harm reduction services, with the goals of providing people who use drugs with critical risk reduction information and tools and functioning as an entrance point for enhanced service provision. A study that evaluated the perspectives of 32 stakeholders from organizations that work with people who use drugs demonstrated that stakeholders overwhelmingly supported drug checking but expressed concerns about its legality (Glick et al. 2019). Concerns include the possibility that the strips could be used to support accusations that providers or drug users are in possession of drug paraphernalia and to support drug possession charges against providers that operate testing machines (Glick et al. 2019).

3. Facilitators and barriers to use of drug checking services

People who use drugs who either seek or avoid fentanyl use have expressed concerns about the content of the drugs that they use and have conveyed a desire for more information. Research shows that although some people who use drugs express their desire to avoid fentanyl for fear of overdose, others who actively seek out fentanyl bemoan their inability to properly detect fentanyl in heroin bags (McLean et al. 2019). Most people who use drugs support drug testing for overdose prevention, with intent heightened by having witnessed a fatal overdose and having recently been exposed to fentanyl (Oh et al. 2020; Sherman et al. 2019). Other factors that predict higher FTS use include currently owning naloxone and receiving overdose prevention training (Oh et al. 2020).

Sociodemographic factors have also been implicated in the use of drug checking services. The results regarding racial differences are mixed. Although one of the studies we reviewed found that FTS use was lower among Black or African American people who inject drugs than among White people who inject drugs (Oh et al. 2020), another study suggested being non-White was associated with greater intent to use drug checking (Sherman et al. 2019). Other factors that have been associated with greater willingness and intent to use drug checking are young age, older age, homelessness, and being female (Kennedy et al. 2018; Sherman et al. 2019).

Despite recognizing the benefits of FTS use, people who use drugs in various studies reported barriers to using drug checking services. These include significant barriers such as concerns about criminalization, stigma, anonymity and data privacy, and trauma experienced by potential service users (Betzler et al. 2021; Wallace et al. 2020). Drug testing continues to exist in a legal gray area, prompting mistrust among potential service users and barriers for those who implement these services (Wallace et al. 2020). Therefore, respectful, confidential, and anonymous services are essential. Other limitations mentioned include lack of access to drug testing locations or accompanying services; the unpredictability of purchasing or using drugs, which limits the ability to plan for or access testing before use; and the unwillingness to postpone drug use for testing (Reed et al. 2021).

IV. Opportunities and Future Research

Our review has shown that organizations in the United States and internationally have implemented innovative strategies and adopted drug checking services to address the overdose crisis. These interventions are implemented in different settings and include creative use of other harm reduction services. There is a clear indication that the efforts to provide drug checking services have been largely effective in changing intended and actual drug use behaviors. Results of this environmental scan suggest several implications for future drug checking initiatives and further research on drug checking programs. First, most of the drug checking programs in our review provided information only about the presence or absence of fentanyl. Users desire additional information, such as quantity of fentanyl, other toxic contaminants, and cutting agents, that can help them make informed decisions to reduce risk of overdose (FORECAST 2018). For example, some fentanyl analogues, such as carfentanil, have an even higher potency than fentanyl and might go undetected with some test strips (McGowan et al. 2018). Second, sensitivity and specificity of drug checking results often vary by testing technologies. FTS is the predominant testing methodology adopted by drug checking programs included in this environmental scan. One particular concern about the use of FTS is its potential excessive sensitivity. Repeated positive test results with lack of ill-effects after consumption can lead to decreased trust and acceptability of drug checking services (McGowan et al. 2018). Lastly, removing legal barriers to providing drug checking services is also important. In the United States, many states still include FTS and other similar items to test drugs in their drug paraphernalia laws, which might increase concerns about distributing these drug checking items and become a barrier for people who use drugs to use drug checking services (Lieberman 2020). Although state paraphernalia laws remain unchanged, the latest guidance from the CDC and the Substance Abuse and Mental Health Services Administration (SAMHSA) states that federal funds can now be used to purchase FTS (Centers for Disease Control and Prevention 2021; Substance Abuse and Mental Health Services Administration 2021). This guidance might be an important factor that influences future discussions that helps to address stakeholder legality concerns.

Because of the limitations of the current programs, it is particularly important to couple drug checking services with other harm reduction services. Drug checking can serve as an important strategy to reach out to people at elevated risk for overdose, engage them with harm reduction counseling, and help them obtain access to necessary health care for treatment of substance use disorder. In addition, it is important to provide training for self-testing and help users better understand the limitations of the drug checking technologies and harm reduction strategies to prevent overdose. For example, to mitigate the risk of false negatives, easy access to naloxone and instructions on the use of naloxone to reverse opioid-related overdoses should be provided in drug checking programs. Because some of the fentanyl analogues with high potency might not be detected by the test strips, other key harm reduction recommendations should be provided alongside test strips, including encouraging the presence of others with naloxone when using drugs, being prepared to call 911, and using or injecting more slowly and in smaller doses (FORECAST 2018; McGowan et al. 2018).

Although drug checking programs have been shown to be associated with positive changes in intended and actual drug use behavior, the implications for health outcomes are less clear. Importantly, few studies have examined the impact of drug checking programs on overdose risk. Although one study shows that drug checking programs might reduce overdose risk through reduction in drug doses, there is still a gap in evidence showing a clear and meaningful relationship between drug checking and overdoses. Studies that track important health outcomes, such as overdose morbidity and mortality, and for longer follow-up periods would improve our understanding of the ultimate benefits of drug checking. Finally, future

studies should consider the special needs of vulnerable populations such as racial and ethnic minorities and sex workers. The population of drug users at risk for overdose has diverse sociodemographic characteristics, so implementing a one-size-fits-all program design for drug checking services is challenging. Tailoring interventions is important to reach the target population most effectively.

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