

3-4-2022

## "You can't go wrong being safe": Motivations, patterns, and context surrounding use of fentanyl test strips for heroin and other drugs.

Megan K Reed  
*Thomas Jefferson University*

Amanda Guth  
*Thomas Jefferson University*

Venise J Salcedo  
*Thomas Jefferson University*

Jeffrey K Hom  
*Philadelphia Department of Public Health*

Kristin L Rising  
Follow this and additional works at: <https://jdc.jefferson.edu/emfp>  
*Thomas Jefferson University*

 Part of the [Emergency Medicine Commons](#)

[Let us know how access to this document benefits you](#)

---

### Recommended Citation

Reed, Megan K; Guth, Amanda; Salcedo, Venise J; Hom, Jeffrey K; and Rising, Kristin L, ""You can't go wrong being safe": Motivations, patterns, and context surrounding use of fentanyl test strips for heroin and other drugs." (2022). *Department of Emergency Medicine Faculty Papers*. Paper 197.  
<https://jdc.jefferson.edu/emfp/197>

This Article is brought to you for free and open access by the Jefferson Digital Commons. The Jefferson Digital Commons is a service of Thomas Jefferson University's [Center for Teaching and Learning \(CTL\)](#). The Commons is a showcase for Jefferson books and journals, peer-reviewed scholarly publications, unique historical collections from the University archives, and teaching tools. The Jefferson Digital Commons allows researchers and interested readers anywhere in the world to learn about and keep up to date with Jefferson scholarship. This article has been accepted for inclusion in Department of Emergency Medicine Faculty Papers by an authorized administrator of the Jefferson Digital Commons. For more information, please contact: [JeffersonDigitalCommons@jefferson.edu](mailto:JeffersonDigitalCommons@jefferson.edu).

**Title: “You can’t go wrong being safe”: Motivations, patterns, and context surrounding use of fentanyl test strips for heroin and other drugs**

**Authors and affiliations at which work was carried out:**

Megan K. Reed<sup>ab</sup>, PhD MPH

Amanda Guth<sup>b</sup>, MPH

Venise J. Salcedo<sup>b</sup>, MPH

Jeffrey K. Hom<sup>c</sup>, MD, MPH, MSHP

Kristin L. Rising<sup>abd</sup>, MD MSHP

<sup>a</sup> Department of Emergency Medicine, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA.

<sup>b</sup> Center for Connected Care, Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, USA.

<sup>c</sup> Division of Substance Use Prevention and Harm Reduction, Philadelphia Department of Public Health, Philadelphia, PA, USA.

<sup>d</sup> College of Nursing, Thomas Jefferson University, Philadelphia, PA, USA.

**Corresponding author:**

Megan K. Reed, PhD MPH

1015 Walnut Street, Curtis Building, Suite 704

Thomas Jefferson University

Philadelphia, PA 19107

[Megan.K.Reed@jefferson.edu](mailto:Megan.K.Reed@jefferson.edu)

C: (917) 656-5449

**Title:**

**Key words:** fentanyl, fentanyl test strips, harm reduction, people who use drugs, overdose prevention, drug-checking

**Abstract****Background**

Unintentional drug overdose fatalities due to fentanyl contamination continue to increase. Fentanyl test strip (FTS) use has emerged as a valuable harm reduction strategy to detect the presence of fentanyl in drugs. However, motivation for FTS uptake and context surrounding use have not been well characterized in the literature. This study aimed to capture people who use drugs' (PWUD) lived experiences to understand motivations underlying FTS uptake, ongoing use, and actions after testing.

**Methods**

We conducted qualitative interviews with PWUD at a harm reduction organization in Philadelphia, PA. Interviews asked about experiences with using FTS. Interviews were audio-recorded, professionally transcribed, and reviewed. Data were analyzed through a conventional content analysis approach and organized into broader categories via team consensus.

**Results**

Twenty-nine PWUD with experience using FTS were interviewed between January and May 2021. Interviews were organized into three thematic categories: first time use of FTS, patterns of FTS use, and contextual factors of FTS use. Motivations to use FTS among PWUD varied, but were largely driven by factors related to knowledge, access, neighborhood, and drug market trends. Frequency of use was characterized by number of FTS, ongoing FTS access, and drug purchasing location and amount. Participants reported few logistical barriers to testing.

**Conclusion**

This research supports the current literature that states FTS are an accepted and effective harm reduction strategy for the PWUD community. To support increased use of FTS, distribution campaigns should be widespread geographically and provide enough strips to ensure availability for PWUD to test more frequently.

## Background

Opioid overdose is a widespread public health crisis (U.S Department of Health and Human Services 2021). Provisional data indicate that an estimated 76,002 individuals in the United States died of an opioid overdose between June 2020 and June 2021 (Centers for Disease Control and Prevention 2022). Reports have shown that many of these deaths are a result of illicitly-manufactured fentanyl being mixed with or sold as other opioid drugs (e.g., heroin) and, increasingly, non-heroin drugs such as counterfeit pharmaceutical opioids (US Drug Enforcement Administration 2021). Fentanyl is an inexpensive, synthetic opioid that is 50 to 100 times as potent as morphine (Centers for Disease Control and Prevention 2021c). Due to potential contamination of fentanyl in other drugs (e.g., stimulants), many people who use drugs (PWUD) may be consuming fentanyl unintentionally, increasing their risk of experiencing an overdose (Centers for Disease Control and Prevention 2021a).

Unintentional drug overdose fatalities due to fentanyl contamination are especially prevalent in Philadelphia (Philadelphia Department of Public Health 2021). According to the Philadelphia Department of Public Health, fentanyl contributed to 91% of opioid-related overdose deaths and 76% of drug overdose deaths overall in 2019 (Farley 2020). In 2020, these fatalities grew to 94% and 81%, respectively (Bettigole 2021). Deaths resulting from an opioid overdose first began increasing in the late 1990s due to a sharp increase in the prescribing of opioid and opioid-combination medications for the treatment of pain alongside increased demand driven by social determinants such as social and economic distress (Ciccarone 2019; Dasgupta, Beletsky, and Ciccarone 2018). Otherwise known as the ‘first wave,’ a ‘second wave’ in 2010 followed this trend, which was characterized by overdose deaths involving heroin. A ‘third wave’ began in 2013 as synthetic opioids – particularly those involving illicitly manufactured fentanyl – contributed significantly to premature fatality (Centers for Disease Control and Prevention 2021b; Ciccarone 2021). Some researchers have suggested that a ‘fourth wave’ has begun, marked by high mortality rates resulting from deaths attributable to both fentanyl and stimulants, some of which may be due to the consumption of fentanyl-contaminated methamphetamine and cocaine (Ciccarone 2021; DiSalvo et al. 2021; Feldman 2020; Khatri, Viner, and Perrone 2018; San Francisco Department of Public Health 2021). Given the diversity of drugs that are increasingly contaminated with fentanyl, all PWUD may be vulnerable to overdose experiences.

One harm reduction strategy to reduce overdose risk includes the use of rapid fentanyl test strips (FTS), which can detect the presence of fentanyl in drugs (Marshall 2018). FTS were originally developed to test urine for the presence of fentanyl in clinical settings, but have since transitioned to being an inexpensive, low-barrier harm reduction strategy for PWUD (Bergh et al. 2021). In Philadelphia, FTS are considered paraphernalia at the state level but their use was formally approved by the local District Attorney’s office in early 2021 (Philadelphia DAO 2021).

Prior research indicates that people who use heroin and a range of stimulants are interested in FTS (Goldman et al. 2019; Krieger, Yedinak, et al. 2018; Park et al. 2021; Reed et al. 2021; Sherman et al. 2019) and that FTS use has changed drug behaviors among PWUD (Park et al. 2020, 2021). For example, a study conducted in North Carolina among people who inject drugs

and another with young people in Rhode Island found that participants used less amount of a drug if fentanyl was detected using FTS (Krieger, Goedel, et al. 2018; Peiper et al. 2019). Another recent study found that FTS prompted many PWUD to make more well-informed choices as consumers in uncertain and dangerous drug markets (Weicker et al. 2020).

However, motivation for and other characteristics of FTS uptake have not been well described in the literature, particularly among people who have used FTS on both heroin and non-heroin drugs. Such practices may be influenced by the social and physical conditions under which PWUD prepare, consume, and experience the sensations of their substances. Known as the *risk environment*, these conditions generate much of the risk associated with opioid overdose at the macro (e.g., geopolitical and legal factors that inform the composition of the drug supply) and micro (e.g., neighborhood and peer norms) levels (Rhodes 2009). Addressing elements of the risk environment can create enabling environments for risk mitigation measures, such as the use of FTS (Ciccarone 2017; Rhodes 2009). An imperative first step in this process is to gather perspectives from PWUD about their FTS use. Thus, the goal of this qualitative study was to engage PWUD to identify FTS practices, real-world contexts that influence FTS uptake and subsequent actions taken by PWUD in response to FTS results.

## **Methods**

### *Design and Setting*

This study aimed to assess motivations, patterns and context surrounding FTS use by PWUD. This was a qualitative subsample from a parent study surveying a larger sample of PWUD regarding test results and behavioral outcomes among people who had experience with FTS on drugs other than heroin. We conducted semi-structured qualitative interviews with a subsample of these survey participants between January and May 2021. Participants were recruited from Prevention Point Philadelphia (PPP), the largest public health organization providing harm reduction services, including FTS, in Philadelphia, PA. This research was approved by the Institutional Review Board at Thomas Jefferson University and the Philadelphia Department of Public Health Institutional Review Board.

### *Participants*

Participants included people who were 18 years and older and English-speaking who had previously used FTS on a drug other than heroin. Those who were unable to provide consent, as assessed by a team member during enrollment, were excluded from the study. Participants were asked to select a pseudonym and to report the drugs on which they have tested with FTS, both of which are reported in addition to their race alongside in-depth quotations.

### *Data Collection*

Research team members and community partners recruited participants through word-of-mouth outside both the PPP building and a mobile PPP overdose response and syringe exchange van. Most participants for surveys were recruited by PPP employees who screened them while they were receiving harm reduction supplies. Other survey participants were approached by the interviewer as they waited to receive supplies. For this study, we asked a subsample of people

who had completed a brief survey about their last use of a FTS on a drug other than heroin if they were interested in a longer qualitative interview. We adjusted recruitment as data collection progressed to ensure we were capturing perspectives of people who had less versus greater histories of FTS use, experience with FTS on different drug types, and variation in racial and gender demographics. Eligible, consenting participants were asked to complete an interview with a member of the research team in a private space on-site or via telephone. Interviews were audio-recorded. Interview questions were designed to assess the following: experiences with using FTS, facilitators and barriers to using FTS specific to drug type, most recent experience using FTS, subsequent actions after receiving a test result, and overdose risk perceptions (See **Appendix A**). Basic demographic information was also collected. Participants received \$20 cash upon completion of interviews. Interviews ceased upon saturation of interviews as agreed upon by team members.

### *Data Analysis*

All audio-recorded interviews were professionally transcribed; participant identifiers were removed and transcripts were imported into qualitative data analysis software, NVivo (Wong, 2008). Interviews were analyzed by three coders using a conventional content analysis approach (Olson et al, 2019). The research team developed preliminary codes from the first two interviews to capture important concepts, and went through an iterative process to establish a final codebook (See **Appendix B**). Inter-coder reliability was confirmed utilizing the kappa coefficient (0.96). Codes were then organized into broader categories. The research team met regularly for debriefing, and any discrepancies were resolved via team consensus. Participant demographics were summarized using descriptive statistics.

### **Results**

We recruited 29 participants for a qualitative interview. Participants were mostly male (72.4%), White (62.1%), and had an average age of 43 years (range 29-59). About three-quarters of participants (75.9%) reported a previous overdose. Most interview participants regularly used heroin and had previously tested heroin as well as non-opioid drugs (See **Tables 1 and 2**).

Interview findings were organized into three thematic categories: first time use of FTS, patterns of FTS use, and contextual factors of FTS use (See **Appendix B**).

#### *First Time Use of FTS*

Many participants first heard about FTS from PPP while already accessing services, from other community organizations, or from their peers. No participants sought out FTS intentionally prior to initiation; all were offered FTS by others. Participants received between four and ten strips their first time getting them, though one individual noted that he received approximately 20 strips. Many participants received brief training on how to use the test strips by representatives from distributing organizations, which sometimes involved demonstrations. One participant explained that he was worried using the strips "would waste the drug" but that the training allayed his concern:

*All you have to do is a small minute – I mean everybody was worried about wasting their drug. You don't even have to do that. You can use the bag themselves to dip it in. Just put a little water to it so you're not wasting the drugs. But they basically explained that it's just a small amount – it'll come up. Just basically dipping the strip in the water. – Michael (White, cocaine, methamphetamine, synthetic cannabinoids, heroin)*

One participant mentioned that someone showed her how to use the strips "with all the different drugs" she was interested in testing. Others who did not receive training were given instructional manuals that described this process. Some interviewees received FTS alongside naloxone.

Motivations for initial FTS uptake varied among participants. Some participants started using them because they either wanted to prevent themselves from overdosing or to prevent others from overdosing, as several participants expressed that many people they knew were dying due to fentanyl. One participant, who no longer used heroin, started testing because he began experiencing greater withdrawal symptoms in between use of drugs like cocaine or street-acquired benzodiazepines, stating:

*I never thought about using them. You know what I mean? I just blew it off like it was a joke. But when I started becoming – keep getting hot and feeling sick, you know what I mean, from fentanyl, I was thinking maybe I should start testing this stuff. I'm – you know what I mean? If I decide to relapse or I'm deciding using. Test it. You know what I mean? Make sure, you know what I mean, it don't have fentanyl in it. But everything's coming up hot for fentanyl in it. – Ynot (White, methamphetamine, crack cocaine, powder cocaine, street-acquired benzodiazepines)*

Others started using FTS simply because they were curious to know if their drugs were contaminated with fentanyl. One participant described using FTS to confirm whether he was physically dependent on fentanyl due to contamination of his K2, a synthetic cannabinoid. Additionally, some started testing because they wanted to determine which sellers to buy from. For example, one interviewee explained,

*I buy specific things from specific places, and all of the dealers out there are telling you like, 'No, no, no, this is legit. There's no fentanyl in it, you're getting what you're buying.' I guess I basically wanted to know if they were lying to me or not. Because that's their goal is to get you to come back and buy more of whatever they're selling when they really don't care what they're selling. – Nicole (White, crack cocaine, powder cocaine, street-acquired benzodiazepines, heroin)*

Two other participants noted that when friends were trying to self-withdraw from opioids, they used benzodiazepines purchased on the street to alleviate anticipated opioid withdrawal symptoms. When they did not experience withdrawal, these participants tested their friends' benzodiazepines which tested positive for fentanyl. For example, Shelby (Native American, street-acquired benzodiazepines) tested on behalf of her friend:

*Well, I didn't actually take [FTS] until [my friend] wanted to detox ... And he kept taking the Xanax. No matter where we got it, whatever, he just – like he wasn't getting sick, you*

*know ... I wanted him to test. Yeah. I wanted to test it because he would take the Xanax and tell me that he was fine. You know? And I'm like, you shouldn't be fine. You're going to be starting to feel [withdrawal], at least, right now, like something.*

Individuals initiated FTS use on various drugs including heroin, methamphetamine, K2, and cocaine. Most participants indicated a positive detection for fentanyl their first time using FTS. However, actions varied in response to a positive test result the first time a test strip was used. Several participants decided not to use the drug. Instead, they gave it to others who used fentanyl or simply threw it away. For example, one participant who disposed of the contaminated drug stated "I didn't want it on my conscience. I didn't want it on my conscience that I gave it to somebody, and it caused their death or something. So, I just got rid of it." Another participant explained that having to get rid of a drug "hurts...Because you done spent all that money on something and you can't use it... So, it's bad. It's not good at all." Others modified how much they consumed, such as one participant who stated, "I would use less of it, so I wouldn't have the chance of OD'ing, or at least try and prevent the chance." Several participants noted that they would not buy again from those who sold them drugs that tested positive for fentanyl. Some proceeded to use the drug regardless of the positive test result because they either: 1) wanted the fentanyl, 2) perceived having a pre-existing tolerance to fentanyl, 3) were experiencing "the shakes" and needed the drug regardless of its contamination, or 4) did not care that fentanyl was in it.

### *Patterns of FTS Use*

Participants indicated that they had been using FTS anywhere between two weeks to three years. The frequency of testing varied; some participants tested often (e.g., once a day) while others tested much less routinely (e.g., once a month). Similarly, patterns of using FTS after initiation varied. Several participants noted that they would test if they purchased drugs from a new seller; if they purchased a larger batch; or if they purchased from Kensington, the neighborhood in Philadelphia with the highest number of overdose deaths. Others tested because they lived in proximity to a FTS distribution site, so they were able to acquire strips more often and therefore test more readily. Other explanations for testing included one participant who stated that she would test when using if "it just doesn't feel right" and another interviewee reported she would test when her drugs appeared an "odd" color, such as brown. Some mentioned that they tested as a measure to monitor drugs that they perceived to be consistently positive for fentanyl, such as cocaine and K2. Lastly, one participant noted testing because she wanted fentanyl in her drugs. A few participants strategically used FTS to determine if their urinalysis would screen positive for fentanyl at a probation or buprenorphine clinic appointment. Two additional participants believed that a negative FTS result on heroin implied contamination with xylazine, a veterinary tranquilizer frequently found in drugs sold as heroin locally. Nearly three-quarters of the sample population used heroin in addition to other drugs. Though they all noted that the heroin market is saturated with fentanyl, most used FTS on heroin in addition to other drugs.



When asked about how participants reacted to a positive FTS result after their initial use of the strips, while several participants expressed that they continued to use their drugs, the majority practiced harm reduction strategies when doing so. In response to a positive test result, many modified how much or the route they used. For example, one participant noted “I – well, first off, I’m addicted to the fentanyl, so I’m gonna use the fentanyl anyway. But I would use less of it. I wouldn’t use more of it.” Another noted:

*I do a little bit less or I’ll do a little like, you know, because I’m an IV user. So I’ll do a little slower, inject a little slower instead of, you know, just all at once. So I’ll just kind of see how it goes, gauge, you know, just based upon my own feeling of it. – Shook (Latinx, heroin, powder cocaine)*

Participants who did not regularly use heroin reported more frequent FTS patterns such as testing a new batch of their non-heroin drug. Most of these participants would not use a drug that tested positive for fentanyl, deciding instead to either dispose of it, sell it, or give it to someone who used fentanyl. Twenty-eight participants only discussed testing prior to consumption of their drug. The remaining participant noted testing her cocaine after she used because she “started feeling weird. You know what I mean? Started sweating and everything because I’m on Suboxone. And I know I had the strips in my bookbag, so I was, you know what, let me test it.”

#### *Contextual Factors of FTS Use*

Testing patterns varied by characteristics at the micro-level (e.g., testing location, likelihood of encountering police) and the macro-level (e.g., composition of the drug supply). At the micro-level, participants described testing their drugs both indoors in their apartments/friends’ houses and outdoors on the street. A few participants stated they would test anywhere: “I’m wherever. I’ve been anywhere. Wherever I feel I got to use them”; “I’ll sit down and – I’ll just sit down. I’m not running around when I smoke crack”; “Yeah, you’ll just test wherever you are. You go around the corner to get high. You can go around the corner to test it. I mean, it’s just – it’s pretty easy.”

Most participants stated they tested inside because it was more private. Participants described that they preferred not to test outside because of people who may be around: “My surrounding. Who watching me. Stuff like that” and “I don’t ever know who walk past.” Additionally, one participant stated “Kensington is full of nothing but drugs. So, people would constantly question” him when using FTS. Six participants indicated they were currently undomiciled and two indicated previously experiencing homelessness. These participants tended to test in sheltered locations, such as their car or a tent. A few participants described how it was more difficult to test outside because of the weather: “... you’re around more elements than anything. Inside you got cover, you’re safe” and “Especially during the wintertime, not being cold.” Additionally, a few participants intentionally chose to be inside when using drugs, so they always tested inside. One participant stated that others might not have anywhere else to go, so they tested outside. Lastly, a few participants noted that they felt safer testing in certain areas because of their familiarity with the drug market in those neighborhoods.

Participants' responses varied when asked if they were worried about the police while using FTS. Of the 29 participants, 19 expressed not having concerns about the police, with one participant stating, "I believe they have other things to worry about than me testing my personal stuff for fentanyl." Some participants talked about the police specifically in the Kensington area. One participant described the police there as desensitized and stated he was not worried because "they don't bother these addicts down here really." Another participant stated "Considering where we're at, hell no. The police let you do what you want to do" and "I basically wouldn't do it out in the open in another neighborhood." Another participant stated, "I mean if we're allowed to use [fentanyl test strips], we shouldn't have – we shouldn't have a problem." One participant stated he was worried about the police if he was holding an illegal drug, but not because of carrying FTS. Two participants noted that they would be concerned about police if they were testing and using outside Kensington. In contrast, another interviewee shared he was worried about police in Kensington, but elsewhere in the city the police were "more mellow." Of the ten who did express concern, six were Black, two were white, one was Native American, and one was Latinx. For example, Jeff (Black, crack cocaine, synthetic cannabinoids) discussed multiple reasons for testing inside, including fear of arrest:

*Well, usually I'm inside the majority of the times. I don't really choose to get high outside too often or too much, especially smoking K2 because sometimes – I just – I really ain't good with using drugs outside because you've gotta keep looking around and you can't enjoy yourself. You always gotta look for the next man coming down the street or the police rolling up on you.*

Macro-level factors influenced motivations to use FTS. Over the course of interviews, most participants commented on the proliferation of fentanyl throughout the drug market in Philadelphia, especially in Kensington, and the unpredictability of an unregulated drug supply. The increasing presence of xylazine in the local heroin was frequently mentioned. One participant would not "even bother testing the heroin" because he perceived it was entirely fentanyl. Instead, he tested methamphetamine and powder cocaine, noting "there's no regular heroin out there no more."

Others noted a belief in the high likelihood of buying a counterfeit pill that had been pressed with fentanyl, such as street-acquired benzodiazepines. It was difficult for them to differentiate between counterfeit and diverted pharmaceutical pills. Again, the Kensington neighborhood was noted as having a particularly high percentage of contaminated drugs.

Synthetic cannabinoids (K2) in particular were noted as a non-heroin drug likely to contain fentanyl, though crack cocaine was also mentioned as having high fentanyl overdose potential. In an attempt to avoid fentanyl-contaminated crack cocaine that he believed was concentrated in the Kensington neighborhood, one participant traveled to another part of the city to buy his product. He began doing this after his crack cocaine consistently tested positive for fentanyl. None of the crack he purchased outside of Kensington tested positive for fentanyl.

All participants described that it was easy to use FTS, with numerous participants stating they were “self-explanatory” to use. When asked what made using FTS easy, a few participants recited directions back to the interviewer, such as:

*All you have to do is open the pack up and, whatever you use to – for your stuff, that you had your stuff in, and just put a little drop of water in it and dip the stick in it. That’s plain as – it’s plain and simple, just like that. – E (Black, heroin, powder cocaine, crack cocaine)*

Another participant stated that:

*Basically it’s like a one, two, three. It’s like the alphabet, A, B, C. You just take the cup, pour the bottle with the water in it, drop the drugs in there, let it sit for about a minute, and then put the strip in it. And it come right up. The lines will come right up and tell you. It’s like a pregnancy test. – James Jones (Black, heroin, crack cocaine)*

One participant liked how the directions for FTS were on the packaging. Participants noted how quickly results appeared – “it only takes a couple of seconds.” One participant stated, “I mean they’re pretty quick and they’re pretty self-explanatory. You pretty much just put it in what you want to test and you get the answer right away, you know.” A few other participants compared how easy it was to use FTS to litmus paper or a pregnancy test – “...they’re real simple. It’s like a pregnancy test.” Moreover, participants described the ease of FTS use because of their accessibility – “I mean, the fact that it’s easily available, you know. I think that’s about it. The fact that the availability of being able to have them all the time.” One participant stated, “It’s so simple. I mean I don’t know why everybody don’t do it. It’s better to be safe than sorry.” Generally, participants did not think FTS were hard to use and did not describe many barriers.

The one context in which participants identified that FTS were hard to use was if they did not have the tools needed to test. James Jones, who said how easy it was to use FTS, noted an important caveat:

*If you ain’t got the water. If you’re somewhere and you don’t have water, no access to water. You know what I mean? So, a lot of people, if they ain’t got access to water, a lot of times they’ll just be like, you know what, I just spent \$100 on all this stuff, I’m gonna go ahead and use it. You know what I mean? And that’s bad. That’s not good.*

A few participants identified that location - “not having a proper place for you to do it at” - could be a barrier when trying to use FTS. Additionally, participants described that they would rather test inside than outside, though that was not always possible. JR (White, crack cocaine, heroin, synthetic cannabinoids) echoed this, saying it had impacted his decision to test previously:

*I try doing it inside because I don’t have to worry about people...I don’t have to worry about people coming over and spilling it or coming over and asking me what I’m doing. You know what I mean?*

Likewise, another participant stated, “I got tired of people looking at me funny” when using FTS outdoors.

One participant stated that a barrier to FTS use was availability because he did not know where to get FTS. A few participants specifically indicated it was hard to test crack cocaine for fear of wasting it: “And I wanted to try it on the crack, but I never did because you don’t get a big enough piece that you want to break a little piece off and waste it. So just smoke it and see what happens.” Other participants stated they simply did not want to take the time to test, with one participant pointing to his anxiety in anticipation of use of his cocaine.

A few participants also noted how FTS results do not inform them how much fentanyl is in a drug. Nick (White, crack, heroin, methamphetamine) erroneously believed the visibility of the line indicating a positive result was related to how much fentanyl his drug contained:

*They don’t tell you the amount of fentanyl in them though, so I just try to be careful. If the red line shows up immediately, dark, you know what I mean? Sometimes it takes time for it to show up and sometimes it just shows up immediately. So I kind of – my judgment is that if it immediately turns red and dark that it’s probably got a lot of fentanyl in what I’m using.*

Another participant described how he would like to know the purity of the drug he was doing.

A few participants described how sometimes it was confusing to distinguish a positive test from a negative test – “The only thing that I had a problem with was that – the line thing. So if it was more clear on the positive and the negative” and “...in the beginning I had gotten confused a couple of times, I didn’t remember if one line or two lines was positive or negative.”

## **Discussion**

Among this sample of PWUD, perspectives on initiation of FTS, their utility, and ease of use were positive overall with few barriers to use noted. Various contexts representing micro-level facets of their risk environment impacted FTS use patterns, specifically availability, neighborhood, testing location, and drug amount and type purchased. To our knowledge, this is the first study to assess these factors for use of FTS with an explicit focus on their use on multiple, non-opioid drugs alongside their use on heroin. The PWUD we engaged in our work expressed the utility of FTS in their daily lives by helping to inform their decisions, such as modifying their behavior after a positive test strip result, continuing to use FTS due to fluctuations in the drug market, and incorporating FTS into their drug use routines.

Though an increasing body of literature is assessing FTS on all types of drugs, analyses generally do not break down results by drug type in depth (Goldman et al. 2019; Krieger, Goedel, et al. 2018; Park et al. 2020). While we recruited specifically for people who had used FTS on drugs other than heroin, most participants also used, and had used FTS on, heroin. This allowed us to expand analysis beyond just FTS use on non-heroin drugs to detect global FTS patterns among the sample. In fact, all but a few participants in this study engaged in polysubstance use. Participants noted that they perceived that macro-level factors led to contamination of the drug supply of all drugs, not just heroin. In general, people tested all their substances for fentanyl, though some exceptions emerged. Differences by drug type included strategic use of FTS on heroin to determine whether it contained xylazine and to predict whether a urine drug screen

would be positive for probation or for their buprenorphine provider. Synthetic cannabinoids were tested by “batch” purchased to determine whether a bag that would get used over multiple days contained fentanyl. A minority of people who had used FTS on crack cocaine noted they had difficulty taking the time to test or allocating some of the drug to the test, which may be a concern specific to that drug type (Reed et al. 2021). Finally, people who had tested street-acquired benzodiazepines reported their pills tested positive for fentanyl. Testing counterfeit pills designed to appear as prescription benzodiazepines or other prescription medications is of increasing importance as seizures of counterfeit pills are regularly testing positive for fentanyl (CDC Health Alert Network 2016; US Drug Enforcement Administration 2021).

Regarding timing of testing, the vast majority tested prior to consumption of the drug. Yet motivations for testing prior to consumption varied. Some were testing to determine whether the drug they were about to consume had overdose potential while others were attempting to monitor the drug supply more broadly. Participants additionally sought to understand a lack of withdrawal symptoms, anticipate problems with probation and buprenorphine providers, and use a process of elimination to assess whether their heroin contained fentanyl or other contaminants. Additional “off-label” uses of FTS for reasons beyond immediate overdose prevention have been observed elsewhere (Weicker et al. 2020)

Similar to other studies, most participants expressed that their primary motivations for FTS use included prior overdose experience and wanting to avoid fentanyl (Krieger, Yedinak, et al. 2018). However, many were not actively seeking FTS when they first acquired them. Rather, most received them because of their participation in other services, such as syringe exchanges. It is important that harm reduction services offer FTS as routine distribution of safer drug use supplies, but it is also important that other organizations that regularly interact with PWUD initiate FTS training and distribution. Examples of other organizations include shelters, food banks, and other outreach programs. Some of these locations have been found in other studies as desirable for receiving FTS (Park et al. 2020).

Motivations to use FTS were also driven by structural factors, such as racialized policing and drug market trends. Given that Black people in particular are experiencing higher rates of overdose locally and in many places nationally along with the fact that most of people who expressed concerns about FTS and police were people of color, FTS outreach should explicitly address these concerns (Bettigole 2021; Lippold et al. 2019). In Pennsylvania, FTS are considered drug paraphernalia, but at the time of data collection, the Philadelphia District Attorney’s office had stated no one would be prosecuted for carrying FTS (Philadelphia DAO 2021). While legal protections often do not automatically extend to people of color due to a racist criminal justice system, widely advertising this policy approach in tandem with distribution efforts may help protect people who carry and use FTS (Hradilová et al. 2018).

Furthermore, we found that participants tested their drugs with varying levels of frequency. The reasons given for not testing more often included inadequate supply of FTS and being farther from to an FTS distribution site. Many participants indicated they would use FTS more often if they had better access to a reliable source for unlimited strips. Given a lack of access to a stable supply of unlimited strips, many rationed their strips by testing part of a larger batch of drugs

they had purchased. While this is a strategic solution to scarcity, the heterogeneity, or “chocolate chip cookie effect”, of fentanyl in a batch of drugs such as synthetic cannabinoids or powder cocaine is of concern. Community saturation of FTS would likely increase frequency of testing and further mitigate overdose risk.

Several interviewees noted that the location from which they purchased their drugs was a good indicator of whether their drugs would test positive for fentanyl, thus motivating them to use FTS to validate these observations. Additionally, motivations to test were influenced by the increasing presence of xylazine in heroin. Two participants stated they tested to confirm the presence of fentanyl in their drugs, as they believed a negative result indicated xylazine contamination. This underscores the need to develop more dynamic testing resources to further prevent unwanted exposure to harmful contaminants like xylazine (Johnson et al. 2021), as PWUD in our sample indicated they wanted more information about what they had purchased. More technologically-advanced drug checking equipment such as Fourier-transform infrared (FTIR) spectroscopy can provide PWUD with more comprehensive on-demand consumer information.

As seen elsewhere, participants in this study named harm reduction actions they regularly engaged in to reduce their overdose risk (Krieger, Goedel, et al. 2018). These were often informed by the results of the FTS, adding to a growing body of evidence that FTS use influences subsequent drug use actions (Krieger, Goedel, et al. 2018; Peiper et al. 2019; Weicker et al. 2020). Multiple participants indicated that they would use information from FTS results to communicate back to people who sold them the drug or to assist their friends, a finding supported by existing literature (Weicker et al. 2020).

Finally, although many people continued to use a drug that tested positive, the vast majority were already consistently practicing “standard precautions” related to safer drug use: they indicated using with someone they trusted, carried naloxone, and many “started slow” to gauge the potency and effects of a drug before using their full dose. This indicates that PWUD are exerting maximal safety efforts in an unregulated drug market largely outside of their control. Overdose prevention campaigns should continue to promote the steps PWUD can take to protect themselves while pushing for policy and legislative changes that will truly empower PWUD to stay safe. This includes making FTS readily available, expanding drugs that are considered as medications for opioid use disorder, making more advanced drug checking technology equipment like FTIR machines available at point-of-care services, and pushing for a legal and safe supply of drugs (Maghsoudi et al. 2021).

## **Limitations**

This study has limitations to consider. In 2020 in Philadelphia, overdose deaths among Black residents rose 30% and decreased 10% among White residents (Bettigole 2021). Yet most participants in this study were White and were recruited from the same harm reduction organization, therefore limiting generalizability of the findings to other settings and PWUD populations at a time when perspectives of people of color who use drugs, in particular Black people, are especially needed.

As an artifact of recruiting participants from syringe service programs, which serve a large population of people who use heroin, most participants indicated ongoing heroin use so many had a preexisting fentanyl tolerance. It is important that future research captures the perspectives of greater numbers of opioid naïve PWUD, as well as those with less regular opioid use, about FTS.

There were also several limitations related to conducting data collection during the coronavirus (COVID-19) pandemic. Access to harm reduction services such as receiving FTS as well as the composition of the drug supply in Philadelphia were likely impacted because of COVID-19 (United National Office on Drugs and Crime 2020). Additionally, most interviews were conducted over the phone. Because of this, participants were sometimes in chaotic and loud environments, which likely influenced their responses.

Finally, we achieved thematic saturation on FTS use for many types of drugs, including street-acquired benzodiazepine pills, but our sample did not contain participants who used prescription opioids obtained by means other than directly from a prescriber. Given the increasing contamination of counterfeit prescription opioids nationally, this is an important perspective that is lacking from the sample.

## **Conclusion**

Motivations to use FTS among PWUD varied, but were largely driven by factors related to knowledge, access, neighborhood, and drug market trends. Future studies are needed to address disparities in FTS access and use among different PWUD populations. However, this research supports the current literature that states FTS are an accepted and effective harm reduction strategy for PWUD.

## **Conflicts of Interest**

The authors have no conflicts of interest to declare.

## **Funding**

This work was supported by Vital Strategies through funding from Bloomberg Philanthropies.

## **Acknowledgments**

The authors would like to gratefully acknowledge the time and expertise of the PWUD who agreed to be interviewed for this study. Additionally, we would like to thank our research partners at Prevention Point Philadelphia and the Philadelphia Department of Public Health.

## References

- Bergh, Marianne Skov Skov, Åse Marit Leere Øiestad, Michael H. Baumann, and Inger Lise Bogen. 2021. "Selectivity and Sensitivity of Urine Fentanyl Test Strips to Detect Fentanyl Analogues in Illicit Drugs." *International Journal of Drug Policy* 90.
- Bettigole, Cheryl. 2021. "Unintentional Drug Overdose Fatalities in Philadelphia, 2020." *CHART* 6(5).
- CDC Health Alert Network. 2016. "Influx of Fentanyl-Laced Counterfeit Pills and Toxic Fentanyl-Related Compounds Further Increases Risk of Fentanyl-Related Overdose and Fatalities." <https://emergency.cdc.gov/han/han00395.asp>.
- Centers for Disease Control and Prevention. 2021. "Understanding the Opioid Overdose Epidemic." <https://www.cdc.gov/opioids/basics/epidemic.html> (February 15, 2022).
- . 2022. "Products - Vital Statistics Rapid Release - Provisional Drug Overdose Data." <https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm> (January 24, 2022).
- Ciccarone, Daniel. 2017. 46 *International Journal of Drug Policy Fentanyl in the US Heroin Supply: A Rapidly Changing Risk Environment*. Elsevier B.V. <http://www.ncbi.nlm.nih.gov/pubmed/28735776> (February 11, 2020).
- . 2019. "The Triple Wave Epidemic: Supply and Demand Drivers of the US Opioid Overdose Crisis." *International Journal of Drug Policy* 71: 183–88.
- . 2021. "The Rise of Illicit Fentanyls, Stimulants and the Fourth Wave of the Opioid Overdose Crisis." *Current Opinion in Psychiatry* 34(4).
- Dasgupta, Nabarun, Leo Beletsky, and Daniel Ciccarone. 2018. "Opioid Crisis: No Easy Fix to Its Social and Economic Determinants." *American Journal of Public Health* 108(2): 182–86.
- DiSalvo, Philip et al. 2021. "Fentanyl-Contaminated Cocaine Outbreak with Laboratory Confirmation in New York City in 2019." *American Journal of Emergency Medicine* 40.
- Farley, Thomas. 2020. "Unintentional Drug Overdose Fatalities in Philadelphia, 2019." *CHART* 5(4). <https://www.phila.gov/media/20200511105852/CHART-v5e4.pdf> (September 9, 2020).
- Feldman, Nina. 2020. "Spate of Overdoses Hits Service Industry Workers in Philly Who Thought They Were Doing Cocaine." *WHYY*.
- Goldman, Jacqueline E. et al. 2019. "Perspectives on Rapid Fentanyl Test Strips as a Harm Reduction Practice among Young Adults Who Use Drugs: A Qualitative Study 11 Medical and Health Sciences 1117 Public Health and Health Services 17 Psychology and Cognitive Sciences 1701 Psychology." *Harm Reduction Journal* 16(1): 1–11.
- Hradilová, Iveta et al. 2018. "Sharks and Minnows in the War on Drugs: A Study of Quantity, Race and Drug Type in Drug Arrests." *PeerJ* 2019(1). <https://papers.ssrn.com/abstract=3305732> (January 24, 2022).
- Johnson, Jewell, Lia Pizzicato, Caroline Johnson, and Kendra Viner. 2021. "Increasing Presence



- of Xylazine in Heroin and/or Fentanyl Deaths, Philadelphia, Pennsylvania, 2010-2019.” *Injury Prevention*. <https://injuryprevention.bmj.com/content/early/2020/12/02/injuryprev-2020-043968> (March 18, 2021).
- Khatri, Utsha G., Kendra Viner, and Jeanmarie Perrone. 2018. “Lethal Fentanyl and Cocaine Intoxication.” *New England Journal of Medicine* 379(18): 1782.
- Krieger, Maxwell S., Jesse L. Yedinak, et al. 2018. “High Willingness to Use Rapid Fentanyl Test Strips among Young Adults Who Use Drugs.” *Harm Reduction Journal* 15(1): 1–9.
- Krieger, Maxwell S., William C. Goedel, et al. 2018. “Use of Rapid Fentanyl Test Strips among Young Adults Who Use Drugs.” *International Journal of Drug Policy* 61: 52–58.
- Lippold, Kumiko M., Christopher M. Jones, Emily O. Malley Olsen, and Brett P. Giroir. 2019. “Racial/Ethnic and Age Group Differences in Opioid and Synthetic Opioid-Involved Overdose Deaths Among Adults Aged  $\geq 18$  Years in Metropolitan Areas - United States, 2015-2017.” *MMWR. Morbidity and mortality weekly report* 68(43): 967–73.
- Maghsoudi, Nazlee et al. 2021. “Drug Checking Services for People Who Use Drugs: A Systematic Review.” *Addiction*.
- Marshall, Kristen. 2018. “Fact Sheet: Fentanyl Test Strip Pilot .” <https://harmreduction.org/issues/fentanyl/fentanyl-test-strip-pilot/> (August 17, 2021).
- Park, Ju Nyeong et al. 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.
- . 2021. “Evaluation of Fentanyl Test Strip Distribution in Two Mid-Atlantic Syringe Services Programs.” *International Journal of Drug Policy* 94: 103196.
- Peiper, Nicholas C. et al. 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: 122–28.
- Philadelphia DAO. 2021. “District Attorney Krasner Calls for Greater Urgency & Action on Overdose Prevention .” *Medium*. <https://medium.com/philadelphia-justice/district-attorney-krasner-calls-for-greater-urgency-action-on-overdose-prevention-da653f298c9e> (January 24, 2022).
- Philadelphia Department of Public Health. 2021. “Health Department Releases Update on 2021 Overdose Death Counts.” <https://www.phila.gov/2021-12-02-health-department-releases-update-on-2021-overdose-death-counts/> (January 24, 2022).
- Reed, Megan K. et al. 2021. “‘I Probably Got a Minute’: Perceptions of Fentanyl Test Strip Use among People Who Use Stimulants.” *International Journal of Drug Policy*: 103147.
- Rhodes, Tim. 2009. “Risk Environments and Drug Harms: A Social Science for Harm Reduction Approach.” *The International journal on drug policy* 20(3): 193–201. <http://www.ncbi.nlm.nih.gov/pubmed/19147339> (October 16, 2016).
- San Francisco Department of Public Health. 2021. “Health Alert: Fentanyl Overdoses Among

Persons Using Cocaine.” <https://www.sfdcdp.org/wp-content/uploads/2021/02/health-alert-fentanyl-overdoses-020521.pdf> (September 21, 2021).

Sherman, Susan G. et al. 2019. “Acceptability of Implementing Community-Based Drug Checking Services for People Who Use Drugs in Three United States Cities: Baltimore, Boston and Providence.” *International Journal of Drug Policy* 68: 46–53.

U.S Department of Health and Human Services. 2021. “About the Epidemic .” <https://www.hhs.gov/opioids/about-the-epidemic/index.html> (January 24, 2022).

United National Office on Drugs and Crime. 2020. *COVID-19 and the Drug Supply Chain: From Production and Trafficking to Use*. Vienna. [www.unodc.org](http://www.unodc.org) (January 24, 2022).

US Drug Enforcement Administration. 2021. “DEA Issues Public Safety Alert on Sharp Increase in Fake Prescription Pills Containing Fentanyl and Meth.”

Weicker, Noelle P. et al. 2020. “Agency in the Fentanyl Era: Exploring the Utility of Fentanyl Test Strips in an Opaque Drug Market.” *International Journal of Drug Policy* 84.

**Table 1.** Demographics of Participants with a History of FTS Use in Philadelphia, PA (N=29)

		Participants (N=29)
Age – mean (range), SD		42.7 (29-59), 8.7
Gender Identity – n (%)		
	Male	21 (72.4)
	Female	8 (27.6)
Ethnicity – n (%)		
	Not Latino/Hispanic/Latinx	27 (93.1)
	Latino/Hispanic/Latinx	2 (6.9)
Race – n (%)		
	White	18 (62.1)
	African-American/Black	10 (34.5)
	Other	1 (3.4)
Previous Overdose – n (%)		22 (75.9)
	Heroin/fentanyl	15 (51.7)
	Cocaine	4 (13.8)
	Synthetic cannabinoids (e.g., K2)	3 (10.3)
	Unknown	3 (10.3)
	PCP	1 (3.4)
How Learned About FTS – n (%)		
	Harm Reduction Organizations	25 (86.2)
	Peer/Friend	3 (10.3)
	Police During an Arrest	1 (3.4)

**Table 2.** Drugs Regularly Used and Tested with FTS by 29 Qualitative Interview Participants in Philadelphia, PA

Participants (N=29)		
	Drugs Regularly Used n (%)	Drugs Ever Tested with FTS n (%)
Heroin	21 (72.4)	19 (65.5)
Crack cocaine	14 (48.3)	16 (55.2)
Powder cocaine	10 (34.5)	14 (48.3)
Synthetic cannabinoids (e.g., K2)	9 (31.0)	9 (31.0)
Benzodiazepines (e.g., Xanax)	6 (20.7)	7 (24.1)
Polysubstance use/multiple substance tested	26 (89.7)	24 (82.8)

## Appendix A: Interview Guide

1. How did you first hear about fentanyl test strips?
  - When was that?
  - What motivated you to get them? (Did you seek them out, were you afraid of fentanyl?)
  - How did you learn to use them?
2. Tell me about the first time you used a strip.
  - What did you do as a result?
3. Tell me how you decide when to use them?
  - New seller? New batch? New location? Word on the street?
  - How often would you like to use them?
4. Tell me about the most recent time you used a strip.
  - What did you do as a result?
  - [If participant has never gotten a positive test result] What would you do if your strip showed your drug had fentanyl in it?
  - Let's make a list of all the possible things someone could do with a positive test result. Which are unrealistic? Realistic? What would happen if someone did those things? Would you be able to do any of those things?
5. What do you think about whether someone who uses <drug of choice> is at risk of an overdose from fentanyl?
  - Do you feel you're at low or high risk for an overdose? Why?
  - Does using strips make you feel like you're more at risk of an overdose? Less? Why?
6. What makes it hard to use FTS?
7. What makes it easy to use FTS?
8. Who do you think should use FTS? Why?
9. What would be the best way for you to get FTS?
  - How many FTS would you need to feel safe?
10. What else do you do to stay safe when you use drugs?
  - Probe for: use with others, carry naloxone
11. Have you ever overdosed before?
  - If not, have you ever had a bad reaction?
  - If yes, what happened? Why do you think you overdosed that time?

## Appendix B: Categories, Codes, and Definitions

Category	Code	Definition
<b>First Time Use of FTS</b>	<i>Initiation</i>	The first time participant used FTS and subsequent actions
	<i>Learning Experience</i>	Where participant heard about FTS and learned to use them, how many FTS they received, training received
	<i>Intrinsic Motivation</i>	Motivation for initial FTS uptake (e.g. knowledge of fentanyl in drug supply, overdose history personally or in network, simply because it was offered)
<b>Patterns of FTS Use</b>	<i>Extrinsic Motivation</i>	Current motivations for use (e.g. neighborhood of purchase, proximity to PPP or another location that offers FTS regularly, the way the drug looks, new seller, word on the street from friends or rumors). Includes frequency of use of FTS, patterns, etc.
	<i>Results and Outcomes</i>	Participant's experience of utilizing FTS  a. <i>Continue to use it</i> – After testing, participant continued to use the drug as they normally would without testing  b. <i>Not use it</i> – After testing, participant does not use drug (e.g. throws away, gives away, or sells it)  c. <i>Modify use</i> – After testing, participant modifies normal use (e.g. only taking half of the drug, etc.)  d. <i>Testing after use</i>
<b>Contextual Factors of FTS Use</b>	<i>FTS Use Environment</i>	Participant talks about experience of FTS, where they have used FTS, concerns about environment while testing, location (inside vs. outside), testing with other people, concerns about other people while testing. Includes concerns about police while testing.
	<i>Drug Market Observations</i>	Participant states observations about drug potency, adulteration, trends in buying and selling, etc. This code should be used for macro market statements.
	<i>Facilitators</i>	Things that make it easy to use FTS (e.g. built environment, presence of cooker, time it takes to test, etc.)
	<i>Barriers</i>	Things that make it hard to use FTS (e.g. built environment, absence of cooker, time it takes to test, etc.)