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Consuming Illicit Opioids During a Drug Overdose Epidemic: Illicit Fentanyl, Drug Discernment, and the Radical Transformation of the Illicit Opioid Market

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Abstract

Background: North America continues to face an opioid overdose epidemic, driven by persistent increases in illicit fentanyl and fluctuations in potency leading to uncertainty for consumers. This qualitative study was conducted to better understand how people who inject drugs (PWID) came to recognize fentanyl as a growing adulterant of heroin and the subsequent sensory discernment strategies they employed to continue injecting. Our main objective was to investigate how observations and knowledge are combined as homegrown techniques for detecting fentanyl and minimizing risk. Secondary objectives were to examine the impact of growing fentanyl adulteration on individual drug use behavior.

Methods: Between April and May 2019, 28 PWID (18 men, 10 women; average age = 38.43 years, $SD = 9.26$) were purposely recruited from a needle services program in Greensboro, North Carolina. Study participants were interviewed in-person using a qualitative, semi-structured instrument. Interviews were analyzed with a general inductive approach using NVivo12.

Results: Participants described methods for detecting fentanyl in illicit opioids. Sudden increases in the potency of the ‘rush’ and sharp decreases in the length of the ‘high’ were chief indicators along with changes in drug color and texture. Heavy sedation was associated with fentanyl use and histamine-releasing effects characterized as ‘pins and needles’ were ascribed to injecting fentanyl as a component of the rush. Fentanyl’s short high helped explain higher injection frequency and heavy sedation was the leading reason for co-using fentanyl with cocaine/crack or methamphetamine.

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Contributors

Jon E. Zibbell and Sarah E. Duhart Clarke originated the idea and design for this article. Sarah E. Duhart Clarke and Jon E. Zibbell analyzed the data. Sarah E. Duhart Clarke created the figures and tables. Jon E. Zibbell, Sarah E. Duhart Clarke, and Alex H. Kral conducted literature searches and wrote the article. This manuscript has been approved by all authors and is not being reviewed or considered for publication at another journal.

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Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

This study was reviewed and approved by the Institutional Review Board (IRB) at RTI International.

Conclusion: PWID have the capacity to recognize changes to the illicit opioid supply. Study participants navigated unpredictable fluctuations in the illicit opioid market by employing homegrown discernment techniques, modifying drug use behavior, and co-using non-opioid drugs. Researchers and policymakers should involve PWID as subject matter experts to help modernize harm reduction for the fentanyl age with practical strategies to boost resiliency and save lives.

Keywords

PWID; fentanyl; opioid overdose; injection drug use; illicit stimulants

Introduction

The United States (US) continues to face a rising epidemic of drug overdose deaths with over 81,000 deaths in 2020 (CDC, 2020a), 80% of which involved illicitly-manufactured fentanyls (hereafter referred to as fentanyl). The opioid overdose epidemic has advanced for more than two decades; nationally, overdose mortality data depicts an evolution involving three distinct but intersecting waves (Zibbell, 2019). The first wave began in the late 1990s with increases in opioid prescribing and concurrent prescription opioid deaths. The second wave appeared midway through the prescription opioid crisis (2008–2010) marked by a sharp increases in heroin use, supply, and overdose deaths. The third and current wave began in 2013 when fentanyl was introduced on a massive scale to the US, initially appearing in several Northeast and mid-Atlantic states as an adulterant of heroin before establishing market dominance coast-to-coast and causing unprecedented numbers of deaths (CDC, 2020b). While other international drug markets have begun witnessing sharp increases in fentanyl-involved overdoses and seizures in recent years (EMCDDA, 2021; NSW Government Health, 2020; Rodda et al., 2017), the *prolonged saturation* of fentanyl in illicit opioid supplies remains a problem distinct to North American illicit drug markets.

The introduction of fentanyl to US illicit opioid markets has led to significant changes in the composition of heroin products. Heroin supply chains previously dominated by Columbian-sourced heroin are now saturated with illicitly-manufactured fentanyls (DEA, 2019). Fentanyl's growing share of the illicit opioid market has facilitated sharp and uneven changes in potency and purity (Ciccarone, 2017). Unpredictable market fluctuations have been shown to generate uncertainty for consumers and present challenges for distinguishing products containing fentanyl (Griswold et al., 2018). To address this ambiguity, people who inject drugs (PWID) are practicing a number of safer consumption strategies to help them better navigate vicissitudes in potency and reduce overdose risk (Rouhani et al., 2019). Common techniques include tester shots, micro-dosing, and staggering injections with peers (Mars et al., 2018). These risk reduction techniques have been shown to offer some protection from overdose but none remove risk completely from the equation given fentanyl's lethality even in micro-doses. Fentanyl test strips (FTS) have also emerged as a strategy to check drug supplies for the presence of fentanyl (Peiper et al., 2019; Zibbell et al., 2021); however, FTS and other drug checking tools are not widely available, leaving many PWID with no external method to determine the contents of their drugs.

Quite recently, qualitative researchers have begun exploring whether PWID have the capacity to identify and distinguish fentanyl from heroin by scrutinizing a drug's physical appearance and dissecting its physiological effects. Rapid street-side interviews with PWID have found visual appearance and physiological effects used as conventional signifiers for both detecting fentanyl *in* heroin and distinguishing fentanyl *from* heroin (Ciccarone et al., 2017; Mars et al., 2016; Mars et al., 2018). Mixed-methods, epidemiological studies with PWID in Rhode Island, Massachusetts, and Baltimore have documented similar discernment techniques and drug checking procedures (Carroll et al., 2017; Mars et al., 2017; Rhodes et al., 2018). Due to continued volatility in the illicit opioid market and persistent fluctuations in potency, there is a need for more first-hand descriptions of the sensory strategies PWID are using to detect fentanyl in illicit opioids. A qualitative understanding of how a growing supply of illicitly-manufactured fentanyls continues to impact the motivations and behaviors of PWID can help strengthen overdose prevention by offering practical strategies to minimize risk in this era of uncertainty.

The purpose of the current study was to explore how PWID came to recognize the adulteration of the heroin supply with fentanyl and the steps they took to continue injecting safely once discovering its permanence. Our main objective was to investigate qualitatively how the iterative process of drug discernment involves the combined use of human faculties (e.g., sight, taste, physical feeling, etc.) and *a posteriori* knowledge as homegrown sensory strategies for detecting fentanyl in illicit opioids. Secondary objectives were informed by the need to better understand fentanyl's influence on drug use behavior and its impact on consumer motivations to use non-opioid drugs (e.g., illicit stimulants).

Methods

Study participants were recruited at a needle services program (NSP) in Greensboro, North Carolina operated by the North Carolina Survivors Union (NCSU). NCSU is a community-based organization comprised of people directly impacted by drug use and addiction, most of whom identify as PWID. Having directly impacted persons deliver harm reduction services allows NSP staff to cultivate entrusting relationships with program participants based on mutual pursuits and shared experience. This shared identity and high degree of trust allows NCSU to engage and interact with social networks of PWID *as peers*. In partnering with NCSU, the established trust between NCSU and its participants afforded researchers of the current study the capacity to recruit both NSP participants and PWID not enrolled at the NSP at the time of study enrollment. NCSU's deep reach into social networks of PWID allowed us to employ targeted sampling methods (Kral et al., 2010) to construct a sample of key informants with insider knowledge of fentanyl and its impact on drug use behavior and overdose risk. The current qualitative study is a component of a larger, NIDA-funded ethnographic investigation into the fentanyl crisis in North Carolina (*Fentanyl Overdose Response and Community Engagement* [FORCE]; DA046444-01, Zibbell, PI).

Recruitment for this study occurred in April and May of 2019. Individuals were eligible for the study if they were aged 18 years, consumed illicitly-made opioids, and injected drugs in the past 7 days at the time of enrollment. Study participants provided informed consent and engaged in a 60-minute, semi-structured, face-to-face interview in a private

room at the NSP. Interview topics were developed during 12 months of direct observation ethnography with PWID as they purchased, prepared, and injected heroin, fentanyl, and other drugs. Study participants received \$25 as remuneration. Twenty-eight people were interviewed; participants included 18 men and 10 women with an overall average age of 38.43 years ($SD = 9.26$, range = 23–61). Race and ethnicity were both self-reported by participants: the vast majority of respondents were White ($n = 26$) and two were Black, with nearly all identifying ethnicity as non-Hispanic ($n = 27$) and one as Native American. These proportions reflect the demographics of program participants at NCSU's NSP and compare with the demographics of study participants recruited from the same NSP for a quantitative study on fentanyl test strips (Peiper et al., 2019).

All interviews were digitally recorded, professionally transcribed, meticulously de-identified, and uploaded into NVivo 12 for qualitative analysis. A systematized data analysis (Znaniecki, 1934) was employed due to the open-ended and exploratory nature of the interviews. This standardized approach began with broad coding categories to identify general themes before developing more specific codes for sharpening themes, determining thematic significance, and quantifying response percentages. Coding was independently performed by the authors and compared for thematic consistency with discrepancies processed in regular team meetings to ensure intercoder reliability. Codes were analyzed for their content, prevalence, and association with other codes. NVivo provides the ability to quantify narrative data by its capability to search patterns and compute prevalence of coding categories, individual words, brief utterances, or entire phrases. To better communicate the strength of qualitative findings, the number of respondents who offered parallel answers or corresponding explanations to the same question or topic were calculated whenever possible and percentages and proportions (e.g., $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of respondents or *all respondents*) presented. The quantification of qualitative findings to highlight the prevalence of study results aligns with analytical methodologies used in comparable qualitative studies conducted with PWID (Pollini, et al., 2021; Strickland & Victor, 2020). The logic informing this strategy is a recognition of a critical distinction in qualitative research between the strength of a claim rendered by 10% of respondents ($n = 3/28$) compared with a claim represented by 90% ($n = 25/28$). Providing respondent percentages is particularly relevant in the current study because consensus among respondents is critical for corroborating that PWID are capable of recognizing changes in the illicit drug market and engaging in subsequent behavioral change to reduce harm. Even so, previous qualitative studies with PWID have established that veracity is not always dependent on the percentage of persons reporting a phenomenon (Page & Singer, 2010), particularly when involving the emergence of novel psychoactive substances whose side-effects and risk factors are difficult to pinpoint in real-time. As such, relevant claims endorsed by only a limited number of respondents are not excluded from results.

Results

Changes in Heroin's Effect: Physical Sensations of the 'Rush' and 'High'

Respondents detected changes to the heroin supply using both physical and physiological indicators. These indicators were based on the way a drug appeared, as both raw drug and

when mixed with water, and the physiological effects it produced, including the potency or strength of the ‘rush’ and the length and character of the ‘high’. Of participants that spoke to the exact timing of changes in the illicit opioid market, a majority (86%) identified 2014 and 2015 as the point when the ‘heroin’ started to feel different and all participants insisted that it happened quite suddenly and without warning. “Fentanyl showed up seemingly overnight,” one respondent observed (47-year-old woman). Changes to the heroin supply did not happen in a uniform or measured fashion, explained one respondent: “It [heroin] is very inconsistent; like you buy something from someone one day and the next [day] it’s changed: it can be stronger, it can be weaker...but never the same” (25-year-old man). (See Table 1 for exemplar quotes describing the changing illicit opioid market.)

All respondents reported sharp increases in potency as the first indication that the ‘heroin’ was changing. “It was the way the dope started to make you feel that was the dead giveaway,” testified one respondent, describing the new sensations as unique but also familiar because “we knew it was most definitely an opioid” (33-year-old woman). All participants described changes in the type of ‘rush’ they regularly experienced when injecting unadulterated heroin, with 84% percent specifying increased potency as the first sign. Participants employed catchphrases like “way more intense,” “scarier,” and “way stronger” to express the magnitude of the contrast. Fentanyl was described somewhat similarly to heroin but with distinct differences in the type of rush reported. Many admitted that the rush could be incredibly strong and present so suddenly that it frequently triggered acute feelings of panic and anxiety. “The [fentanyl] rush is different. When you inject it, you get this feeling, it hits you so hard [and] you immediately start thinking, ‘Oh shit, what have I done?’ you know. You start getting kind of scared. You go look in the mirror and you’re like, you know, red and sweating and shit and you’re like, ‘Oh my god’” (36-year-old man). The sudden appearance of a much stronger rush was a clear indication that it was no longer just heroin they were injecting.

Respondents portrayed the rush from injecting fentanyl in similar ways and offered comparable descriptors from which to paint a general illustration. A fentanyl rush presents within 5–10 seconds after intravenous injection and starts with an initial warm feeling in the chest and head that quickly develops into a lightheaded, ‘dizzying effect’. Several respondents declared the dizzying effect made them mentally disorientated and unsteady on their feet when the fentanyl is particularly strong. Depictions of the rush conveyed strength and power, such as “a powerful punch” and “a feeling so strong you feel like throwing up.” Roughly 25% regularly experienced ‘pins and needles’ on the neck and/or face during the initial rush from intravenous injecting and then dissipated as the rush receded. Participants also noted that these type of ‘prickly sensations’ did not present during the rush from injecting heroin. “Once in a while I will shoot the stuff I’m getting now, once in a while I will get a tingly sensation in my head. And come to think of it, the dope I was doing back then [before fentanyl appeared] didn’t do that, it didn’t do that at all. It [the prickly sensations] doesn’t even hurt me; it’s more just like a tingly sensation in my head, and it doesn’t happen every time” (61-year-old man).

While the fentanyl rush was generally described as stronger and more powerful than heroin, respondents agreed that the subsequent high was not. Contrary to popular belief, heroin

did not make them anesthetized or lackluster—quite the contrary. “Heroin provides me energy,” declared one respondent (33-year-old man), with another insisting that “heroin helps me get stuff done” (61-year-old man). Heroin was generally described as producing long stretches of bodily euphoria lasting between four-to-eight hours. Study participants insisted that the high from fentanyl subsided more quickly than heroin, lasting only minutes in some cases. Participants regularly used the term “legs” to describe a drug’s duration of effect and fentanyl was generally characterized as having no legs. Respondents differed in their assessments for how long the typical high from fentanyl lasts but all agreed it was significantly shorter than heroin. Some insisted that the heroin was already weak before fentanyl arrived and hailed its arrival as a welcome boost in potency. “Think of it [fentanyl] as a turbo charger on a car, [it] gives a lot more horsepower. Heroin, by itself eh, like it’s okay, but throw fentanyl and, like, it just supercharges the shit out of it. It makes it a lot better” (27-year-old man).

Although the fentanyl high was portrayed as comparatively shorter than the heroin high, 64% of respondents indicated that chronic fentanyl use produced bouts of heavy sedation that heroin did not. Respondents distinguished this heavy, sedated feeling from the bodily euphoria they attributed to heroin. In contrast, fentanyl was portrayed as performing more like a sedative with tranquilizing effects that produce punctuated spells of unconsciousness that worsen with repeated use, becoming more and more difficult to repel. “I’m seeing people shoot up and they’re fucking drooling,” reported one respondent. “I see people standing on their tip-toes and just drooling. I don’t even see how they’re not falling over; 10–20 minutes just standing there. Then they finally snap out of it and start walking around like nothing happened” (33-year-old man). (See Table 2 for exemplar quotes on a range of physical sensations).

Changes in the Color, Texture, and Taste of ‘Heroin’

As the predictable rush and high from heroin started to change, evidenced by the novel sensations described above, respondents started to look more closely at the illicit opioid products they purchased. Participants fervently believed that they could detect fentanyl in ‘heroin’ simply by looking at the procured product and evaluating the appearance of the subsequent drug solution, but this capability was far from simple or straightforward. Respondents insisted on the importance of knowing what you are consuming, with one respondent emphasizing “to, you know, make sure you know what it is, what it looks like, how strong it is, how it’s going to make me feel, and how my body’s going to react to it” (25-year-old woman). The quickest detection method was observing the physical appearance. Respondents generally relied on heroin’s typical color and texture to identify conspicuous disparities in appearance, which, in this part of North Carolina, resembles a brown, granular powder distinctive of South American heroin (Ciccarone, 2009). Nearly all (84%) respondents insisted they could discern heroin from fentanyl by its color. Respondents depicted a white/brown binary as a useful rule of thumb for discerning fentanyl from heroin, with 64% reporting ‘regular heroin’ is darkish brown and 48% avowing that fentanyl is mainly white or gray.

This white/brown binary, however, started to lose its standing as the chief signifier for distinguishing fentanyl from heroin. Respondents maintained that brown color was no longer a useful signifier for heroin as fentanyl's share of the illicit opioid market grew and heroin became more difficult to obtain. A few (about 20%) respondents insisted that fentanyl was being 'cut' with things to make it appear brown so it would pass as heroin when mixed with water. Numerous respondents vowed they could see coffee grains through careful examination and claimed they turned the drug a brown color in aqueous solution. Respondents also accredited the appearance of 'heroin' in numerous colors to the precipitous decline in the city's heroin supply, with green, lavender, and pink hues reported. While advertised as heroin, respondents insisted that all of the colored heroin was fentanyl because it produced the strong rush described above, but also because it resembled the fine, pharmaceutical-like powder they have come to recognize as fentanyl. A woman in her mid-twenties admitted consuming the pink 'heroin' and knowing immediately it was fentanyl because "the dope was really, really strong and it had that [fentanyl], you know, that taste...and because that's what people were saying who were buying it" (25-year-old woman).

Fentanyl was further distinguished from heroin by its texture as a fine powder with a shiny, pharmaceutical-grade appearance that stood in sharp contrast to the granular and rocky quality they attributed to heroin. Of the participants that discussed using texture to distinguish illicit opioids, 63% agreed that heroin was harder or chunkier than fentanyl, with fentanyl commonly described as a fine, white, off-white, or grayish powder, but this did not mean they could completely identify fentanyl by texture alone. One respondent painted a picture that captured what others described as the main difference: "Heroin is brown, almost always, or tan, and it looks more like the consistency of cocaine: rocky...and fentanyl's never going to be rocky or anything like that" (36-year-old man). Recognizing a drug's texture was acknowledged by most respondents as a viable way to distinguish fentanyl from heroin, with nearly two-thirds proclaiming they could differentiate fentanyl from heroin by a product's consistency alone.

Nearly half of respondents described using their sense of taste to distinguish heroin from fentanyl. The most direct technique was to generate flavor sensations in the mouth and throat by putting a small amount of drug on the tongue. This is done either by removing a nominal amount of drug from the package and placing it on the tongue or by licking a corner of the package after removing its contents. Irrespective of technique, all respondents who described the taste of illicit opioids agreed that heroin has a bitter flavor and often a vinegary smell that is easily recognizable, whereas fentanyl always tastes sweet or has a medicinal flavor: "I tasted it," said one respondent, "and was like 'it's not heroin.' Fentanyl's sweet" (36-year-old woman). Several respondents explained how flavor sensations develop in the back of the throat during the rush from intravenous injection, depicting the same binary that heroin is bitter and fentanyl is sweet in their descriptive comparisons of this post-injection taste.

Modifying Drug Preferences in Response to Fentanyl

In the wake of a rapidly changing heroin market, respondents described how their preference for particular drugs changed as fentanyl took over the heroin market. Nearly 30% acknowledged favoring heroin over fentanyl because it has a longer high, less sedation, and improved their motivation and capacity to accomplish daily tasks. Roughly 25% preferred fentanyl over heroin because the strength and potency of the rush, though there was unanimity that the fentanyl rush can often be *too* strong. Additional explanations centered around the difficulty of finding pure heroin or even heroin mixed with fentanyl. Respondents insisted that fentanyl is the only opioid currently available on the streets of North Carolina and several vowed that fentanyl is now the only opioid able to stave off withdrawal symptoms. Respondents aged 40 years and older were quite reluctant to disclose a predilection for fentanyl, highlighting other people's preferences instead. Twenty-eight percent acknowledged knowing people who preferred fentanyl to heroin with several maintaining that fentanyl is trendy for younger persons or neophytes with little to no knowledge of what 'real heroin' is actually like.

Fentanyl's growing dominance of the illicit opioid market had the effect of altering not only respondents' preferences for heroin but also their consumption patterns and drug preferences, particularly the increased use of illicit stimulants. The most common stimulant used was cocaine, with 72% reporting either smoking/injecting crack or injecting powder cocaine in conjunction with injecting fentanyl, and 44% reported co-using methamphetamine with fentanyl. Respondents described two approaches for co-using cocaine or methamphetamine with fentanyl: PWID either consumed fentanyl concurrently with cocaine/crack or methamphetamine during a single injection episode (i.e., 'speedball' or 'goofball' respectively) or the stimulant is injected or smoked independently from the injection of fentanyl and administered sequentially (i.e., one after the other) or in a staggered manner over a 24-hour period. One respondent's terse calculation demonstrates the utilitarian rationale for using opioids and stimulants sequentially rather than concurrently: "If I get too high on uppers, I like to come down with heroin" (25-year-old woman). Benzodiazepines represented the next highest percentage of non-stimulant drugs reportedly co-used with fentanyl (56%) followed by gabapentin (24%).

Of the non-opioid drugs used by respondents, cocaine/crack or methamphetamine were the only combinations portrayed as a direct consequence of fentanyl. Nearly all respondents maintained that fentanyl was substantially more sedative than heroin and produced tranquilizing effects that made daily functioning arduous. "It's so sedative," lamented one respondent, "and so heavy, you know; whereas heroin is lighter, and you can do a shot and then go down and talk to your parents if you need to, or drive [a car] if you need to, or do whatever you need to" (36-year-old man). Respondents claimed fentanyl was so sedative that it required another drug to counter the intense bouts of drowsiness that would frequently appear and without warning, particularly among people who were not seeking to be heavily sedated. "I'm the kind of person," revealed one respondent, "that I don't like to do it [opioids] and just sit and nod-off. I want to do it and, like, function and get up and walk around and talk and do things. And it's hard to do that with fentanyl because it's so sedative and heavy" (30-year-old woman).

Respondents insisted that stimulants, particularly cocaine and methamphetamine, offer a counterbalance by neutralizing fentanyl's unavoidable sedation and tranquilizing effects. One respondent described his method for co-using fentanyl with methamphetamine:

“There is stuff that I do to counter the sedative effects...I take speed, ya know, meth, but I usually do them [fentanyl and methamphetamine] separately, just because that way I can feel each one. The ideal situation would be, I would get up in the morning, maybe do a mixture of meth and heroin so I'm not sick in the morning, but I also get the speed so I can get up and get moving. I would continue to do meth throughout the day with fentanyl. Yeah, I'd probably do another shot of dope [fentanyl] that night, that evening, for maintenance”

(36-year-old man).

One respondent professed a similar rationale for using methamphetamine with fentanyl but in the context of reducing overdose risk: “Because it [the meth] is going to keep you awake, which is important when using fentanyl, since what overdoses you is that you fall asleep hard and then you stop breathing, you know, [and] your body basically forgets to breathe” (36-year-old man). Another respondent agreed that the use of methamphetamine was increasing among people using heroin and she similarly accredited it to fentanyl: “It's really heroin users that are crossing more into the meth scene, from my understanding, from what I've seen, they're crossing more because of the fentanyl” (35-year-old woman). (See Table 3 for more exemplar quotes related to co-using illicit opioids and stimulants).

Close to a quarter (24%) of respondents reported using gabapentin, an anticonvulsant and neuropathic prescription medication, to both enhance the opioid high and to minimize withdrawal symptoms. “I love gabapentin,” cited one respondent, “When I was in drug court, that's the only thing I could get away with, and I would get so high off gabapentin. They give me energy, it just makes me feel good. It [gabapentin] enhances the high from dope. It potentiates it. And they [diverted gabapentin] are cheap. Dirt cheap, \$1.00 apiece” (32-year-old man). While several respondents reported taking gabapentin to potentiate the effects from opioids, the ‘medical use’ of the drug to reduce withdrawal symptoms was cited most often. Two male PWID were interviewed together as intimate partners and recounted their process for taking gabapentin before entering treatment for opioid use disorder. “We make sure before we go [to detox],” said one man, “that we get a handful of gabapentin, about 500–600 Neurontins” (23-year-old man). “And we take them with us,” resumed his partner, “because otherwise the detox is so bad—this is what we've done the past couple times we've went. We take them only for withdrawal because they help” (36-year-old man). “Yeah, they kick withdrawals if you take them,” the first man concluded (23-year-old man). Another respondent likewise insisted that gabapentin's was effective in easing withdrawal pains, underscoring the benefit during early onset: “If I'm not feeling too good early on [during withdrawal], I can take those [gabapentin] and they make me feel a little bit better, less sick” (44-year-old woman). Indications for how much was needed to reduce the pangs of opioid withdrawal were provided but amounts varied. A 32-year-old man described taking anywhere between 900–1800mg at a time to ameliorate withdrawal symptoms while another man of 36 maintained that a higher amount of 2000mg was needed. Regardless of quantity, gabapentin's ability to lessen the dreadful pains of withdrawal, particularly the collection

of unnerving symptoms associated with early-onset, was the consensus among respondents who reported using gabapentin for ‘medical’ reasons to ease withdrawal symptoms.

Changing Patterns of Drug Consumption Techniques in Response to Fentanyl

All respondents found themselves using illicit opioids more frequently in recent years and most listed fentanyl’s short high as the key reason. A typical fentanyl effect from intravenous injection was generally described as a strong rush that came on quickly but then disappeared just as fast. “Kinda like shootin’ cocaine,” declared one respondent, “with a solid rush but no real lasting high to speak of” (33-year-old man). A strong rush with little to no high required respondents to consume fentanyl more frequently if they wanted to maintain the protracted opioid effect they were accustomed to receiving from heroin. Consequently, the cumulative number of daily injections performed by respondents rose substantially as did related physical harm. As one respondent bemoaned, “[t]he fact that I have to inject more is tearing my veins up. It’s harder to find places to shoot and I’m losing sensation in my fingers; my legs now swell because I’m using the veins in my legs” (44-year-old woman). (See Table 4 for exemplar quotes describing PWID’s behavioral responses to the increased risk associated with fentanyl use.)

Among the list of discomforts enumerated as reasons for modifying routes of administration, the need to reduce the number of injections demanded by fentanyl’s short high was most cited. Several respondents recounted staggering their injecting episodes with insufflating, either smoking or sniffing. A respondent lamented having to inject so often, saying, “I’ll get so damn tired of poking myself that I just wanna snort” (33-year-old man). And a respondent who regularly injects crack bemoaned having to smoke it for similar reasons, citing disparagingly, “I really, really like to shoot it [crack cocaine] but I just don’t have [useable] veins and I still have to shoot the heroin” (36-year-old woman). Respondents who used stimulants and opioids sequentially by smoking crack or methamphetamine between fentanyl injections related smoking as a tactic meant to save their veins for injecting opioids, claiming that stimulants increased the need for more injections and they wanted to reserve their veins for fentanyl because physical dependency demanded it.

Several respondents changed their preferred route of administration to reduce overdose risk, which involved switching from intravenous injection to nasal insufflation based on the logic that insufflation was safer. One respondent that switched from injecting to insufflation for safety concerns proclaimed, “the reason I don’t inject anymore is just because it’s safer, it’s just safer to smoke in general” (46-year-old woman). Yet others contended that insufflation, particularly sniffing, is just as dangerous as injecting. A respondent described witnessing a friend overdose from sniffing fentanyl, leading him to believe that nasal insufflation presents similar risks:

“I had a friend of mine, he was a young man, like 24 years old. I loved him like, you know, my son...and he died. He overdosed snorting it [fentanyl], the same way I did, you know. So just tell people, ‘Hey, number one, snorting is not going to save you.’ As a matter of fact, it might trick you and be a little bit even more dangerous because you don’t get that quick rush, you know, and it just builds up in your system”

(57-year-old man).

While respondents overwhelmingly maintained that injecting is less safe than sniffing, they also admitted to preferring injecting over nasal insufflation for several reasons: injecting offered a rush; injecting was more effective at getting rid of withdrawal symptoms; and injecting became a ritual component of their drug use.

Respondents generally preferred the immediate rush from intravenous injection to the slower onset of action generated by nasal insufflation. A respondent with 15 years of experience both insufflating and injecting drugs advised that “the highs are somewhat similar but the rush [from sniffing] is nowhere near what it is shooting it” (40-year-old woman). Another respondent concurred and added that she favored injecting during early-onset opioid withdrawal because “if you’re dope sick, it [the symptoms] instantly goes away as soon as you inject, compared to snorting when you got to wait, like, five, ten minutes” (25-year-old woman). A man in his mid-30s agreed that injection is quicker at easing withdrawal symptoms, declaring its rapid effect as the reason he switched from nasal insufflation to injecting. “It got to the point where I was using so much of it [fentanyl] snorting, that I didn’t have the money to get enough to get un-sick one day and had to shoot it up in order to get un-sick” (36-year-old man). A final reason for continuing to inject with higher frequency was because of liking the ritual of injecting itself. One respondent described this rationale: “It’s just the process, you know, it’s kind of like a science project. I just like the process of it [injecting]; the whole process. The needle is half the addiction” (25-year-old woman).

Beyond the need to manage fentanyl’s side effects, respondents also reported modifying their drug use behavior in ways that reduced overdose risk. The most common strategy respondents engaged in *after* their drugs were acquired was the *tester shot*, an eponymous act involving the injection of a smaller-than-normal amount of a drug initially to first check its potency, followed by *not using alone*. Yet one technique—patronizing the same drug seller—was submitted by several respondents as a *pre-purchasing* strategy. This practice involves buying from sellers who consumers know well, frequent regularly, and could entrust to disclose a product’s type and strength. More than half of respondents (56%) reported using the same dealer as a strategy, and, of these, most claimed to have a decent rapport with a number of sellers. Several respondents insisted that low-level, street sellers rarely knew what was in their products and just repeated what superiors told them to say. The relationship between sellers and consumers was depicted as reciprocal. Sellers would tell consumers what they knew about the product and consumers, in turn, would let sellers know if there was something about the product they should know. A respondent described his relationship with a seller thusly: “We’ve gotten so close to our main dealer, we were so tight with him, that he would call us to test his dope he would get and everything like that. We got to the point with him that we knew what we were getting; we knew if it was going to be cut with fentanyl; we would know exactly what it was going to be” (23-year-old man). This individual also stated that once, when using a fentanyl test strip to test his product, he found that it contained fentanyl and told the seller right away. “He [the drug seller] was happy to know,” said the man enthusiastically, “and even asked if they could get more fentanyl test strips to test future supplies.”

Discussion

The purpose of this qualitative study was to examine how PWID came to recognize and adapt to the rapid adulteration of North Carolina's heroin supply with illicitly-manufactured fentanyl. Overall, respondents identified a sudden and dramatic change in the potency of the opioids they injected indicated by a more powerful 'rush' and a relatively briefer 'high.' Respondents recognized changes in the drug product's physical appearance and began making associations between how the new 'heroin' looked and how it made them feel. The introduction of illicit fentanyl into the heroin market corresponded to changes in the hue, texture, and physical sensations commonly associated with heroin. The most pronounced difference was the extreme amount of sedation caused by recurring fentanyl consumption. Novel histamine effects were reported and described as "pins and needles" and a "warming of the head and neck" and identified as a component of the rush from intravenous injection. Respondents reported varied preferences for heroin or fentanyl but all agreed that pure heroin, i.e., heroin without fentanyl, was no longer accessible in the North Carolina market. Also noteworthy is the increased use of cocaine/crack and methamphetamine as a deliberate strategy to counteract fentanyl's heavy sedation. Lastly, respondents insisted that the current overdose crisis was inextricably linked to fentanyl and offered several homegrown methods to reduce overdose risk.

The sudden and dramatic change in potency was the most noticeable indication amongst study respondents that the "heroin" supply was in rapid flux. Respondents recognized the difference immediately and experienced the transformation of the illicit opioid market as changes in the bodily sensations they came to expect from heroin. Respondents agreed that fentanyl provides a much stronger 'rush' when injected compared with heroin but with a contrastingly shorter 'high,' lasting anywhere from several minutes to an hour. This characterization is consistent with fentanyl's pharmacologic profile as a synthetic opioid with high lipophilicity resulting in rapid onset of action and short duration of effect (Medscape 2005). In effect, the sequence of *rapid onset* and *short duration* characteristic of fentanyl translates to an effect accurately described by study participants as "a strong rush followed by a short high."

Respondents portrayed fentanyl's short duration of effect as an obstacle towards maintaining the opioid effect over time, citing its short high as the reason for needing to inject more frequently compared with heroin. The assertion by PWID that fentanyl is causing them to inject more often compared with heroin is consistent with recent qualitative and quantitative studies on the fentanyl crisis (Somerville et al. 2017; Mayer et al. 2018). Lambdin et al. (2019), for example, found that PWID in California wittingly consuming fentanyl were administering a higher number of daily injections compared with PWID who injected heroin but not fentanyl. Correspondingly, an ethnographic study by Mayer et al. (2018) discovered that PWID were injecting more frequently with fentanyl than heroin and identified fentanyl's short high as the reason. This emerging evidence indicates that the fentanyl crisis is facilitating changes in injection behavior that bode ill for the prevention of infectious disease among PWID, which is particular concerning given fentanyl's ubiquity in North American illicit drug markets. Increases in the number of times people inject per day has been shown to increase the frequency with which they are exposed to blood-borne

pathogens (e.g., HIV/HCV). Higher injection frequency arose in British Columbia due to escalating cocaine use in the 1990s and was associated with sharp increases in HIV infection among PWID (Patrick et al., 1997). More recently, a large HIV outbreak in Scott County, Indiana was facilitated by the prescription opioid oxycodone (Opana®) whose abuse-deterrent properties required more water to circumvent and multiple injections per injection episode (MIPIE) to consume (Broz et al., 2018). In view of these changes in injecting frequency, public health agencies need to incorporate (or expand) infectious disease prevention with existing overdose response strategies to both prevent emerging disease outbreaks (e.g., HIV) and reduce morbidity and mortality associated with existing epidemics (e.g., HCV).

In addition to the high, respondents described a number of novel physical sensations they experienced during the rush from injecting fentanyl. Descriptive accounts of the “fentanyl rush” were consistent among respondents and included novel physiological sensations and bodily locations where they presented. Commonly reported sensations included gradual warming of the upper chest that moves to the head and face; ‘prickly’ sensations like ‘pins and needles’ on the brow and crown of the head; a ‘dizzying’ effect often experienced as lightheadedness; and a tightening of the chest with occasional shortness of breath. Reports of chest tightness and labored breathing are particularly concerning because *angina pectoris* and *dyspnea* are established portents of respiratory depression while also serving as early indicators of fentanyl-induced chest wall rigidity/rigid chest syndrome (Burns et al., 2016; Phua et al. 2017; Zibbell et al., 2019). The presentation of ‘pins and needles’ and ‘prickly’ sensations is additionally noteworthy because this type of histamine-releasing effect differs markedly from the systemic itchiness (i.e., *pruritus*) commonly associated with opioid analgesia (Baldo & Pham, 2012). The ‘prickly’ sensations described by respondents presented exclusively during the ‘rush’ from intravenous injection and thus seem more akin to clinical case reports of *paraesthesia* as a side-effect of bolus fentanyl (Gupta et al., 2014) or medical research linking facial tingling, coughing, and other neurological complications to iatrogenic fentanyl pushes (Han et al., 2002; Kim et al, 2014). Several qualitative studies have captured comparable descriptions of ‘pins and needles’ stemming from the intravenous injection of opioids (Strang et al., 2010; Zibbell et al., 2021) and details of their presentation and bodily placement are concomitant with current study findings. The similarities between current study findings and existing case studies in the medical literature suggests that prescription fentanyl and IMF produce similar side-effects when intravenously administered. Yet, the fact that prescription and illicitly-manufactured forms of fentanyl produce analogous side-effects but are disconnected in the clinical case literature situates the medical community as a largely untapped resource that could help public health better recognize and respond to fentanyl toxicity.

Increased consumption of illicit stimulants, specifically methamphetamine and cocaine or crack, was reported by respondents and broadly portrayed as a direct consequence of fentanyl. The fentanyl high was commonly described as drastically more depressive than heroin with the capacity to generate unpredictable and overpowering bouts of heavy sedation. Fentanyl-induced sedation was explained as more akin to the intense drowsiness produced by benzodiazepines in contrast to the tranquil, semiconscious effect more characteristic of the traditional heroin ‘nod.’ Respondents described the heroin high as

‘energetic’ because it produces feelings of vigor that allow them to work or complete daily tasks, even when physically dependent. Fentanyl, in contrast, was criticized not only for its brief high but because of its capability to induce unpredictable bouts of unresponsiveness as an unwanted side effect. Respondents described how fentanyl made them too incapacitated to function and worryingly emphasized that they lived with impending fear that erratic fits of sleepiness would suddenly appear, without prior warning. For respondents, the unpredictable and uncontrollable nature of fentanyl-induced heavy sedation is what makes it exceptionally difficult to anticipate and control.

Faced with this challenging situation, respondents are intentionally mixing cocaine or methamphetamine with fentanyl by consuming them either concurrently or sequentially, contending that illicit stimulants are the only drugs capable of combating acute fentanyl sedation. Deliberately consuming illicit stimulants as a strategy to manage fentanyl sedation is consistent with a recent qualitative study identifying self-regulation and effect-management as primary motivations for co-using methamphetamine and illicit opioids (Lopez et al., 2021). Together, these qualitative results show that, on the one hand, illicit drug markets have the power to both influence consumer preferences for specific drugs and impact co-use patterns, and on the other showing that PWID are adapting to impersonal market forces by modifying the type and timing of drug consumption as a strategy to increase locus of control. Mounting evidence that PWID are using illicit stimulants to manage fentanyl-induced sedation provides much needed context to understand the recent surge in fentanyl overdose deaths that involve co-occurring illicit stimulants.

Current and recent qualitative findings suggest that the increase in overdose deaths involving both illicit fentanyls and illicit stimulants are largely due to intentional mixing by consumers and not driven by systemic adulteration of the illicit stimulant supply with fentanyl (Twillman et al., 2020; LaRue et al., 2019; Zibbell, Aldridge, Cauchon, et al., 2019). Previous studies have documented numerous cardiac-related outcomes associated with the use of cocaine and methamphetamine, including arrhythmias, myocardial infarction, and neurological effects like headache, seizure, and stroke. Cocaine toxicity is known to cause sudden overdose and death (Liu et al., 2018) but methamphetamine is conversely less toxic and considerably less lethal, mostly involving cardiovascular complications such as tachycardia, arrhythmias, and hypertension (Sexton et al., 2006). The growing co-use of stimulant and opioids represented in the current study and other recent investigations presents significant challenges for public health. A paucity of data on the health risks associated with the impact of concurring cardiac and respiratory effects demonstrates a lack of scientific understanding on the factors contributing to surging opioid overdose deaths involving illicit stimulants (Karissa et al, 2019). The growing involvement of illicit stimulants in opioid overdose deaths further confounds the ability to distinguish cause-of-death and the specific overdose risks associated with each drug class; similar to the way polydrug use heightens overdose risk and presents challenges for treating substance use disorders involving multiple drugs of abuse (Cicero et al. 2020).

Beyond stimulants, numerous respondents indicated using gabapentin with fentanyl. Gabapentin, an anticonvulsant medication, is increasingly being prescribed off-label to treat forms of neuropathy (e.g., restless leg syndrome) and chronic pain. Participants in the

current study reported using gabapentin to both potentiate the effect of opioids and to ease opioid withdrawal symptoms, although the latter was cited more often. Respondents' use of gabapentin to reduce the pangs of opioid withdrawal is consistent with contemporary medical literature that indicates its efficacy for ameliorating symptoms associated with opioid withdrawal, such as anxiety and restless legs (Andrews et al., 2001). For over a decade, addiction researchers in North America and Europe have explored using gabapentin to treat opioid withdrawal and clinical trials have shown it a viable, non-opioid option for relieving the intense pain associated with opioid detoxification (Behnam et al., 2012; Martinez-Raga et al., 2004), albeit with some indication of prolonged use causing physical dependency (Salehi et al., 2011). The growing use of gabapentin among PWID aligns with recent findings from epidemiological studies conducted during the current fentanyl overdose epidemic (Quintero, 2017; Stein et al., 2020). As PWID continue to use gabapentin medically to treat withdrawal symptoms or non-medically to potentiate the opioid effect, more information is needed to better understand consumer motivations behind these growing trends. Correspondingly, as doctors continue to prescribe gabapentin as a non-opioid alternative for chronic pain, and since it increasingly appears on overdose toxicology reports alongside illicit fentanyls and benzodiazepines (Nahar et al., 2019; Slavova et al., 2018), more research is also needed to understand gabapentin's contraindications with opioids and sedatives and the overdose risks associated with polydrug and polypharmacy use involving gabapentin.

Finally, this qualitative study discovered that PWID are exploiting relationships with drug sellers to exact information as to the contents of illicit opioids. The practice of consumers engaging sellers in order to glean information about the contents of illicit drug products has shown effectiveness in a growing body of literature. Consistent with current study findings, research indicates that PWID who have established trust and rapport with a consistent seller or sellers are more likely to know when illicit opioids contain fentanyl and more likely to engage in safer consumption behaviors (Bardwell et al., 2019; Carroll et al., 2018; Daniulaityte et al., 2019; Kolla & Strike, 2020). Several studies have documented PWID communicating fentanyl test strip (FTS) results to drug sellers who subsequently inform consumers (McKnight & Des Jarlais, 2018; Rhodes et al., 2019). Most recently, an ethnographic study found that drug sellers were concerned about overdoses amongst their clientele and viewed drug checking technologies like FTS as tools that could reduce overdose risk for customers (Betsos et al., 2021). This ethnographic investigation showed that when community-based drug checking with FTS was available, drug sellers demonstrated they were capable of reducing fentanyl-related risks for customers, including tailoring the drugs sold to consumers, returning dangerous batches, and modifying fentanyl-adulterated products to make them safer to consume (Betsos et al., 2021). Broadly speaking, these findings demonstrate that, contrary to popular opinion, people who sell drugs do not, as a population, want customers dying from the drugs they sell and will, whenever possible, take measures in support of their own self-interest to lessen unwitting fentanyl exposure and reduce overdose risk.

Understanding the interpersonal dynamics between seller and consumer, including the trend of consumers selling drugs to other consumers (i.e., joint-users), is critically important for apprising the efficacy of recent laws that hold drug sellers and 'joint users' criminally

liable for fatal overdose deaths. In North Carolina, for example, a recently enacted “Death by Distribution” law (Session Law 2019–83; House Bill 474) has resulted in ‘drug sellers,’ including co-using friends of the decedent, charged with felonious offenses from second-degree murder to manslaughter (Beety et al., 2019; Varner, 2019) for providing drugs to consumers who subsequently overdosed and died. These types of laws presume intentionality of wrongdoing or *mens rea* to demonstrate criminal intent on the part of the accused; for example, a person who adulterates illicit drugs with fentanyl to purposively harm and/or deceive consumers or to strengthen a drug product’s potency. Drug sellers, however, particularly the low-level suppliers involved in the majority of street sales, are largely unaware of the precise contents of drug products due to the bulk of mixing and packaging taking place higher-up on the supply chain (Drug Enforcement Administration, 2019). In light of this evidence, research collaborations with informed drug sellers are urgently needed to provide insight into the machinations of illicit supply chains and how the packaging and distribution of illicit drugs impacts overdose risk and public health. More specifically, research examining drug seller involvement in community-based drug checking efforts could explore whether collaborations with drug sellers can inform supply-side interventions to lessen consumer uncertainty and reduce overdose risk. A deeper understanding of illicit drug markets and the role drug sellers—particularly low-level personnel and ‘joint-users’—occupy in the packaging and distribution process could provide evidence to demand a higher level of juridical scrutiny for using *mens rea* to prosecute Death by Distribution cases (Goulka et al., 2021; Phillips 2020).

The current qualitative study provides a wealth of first-hand information about the fentanyl crisis in North Carolina from the perspective of PWID. In this way, current study findings contribute to a growing body of qualitative scholarship on PWID employing sensory strategies to detect and discern drugs. Similar to previous research demonstrating PWID’s capacity to accurately identify and respond to drug-related harms (Friedman et al, 2007; Somerville et al., 2017; Zibbell, 2012, Zibbell et al. 2021), current study respondents demonstrated a propensity for using sensory strategies to detect and distinguish fentanyl in illicit opioids by a product’s physical appearance and the physiological effects produced. Our findings provide important details about drug discernment by demonstrating how PWID employ a combination of sensory strategies and *a posteriori* experience as homegrown methods to identify fentanyl by color, texture, smell, and taste on the one hand and the type of rush and high on the other. These findings shed light on how consumers of illicit drugs invent techniques and behaviors to better navigate unpredictable markets when illicit opioid products are in constant flux (Zibbell, 2019) and when potency is difficult to gauge or control (Celentano et al., 2002; Mitchell et al., 2017). By illustrating how drug discernment employs a form of practical knowledge built upon sensory strategies and *a posteriori* experience, the current study complements current qualitative literature in the field demonstrating that consumers are capable of discerning fentanyl from heroin in illicit opioid products (e.g., Ciccarone, 2017; Daniulaityte et al., 2019; Mars et al., 2018; Zibbell et al. 2021). By expanding our understanding of the way consumers of illicit opioids employ strategies to detect fentanyl, combat unwanted side-effects, and reduce overdose risk, this study sheds much needed light on the need to include people who use drugs in research

studies and policy making as a community-based approach to strengthen the capacity and reach of harm reduction in the fentanyl era.

Limitations

The current study has several limitations. First, the sample was small (N=28) and recruitment was not random but purposeful due to our search for participants with experience injecting drugs and insider knowledge about illicit opioids and overdose risk. As a consequence, findings cannot be generalized to the population of PWID in North Carolina or elsewhere. Second, respondents were primarily Non-Hispanic White, which means findings may not be generalizable to other demographic groups. Still, our findings are consistent with comparable studies on fentanyl that involve primarily PWID of color (Rhodes et al., 2019), further indicating that PWID across socio-demographic groups are responding to the fentanyl epidemic in consistent ways. The demographic profiles of the current study sample represent the demographics of NSP participants at the time of enrollment, and similar to demographic profiles of PWID in recent epidemiological studies on opioids in Appalachia and the upper South (Carroll et al., 2017; Mars et al., 2017; Peiper et al., 2019; Zibbell et al., 2015). Even so, future studies should aim to continue this work using samples that represent diverse groups impacted by fentanyl (e.g., Latinx populations). Third, recall bias is likely when asking respondents to discuss how their knowledge of and experience with drugs evolved over the course of many years. Yet, recall problems were addressed with eligibility criteria that required study participants to have injected illicit opioids within the past 7 days at the time of enrollment (in contrast to the typical 12 months) and interview questions concentrated on discernment techniques and drug using behaviors currently used by respondents.

Future Directions

The consistency between the clinical and scientific literature on the fentanyl crisis and respondents' practical understanding of how changes in the opioid supply are fueling the overdose crisis demonstrates that PWID have knowledge of drugs and drug-related harms that are critically important to public health. This knowledge can be useful for informing research, interventions, drug surveillance, risk prevention strategies, and policy decisions. For example, consumer knowledge of illicit drugs and the ability to recognize supply-side changes in real-time can help researchers develop more accurate risk profiles for novel psychoactive substances and help strengthen frontline drug checking efforts that require human interface with illicit markets. Further, people who use drugs (PWUD) can help forensic toxicologists and behavioral epidemiologists compile more accurate profiles of new or emergent drugs, including novel sensations, nuanced side-effects, and potential health risks. Having more accurate profiles of novel psychoactive substances as they appear in (near) real time can aid in developing more timely and effective prevention strategies. Researchers and policymakers should consider collaborating with PWUD and other persons directly impacted by illicit drug use to help develop practical behavioral interventions and suitable policy solutions for ending North America's decades-long opioid epidemic.

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Table 1.

Key Indicators Identified by PWID of a Rapidly Changing Illicit Opioid Market

Key Themes	Exemplar Quote
Sudden change in product's appearance	Male, 33: This guy said he had ten pounds of heroin and just ran out. He went out of state and got some stuff, came back, and this is what he's got—pure white. China White is what they called it.
Saturation of illicit opioid market with fentanyl	Male, 36: I do fentanyl because I don't have a choice. The heroin that I buy, the heroin that everyone buys, has fentanyl in it. Therefore, if you want to do heroin, you have to do fentanyl. That's the way it is.
Unusual overdose presentations	Male, 23: We told him, 'Look, this shit's strong. He was sitting there and he was good, ya know—he got up and sat down in a chair. And I'm sitting there just staring at him the whole time and I'm seeing it [the overdose] happen. And I'm like, 'He's overdosing right now!' Right in front of me. Male, 36: And all of a sudden, I watched his eyes go back in his head and he tipped right over and his mouth starts foaming. His mouth was blue and was foaming. I've never seen anything like that. So suddenly. Male, 23: And we had to Narcan him three times. *
Inconsistent Potency	Female, 25: The same dope will last about maybe a month and then it changes, and it's either stronger or weaker.
Change in physical sensations	Male, 36: Once in a while, when I will shoot the stuff I'm getting now, I'll get kind of a tingly sensation in my head. And come to think of it, the dope I was doing back then [before fentanyl] didn't do that at all.
Scarcity of prescription opioids	Male, 46: The market here in Greensboro has went from where anywhere you could go, you could find [opioid] pills, to where, of course, now, because the pills have depleted, the heroin has become more popular. I mean, it's everywhere.
Changes in physical sensations	Male, 57: Well, it's changed, you know, quite a bit since then. The stuff you get nowadays ... you go to see the man one day, he's got something, and the next day he's got something totally different. But what I noticed was when you got some back in the day, it seemed more potent. It was more of a classic high with an opiate.
Increased overdose risk	Male, 57: I think the stuff that's out nowadays is actually more dangerous than what it was back then. I mean, I see more people dying, especially young people, and it's because they're doing it, coming down and doing it, and then they're going to get some one time that's a stronger, or a little different, and it's going to kill them.
Increased overdose risk	Female, 44: We dealt with the same guy [drug seller] for a year and we noticed that fentanyl was slowly being introduced. We didn't know anything about fentanyl; what we had heard about fentanyl was scary as hell. It's ten times stronger than morphine, that's what we kept hearing. And we just kept hearing that people were dying from it and that it was scary.

* These statements were from a single interview involving two PWID who were intimate partners and recorded together. They recounted their experiences by joining and finishing each other's statements and thus included here as a joint quotation.

Table 2:

Physiological sensations identified by PWID as indications of a changing heroin supply

Key Indicator	Exemplar Quote
Strong Rush	Male, 34: Yeah, it's the rush; it's almost like a warm, real rush. If you do too much, sometimes it can almost be like a massive rush, and then it's almost like a panic state.
Strong Rush	Male, 36: Fentanyl hits you so hard. There's a fear associated with it.
Tingly	Male, 36: The 'pins and needles' doesn't ever hurt for me. It's more just like a tingly sensation in my head.
Sedation	Male, 33: The first time, I'd just been injecting about two or three months and I did this little sprinkle of fentanyl and it just about put me out [made me overdose]. And I told you I've never nodded out on dope [heroin without fentanyl].
Heavy sedation	Male, 33: I'm seeing people shoot up and they're fucking drooling. I see people standing on their tip-toes and just drooling. I don't even see how they're not falling over; 10–20 minutes just standing there. Then, they finally snap out of it and start walking around like nothing happened. So I tell 'em, "Man, you're going to die doing this new stuff. Man you look dead." Unfortunately, he did die.
Short High	Female, 36: Fentanyl hits you right away but it doesn't last. I think when they put the fentanyl in the heroin, it cut the half-life. Because nothing lasts...nothing. If you got something that lasts for more than ten minutes [after the initial rush], you found some really amazing shit.
Short high causing more injections	Male, 23: But I'll tell ya one thing, the thing that blows my mind, I used to not like fentanyl because it wears off faster than heroin. It's so short lived and doesn't last as long, so people use more, a lot more—every fucking 30 minutes to an hour.
Ability to Function	Male, 36: I'm not saying heroin doesn't make you nod; if you sit down and relax, you know, you'll probably get a nod going. But as long as you're moving, you're up and talking, it's not as bad. I guess it [the heroin] is easier to function on.
Scary rush	Male, 36: Well, you know, when you inject it [fentanyl], you get this feeling and it hits you so hard that, you know, you immediately start thinking, "Oh shit, what have I done? What have I done?" You start getting kind of scared. You go look in the mirror and you're like, you know, red and sweating and, shit, you're like, Oh my God."
Acute Respiratory Distress	Male, 34: The fentanyl is almost like a scary feeling. I mean, I went to this guy at 10:30 in the morning, got a little something from him, and then at 3:00 in the afternoon went back to him and got something completely different. And then I would do it, and as soon as I would do it, it was almost like an instant: 'Oh, shit, this might be too much.' It's almost like a [gasping sound performed], like you can't breathe. I mean you feel beads of sweating coming, building up on you, like you get kind of panicky, things get kind of dark.

Table 3.

Consumer motivations for co-using cocaine/crack or methamphetamine with fentanyl

Stimulant Type	Exemplar Quote
Methamphetamine	Female, 35: I think people are using more meth to counteract the fentanyl because it's going to wake you up more. People are, from what I hear, they're doing meth now with their heroin to counteract the fentanyl.
Methamphetamine	Male, 33: Yeah, as methamphetamine goes now, everybody calls it ice and it's definitely out there. I would say eight out of ten people that inject heroin love to do ice because it's a speedball, you know, you speedball it. ... Me personally, I like to rush off one and then I wait a while and I like the rush off the other.
Methamphetamine	Male, 23: 'Hey, if you want to get off heroin, meth's a great way to do that.' You're going to get sick, you're going to feel the withdrawals from the heroin because, I mean, meth, what that? It gives you a very short lived high but the effects of it last way longer than the high does."
Methamphetamine	Male, 36: Heroin's my drug of choice so that would be what I would fiend for. These days the meth I do to counteract the sedation [of fentanyl] and, well, just because it's there.
Methamphetamine	Male, 44: Well, I do the meth if I'm sick and can't find heroin.
Crack	Female, 44: We break the crack down. We call them 50/50s. Because sometimes, you know, it's like we'll tell each other, "I don't want to go to sleep," because, you know, when you wake up you're not going to be feeling good.
Mixing illicit stimulants with fentanyl	Male, 36: Most people [who use both stimulants and opioids], they're not going to mix them and do them together at the same time, they're going to do one and then the other. They're going to, like, do it and get that good rush from the fentanyl. And they're going to feel it for a little bit, then they are going to do them up when they start to fall asleep. See, I've never personally met anyone that wants to do it in the same shot. Male, 23: Another reason, too, so they know how much of each is in it [the shot], so they can control how awake they're going to be or how much fentanyl is going to make them tired.*
Cocaine	Male, 47: I just don't do this fentanyl by itself. What I'm doing is so strong that if I were just doing it by itself, that I couldn't probably get my head out of my lap and deal with my day. I don't want to be just zonked out, you know.

* These statements were from a single interview involving two PWID who were intimate partners and recorded together. They recounted their experiences by joining and finishing each other's statements and thus are included here as a joint quotation.

Table 4.

Practical responses employed by PWID to avoid harms from injecting fentanyl

Key Theme	Exemplar Quote
Managing Inconsistent Potency	Male, 33: When I first got around fentanyl, my guy told me, he said, 'Just do a little bit and work your way up.' And I said, "Why?" He said, 'Lookout in the parking lot, there's one of my guys that I just sold it to.' So I looked over there and his head was leaning out the window, drooling. 'He did the whole \$20; I told him not to,' [he said]. When you experience different drugs, or what I do when I do a different kind, because a drug dealer will have a certain amount of dope for a good amount of time, and it'll get switched up, so ya never know. It's always good to start little and then work your way up....You can OD on just a tenth of a gram.
Visual Inspection	Male, 23: Yeah, it took us a while, but we got to the point where we could look at it before doing it and tell if it had fentanyl in it. See, most of it around here...if it's white or very lightish color, that would technically be fentanyl. If it [the solution] pulls up clear, kind of yellowish color, we can tell it has fentanyl in it.
Visual Inspection, Tester Shot	Male, 44: Any time I do go to the dealer and it is something different and he hands it to me, when I dump it out, if it even looks different, I won't do nearly as much. I'll do a little bit first to make sure, because it only takes that, just one time, for one batch, you know [to overdose]. Then I know he didn't step on it, didn't cut it, or it wasn't cut before it got to him, so now it's, you know, triple pure, or more pure than the last stuff. So, any time I do get something different that I do, I don't do some huge fat shot
Recognizing and Responding to Fentanyl Overdose	Male, 34: There were times when we were at the house and she would do a shot. And she'd be fine. And then I would be sitting beside her and I'm doing the next shot and the next time I would feel something hitting [me], and I look over and she's, you know, foaming at the mouth, and I say, "well, fuck," and I get up, draw the Narcan up, give it to her, sit back down and I finish drawing up my shot up....I'm not going to get like super excited like, Oh my god, what do I do? "Oh my," ya know, I got you, don't worry. I've seen it a thousand times and know how and when to respond.
Changing Route of Administration	Male, 27: I'm like: "You can't shoot it," because she pulled out a needle and I then said again: "I'm not letting you shoot—you'll die." And she's like, "No I won't. I use heroin [sic] every day and I inject." And I'm like, "Okay, well if you want me to give it [the 'heroin'] to you, you're going to snort it, and I'm going to stand right here beside of you and watch. And if you don't snort it, I'm going to take it from you, and will not give it to you to shoot because I'm not going to have you dying on the fucking courthouse steps with me beside you."
Tester Shot	Male, 33: You get one-tenth of a gram, you take that one-tenth, and say if you don't know and your people say it's really good dope, make sure to break that one-tenth into five little piles and then take one pile and try that. I would inject the first one to see how big of, how high I'll get off that one. If I didn't get high off it, then I know I can probably do the whole thing.
Using the same seller	Male, 46: We've gotten close to our main dealer and we were so tight with him that he would call us to test the dope that he would get and everything like that. We got to the point that we knew exactly what we were getting, we knew if it was going to be all fentanyl or cut with fentanyl...Using the same dealer, you use them over time and it builds a bond of trust, and it's so much on a dealerto-client basis, you know it more like a personal basis
Not Using Alone	Male, 40: Me and my better-half [girlfriend] have a policy that we only get high together so just in case one of use goes out, someone is there [to administer naloxone]
Not Using Alone	Male, 33: It's like if she [my girlfriend] goes off to go get dope and she stops because she's so dope sick [in withdrawal] and at a store, she calls me; she puts me on speaker phone, she tells me where she's at. 'If I don't hear nothing back from you' [I say], 'at least I know where to call an ambulance and where to send them'

* These statements were from a single interview involving two PWID who were intimate partners and recorded together. They recounted their experiences by joining and finishing each other's statements and thus included here as a joint quotation.