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## Heroin uncertainties: exploring users' perceptions of fentanyl-adulterated and -substituted 'heroin'

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### Abstract

**Background**—The US is experiencing an unprecedented opioid overdose epidemic fostered in recent years by regional contamination of the heroin supply with the fentanyl family of synthetic opioids. Since 2011 opioid-related overdose deaths in the East Coast state of Massachusetts have more than tripled, with 75% of the 1374 deaths with an available toxicology positive for fentanyl. Fentanyl is 30–50× more potent than heroin and its presence makes heroin use more unpredictable. A rapid ethnographic assessment was undertaken to understand the perceptions and experiences of people who inject drugs sold as 'heroin' and to observe the drugs and their use.

**Methods**—A team of ethnographers conducted research in northeast Massachusetts and Nashua, New Hampshire in June 2016, performing (n=38) qualitative interviews with persons who use heroin.

**Results**—1) The composition and appearance of heroin changed in the last four years; 2) heroin is cheaper and more widely available than before; and 3) heroin 'types' have proliferated with several products being sold as 'heroin'. These consisted of two types of heroin (alone), fentanyl (alone), and heroin-fentanyl combinations. In the absence of available toxicological information on retail-level heroin, our research noted a hierarchy of fentanyl discernment methods, with embodied effects considered most reliable in determining fentanyl's presence, followed by taste, solution appearance and powder color. This paper presents a new 'heroin' typology based on users' reports.

**Conclusion**—Massachusetts' heroin has new appearances and is widely adulterated by fentanyl. Persons who use heroin are trying to discern the substances sold as heroin and their preferences for each form vary. The heroin typology presented is inexact but can be validated by correlating users' discernment with drug toxicological testing. If validated, this typology would be a valuable harm reduction tool. Further research on adaptations to heroin adulteration could reduce risks of using heroin and synthetic opioid combinations.

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## Keywords

heroin; fentanyl; opiates; overdose; mortality; qualitative research

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## Introduction

The United States has seen a dramatic increase in the adverse consequences of heroin use. Between 2010 and 2014 heroin-related overdose mortality rates tripled nationally from 1.0 to 3.4 per 100,000 (Rudd et al. 2016), increasing another 20.9% from 2014 to 2015 (Rudd 2016). This epidemic is intertwined and overlaps with the larger prescription opioid misuse epidemic that preceded it (Unick et al. 2013, Compton, Jones, and Baldwin 2016). That a portion of the at-risk population is transitioning from one source of opioids (prescription pills) to a fully illicit source (heroin) is supported by both qualitative (Mars 2014) and quantitative studies (Cicero et al. 2014).

Adding fuel to this fire is the emergent and intensifying contamination of the heroin supply with powerful synthetic opioids, especially fentanyl and its chemical analogues (Drug Enforcement Administration 2016a). Fentanyl is the central chemical in a family of over twenty analogues; it is a synthetic opioid with potent  $\mu$ -receptor activity, registering 30–50 times more potent by weight compared with heroin (lead author calculation).

National overdose deaths attributed to fentanyl began to rise in 2013 from a stable level of approximately 1600 annually in 2010–2012 to 1905 in 2013 and then by a further 120% to 4200 in 2014 (Warner et al. 2016). In opioid overdose deaths, heroin replaced oxycodone as the number one cause as of 2012 and fentanyl moved from 9<sup>th</sup> in 2012 to 5<sup>th</sup> most common opioid in overdose deaths in 2014. Of the deaths primarily attributed to fentanyl, 64% had two or more concomitant drugs identified: heroin (23%) was the most common with an additional 9% co-attributed to morphine (i.e., a breakdown product of heroin and a few other semi-synthetic opiates as well as morphine itself) (Warner et al. 2016).

Drug seizures data from the US Drug Enforcement Administration's (DEA) National Forensics Laboratory Information Service (NFLIS) reveal the increase in illicit fentanyl supply: among samples tested, fentanyl reports increased from approximately 600 annually during 2010–2012 to 14,051 in 2015. Much of this increase (1400%) occurred between 2013 (934) and 2015 (14,051). The most frequent fentanyl analog noted in the most recent NFLIS report is acetyl fentanyl with 2412 reports in 2015 (Drug Enforcement Administration Diversion Control Division 2016).

Connecting drug supply evidence with public health outcomes data, a study from the US Centers for Disease Control and Prevention (CDC) reports a positive correlation ( $r = 0.95$ ) between rises in NFLIS fentanyl reports and increases in synthetic opioid (non-methadone) death rates in 27 US states, 2013 to 2014 (Gladden 2016). The fentanyl responsible for these deaths is likely manufactured illicitly rather than pharmaceutically; while seizures of illicit fentanyl have increased (Drug Enforcement Administration 2015a), there is no correlation between fentanyl prescription rates and the rise in synthetic opioid deaths (Gladden 2016).

There is a strong regional pattern in the fentanyl epidemic; three US regions had the highest year-over-year increases, 2013 to 2014, in synthetic (mostly fentanyl) overdose deaths: Northeast (Massachusetts, Maine, and New Hampshire), Midwest (Ohio), and South (Florida, Kentucky, Maryland, and North Carolina)(Gladden 2016). The US Northeast and Midwest regions also have the highest rates of heroin-related overdose death (Hedegaard, Chen, and Warner 2015) and hospitalizations (Unick 2017)].

Massachusetts, the focus of this study, had the second highest increase in synthetic overdose deaths of the 27 states examined by the CDC. The state reached a pinnacle opioid death rate in 2015: 25.8 deaths per 100,000 residents, a 32% increase from 2014 and a tripling in the rate since 2010. Fentanyl was found in 75% of opioid overdose deaths cases with available toxicology (Massachusetts Department of Public Health 2017).

The aim of this research was to gain an understanding of the experiences of heroin users living through this public health crisis. We chose qualitative inquiry given the extensive unknowns in this rapidly changing environment, thus, our research questions are broad, eg, how has heroin changed? And, what are users' experiences with this new 'heroin'? The perspectives of persons who use heroin have been largely missing from the discussion of the current heroin/fentanyl crisis and can provide important insights into changes in the heroin supply and other aspects of the risk environment. For instance, recent qualitative research among heroin injectors in Baltimore showed that new forms of 'heroin' are perceived as highly variable and unpredictable, resulting in a range of responses and strategies (Mars forthcoming). We relate here users' experiences with and perceptions of fentanyl-adulterated and -substituted 'heroin' (FASH) and other heroin types in Massachusetts.

We report on fieldwork, including qualitative interviews with active heroin users, performed in three towns in Massachusetts in June 2016. We chose Massachusetts and the specific field sites based on the above statistical data as well as preliminary findings, since published, from an ethnographer, regarding local fentanyl use and overdose (Zibell 2016) (Somerville N J 2017). The rapid ethnographic approach used here allows for brief but meaningful immersion into the lives of an affected marginalized population (Needle et al. 2003, Rhodes et al. 1999).

## Methods

'Rapid ethnographic assessment' is a form of highly focused ethnography which enables researchers to gain in-depth knowledge about a rapidly emerging health problem in a short period of time (Harris, Jerome, and Fawcett (1997). It has a record of success in both domestic and international settings (Trotter et al. 2001). The *Heroin in Transition* study (NIH/NIDA R01DA037820, PI: Ciccarone) uses a rapid assessment approach to specifically investigate reports of new and evolving heroin types, described in greater detail in Mars et al (Mars forthcoming).

Following information about high levels of 'heroin'-related overdose in Massachusetts, contact was made with local harm reduction services in the north eastern cities of Worcester, Lowell and Lawrence. Data were collected through semi-structured interviews and

ethnographic observation carried in June 2016. Recruitment in Massachusetts was aimed at gaining an overall impression across sites chosen. Choice of sites was also aimed at avoiding duplication of the recent study in south eastern Massachusetts, see (Somerville N J 2017). Initially New Hampshire was intended to comprise a contrasting location in the study. However, once interviews revealed that New Hampshire's heroin was supplied from Massachusetts, a decision was made to focus the remaining recruitment solely on the Massachusetts sites.

With the help of staff from local syringe exchanges and other harm reduction workers, individuals using heroin were recruited during the course of their daily activities including living at a homeless encampment, sitting around outside, meeting up with friends, as well as visiting harm reduction services. Most were introduced to the researchers by harm reduction workers but some snowball sampling was also carried out. Sampling of the target population was more successful in Lawrence and Lowell than in Worcester.

In order to be eligible for the study, participants had to be at least 18 years of age and self-reported current heroin injectors either living in or commuting to Massachusetts. Particular efforts were made to recruit women who are often under-represented in substance use research. Interviews were conducted in Spanish and English, depending on the interviewee's first language. Spanish language interviews were transcribed, translated and analyzed by ethnographer Fernando Montero.

The semi-structured interviews were carried out by a team of three ethnographers and the PI (DC) immediately upon recruitment. Interviewees received a small cash sum of \$20–25 in compensation for the time it took to conduct each interview (approximately 0.5–1 h). All participants were interviewed at least once while some provided additional in-depth interviews and neighborhood tours. A minority of participants were asked and consented to being filmed during drug preparation and injection sequences in various locations including homeless encampments, inside tents and in the researchers' car. Various criteria were involved in decisions about filming injecting, including practical ones regarding available locations, privacy, scheduling and personal safety considerations.

An interview guide provided a general structure to the conversation, including questions on the respondents' history of drug use, a typical day in their life, perceived changes in the heroin supply, knowledge of fentanyl, methods of use, preferences in heroin type, perceived effects of heroin vs. fentanyl, historical changes in the local heroin scene and medical complications including experiences of overdose. Further questions were generated by the interviewees' responses. During the interviews, respondents were shown swatches of paint colors in themes of white, grey, brown and beige to identify the colors of 'heroin' they had encountered both dry and in solution. These were used to compare responses across the interview data. The color range shown was based on previous ethnographic studies (Mars et al. 2016, Mars forthcoming).

Thirty-eight current heroin injectors were interviewed and five injection sequences were filmed. All interviews were audio recorded and transcribed in their totality. JO verified transcriptions against the audio recording for accuracy. Data not captured by audio or video

recording were extensively documented using written fieldnotes. Detailed observations were made of the participants' lived environments, the social aspects of drug use and the appearance and use of the substances. Fieldnotes were drafted collaboratively at the end of each research day and finalized after the trip.

Analysis of the data was discussed weekly by JO and SM who then produced analytic memos for each interview, see (Christopoulos and Jaiswal 2015), swapping them to add further analytical contributions. Our analysis was inductive, based upon observations from which patterns are discerned and inferences made. Thematic categories were derived from the interview guide and the fieldnote documentation. The first author selected key aspects of the findings for analysis and drew out their significance.

The analysis foregrounded the ways in which people who inject drugs in Massachusetts experience 'heroin' at present, using the consistencies of their responses to construct a picture of their shared reality. The University of California, San Francisco Committee on Human Research approved the study protocol and a Federal Certificate of Confidentiality issued by NIH/NIDA protects the data (and its collection).

The sample of 38 current persons who use heroin included 23 men and 12 women. Of those stating their ethnicity, 16 were white, 3 were African-American, 10 were Hispanic and 7 were of mixed ethnicity. Their ages ranged from 19 to 52 years old. Participants reported using heroin from less than 1 year to 35 years.

## RESULTS

### Locations

The fieldwork was conducted in three locations: Worcester in central Massachusetts, the second most populous city in the state; Lowell—the state's fourth most populous city—and Lawrence in northeastern Massachusetts. Lowell and Lawrence, situated in the Merrimack River Valley, were historical centers for textile milling, while Worcester was a prominent large-scale manufacturing hub. All three cities have been severely affected by post-WWII deindustrialization in the region and have experienced uneven economic recoveries. Lawrence and Lowell share long histories of immigration and labor conflicts, but the economic prospects of the two cities have diverged in recent years. Lawrence has the highest poverty rate of the three cities at 29% (United States Census Bureau 2015). The three towns also vary by the ethnicity of their populations. Nearly three quarters of the Lawrence population is of Latino descent (primarily Dominican and Puerto Rican), much higher than the two other fieldsites, which are predominantly white.

Massachusetts has had syringe exchange programs since 1993, and began a peer-naloxone distribution program in 2006 (Seal et al. 2005, Walley et al. 2013, Doe-Simkins et al. 2009). Of the fieldsites, only Worcester had an official syringe exchange program, begun in early 2016 (Kotsopoulos 2016), while Lawrence and Lowell had informal syringe access and naloxone distribution programs.

In Massachusetts, Southeast Asian and Southwest Asian heroin shared the market until the mid to late 1990s when the northeastern US became almost exclusively supplied by South American-produced heroin (Drug Enforcement Administration 2015c). Lawrence and Lowell, in the Greater Boston area, have been among the primary regional distribution points since at least 2001, while Worcester is considered a secondary distribution center (National Drug Intelligence Center 2001). The proximity of Lawrence and Lowell to towns in southern New Hampshire near the Massachusetts border has contributed to a commuter narcotics market, centered in Lawrence. Dealers are noted for actively marketing to young, white visitors from New Hampshire, believed to be visiting to buy drugs:

Like all you need to do is have New Hampshire plates and drive through Lawrence in certain areas. And if you don't have a drug dealer down there you have a lot of people throwing [free] samples at you and giving you their number.

Q: Yeah, they're profiling you just because of the plates or also because you're white?

A: Because I'm a white, young girl with New Hampshire plates... They're very aggressive. They know what you're down there for. They're very good at picking out why you're down there.

(Rachel, woman in her 20s, injecting heroin for 5 years)

The ethnographers observed that this echoed earlier research carried out in Philadelphia which found heroin distribution concentrated among particular ethnic groups by ethnically and economically segregated neighborhood, and visitors of conspicuously different 'race' liable to suspicion by residents of being drug customers (Rosenblum et al. 2014).

### Rise in 'heroin' variants

In the last few years, like since 2013, 2014 [heroin] has changed a lot.

(Hector, man in his 40s, using heroin on and off for 26 years)

Interview data on the introduction of perceived fentanyl-adulterated or -substituted heroin (FASH) into the regional heroin supply point to around 2013 as a pivotal time. Long-time injectors in Massachusetts indicated that historically heroin was a tan or brown powder which when mixed with water became a medium-to-dark brown solution. While still in powder form, users broadly noted changes in heroin powder and solution color, as well as perceived physiological effects.

Although long-term users reported variable heroin quality since the early 1990s along with periodic instances of FASH, they described major changes since around 2013. These constituted a proliferation of 'heroin' variants in powder heroin from the traditional source-form, with FASH making up a significant, possibly dominant portion of the heroin marketplace. Here Larry, a man in his 30s using heroin for 18 years, described its increased adulteration with synthetics:

Q: So the heroin that is out there right now, how long has that been around? Have there been any changes?

A: No, it's been changing, like 3-1/2 years ago, maybe 4. 2012–2013, it's like that's when like the bullshit started coming in. Like motherfucker's realized, if I got 3 grams of dope I can put 3 grams of bullshit on it.

Q: What do you mean by bullshit?

A: Like cut. Well, the fake cut or fentanyl or whatever [...]

Users' recall of the timing of this most recent emergence of FASH corresponds tidily to data on rises in the regional fentanyl drug supply (Drug Enforcement Administration 2016b, 2015b) and Massachusetts' sudden rise in heroin- and synthetic opioid-related overdoses (Gladden 2016).

### Perceptions of fentanyl in the heroin

*I guess you could say that when you shoot it you could tell the difference between fentanyl and dope.* (Bud, man in his 30s, injecting heroin for 3 years)

There was a widespread perception among our sample that fentanyl was commonly present in the heroin supply. This belief had arisen amidst a context where heroin's appearance and perceived effects had changed, users were losing companions to overdose and local news was extensively reporting fentanyl overdoses.

The term "China White" was originally used to describe a highly refined form of South East Asian heroin (Ayres, Starsiak, and Sokolay 1981) and can refer to any light colored powder heroin (Mars et al. 2016) but has also been applied, sometimes wishfully or unwittingly, to fentanyl and fentanyl analogs sold as heroin since at least 1980 (Kram 1981). In Massachusetts, the term China White was also used in contradictory ways, applying sometimes to what was assumed to be actual heroin in white powdered form and often to suspected fentanyl-substituted heroin. Licit fentanyl salts appear as white granular or crystalline powders (European Monitoring Centre for Drugs and Drug Addiction 2015).

The confusion over whether there was white heroin in circulation in Massachusetts complicated the possibility of visual identification in some users' minds, but, like Bernard, a long term user in his 50s, some asserted that the difference could be detected by tasting a small amount in their mouth:

Q: Can you tell when there is fentanyl in [the heroin]?

A: Yeah, fentanyl tastes sweet [...] And heroin is very, very bitter. It has a real strong bitter taste. Fentanyl is sweet.

Q: Does it look different?

A: Yeah, fentanyl is white and heroin can be white too but like I said when you taste it, you can taste the heroin compared to the fentanyl.

The common observation that fentanyl was sweet may be due to some quality of the illicitly produced fentanyl itself or perhaps to the presence of a sugar diluent such as lactose whose taste is not masked by heroin.

Users described a set of embodied experiences that they associated with fentanyl, which contrasted with those from heroin. Participants noted three primary differences: perceived fentanyl had a more intense ‘rush’ (i.e. explosive onset of strong opioid effect), greater potency and a shorter duration of effect than heroin, typically 1–2 hours. These effects are in accord with known licit fentanyl pharmacodynamics. Jackson, a man in his 20s injecting heroin for 9 years, gave a typical answer: “[Fentanyl] has an excellent rush. The rush is way better than heroin but it only lasts a couple hours then you’re sick again. [...] Heroin will last half a day.” Zach, also in his 20s and injecting heroin for 9 years, differentiated the onset of heroin from that of fentanyl: “it’s like a head rush with fentanyl opposed to like a body rush with the dope [heroin].”

Some users were caught off-guard by FASH’s emergence. Hector, a user-dealer, was surprised by the presence of fentanyl in the heroin he sold, which had been added farther up the supply chain. He found out from his Suboxone treatment program that he had fentanyl in his system:

We’re supposedly buying dope that doesn’t have any fentanyl in it, but when I started showing up dirty with heroin, I [also] started showing up dirty with fentanyl... When we cut the dope, we don’t use fentanyl. The problem was that we were buying the dope already dirty with that and we didn’t know it.

A ‘dirty’ urine usually refers to a sample that is positive for prohibited drug use, and may have disciplinary consequences, but Hector also uses the term to describe adulterated heroin and quotes his boss contrasting the ‘dirty’ fentanyl and his own ‘clean’ cut: “I don’t even know what the hell fentanyl is. I don’t use that to cut my dope and you know it. I cut my dope with a clean cut”. Here, Hector’s account of his boss’s distinction between ‘dirty’ and ‘clean’ presents fentanyl as a pollutant (Douglas 1966, this edition 1984).

### **Users’ preferences for ‘heroin’ vs. ‘fentanyl’**

The rush [from fentanyl] is incredible... you really feel like you’re King Kong or Godzilla. The rush is 10 times stronger.

(Darryl, man in his 50s using for 15 years)

Respondents expressed a wide range of opinions on the type of ‘heroin’ they preferred, based on duration of effect, variations in embodied experience, efficacy in pain management, perceived risk of overdose and availability. Among proponents of perceived fentanyl, the powerful rush sensation mentioned above was always listed as among the principal benefits of the substance.

The primary negative quality of FASH was its short duration. Julie, a woman in her 20s, injecting for one year, disliked the intensity and preferred a slower, steadier effect associated with heroin: “I like stuff that has legs, that lasts a long time and not like a quick rush... I’m looking for legs; I’m not looking for the rush.” Even those who regarded the effects of perceived fentanyl favorably acknowledged the disadvantages of a shorter-acting product. “The fentanyl feels good. [It] feels a lot better, but you get sick a lot faster, like a lot faster. It’s like a very noticeable difference” (Kristin, a woman in her late teens, using heroin for 5 years). Some disagreed, believing that fentanyl was simply an inferior substitute for heroin:



“It’s like a shitty bag of dope. And the rush ain’t nowhere near as intense” (Dana, woman in her 30s using heroin for 17 years).

Surprisingly for the ethnographic team, only one respondent explicitly mentioned avoiding fentanyl because of the increased costs of injecting more frequently. However, given the daily cycle of raising money to pay for each shot that characterized many of these users’ lives, the disadvantage of fentanyl’s more frequent shots likely implied this economic component. Concerns about becoming sick more quickly and needing to inject more frequently deterred some users, but others described the appeal of immediate gratification over other considerations:

A: You’ll just get people that no matter will still gravitate towards the fentanyl. Whatever will give that most intense rush and intense feeling yeah then they’ll pick that.

Q: And they don’t mind having to use more during the day?

A: It doesn’t seem that way. You really kind of don’t think about it then anyway at the moment.

(Angela, woman in her 30s injecting heroin for 2 years)

A few respondents reported nuances in the duration of fentanyl’s effects separating the euphoria from the drug’s ability to stave off opioid withdrawal symptoms. “Fentanyl, it’s like the initial high is only like an hour or two, but I don’t get sick for like at least 6–7 hours after.” (Zach) Albert, in his injecting since the early 1990s, also believed that he had experienced longer lasting fentanyl effects: “It’s just more steady. It doesn’t fade off quick. It lasts a little bit longer.”

The greater potency of perceived fentanyl allowed some users to overcome the tolerance they had developed to heroin or the blocking effects of medication. Isaac, a man in his 30s injecting heroin for 2 years, explained that he often sought out the stronger FASH in pursuit of the intense early experiences lost to heroin tolerance: “I just feel like I want to chase that high, you know it’s a different high [...and] get fucked up.” Suboxone, a combination of buprenorphine and naloxone, is prescribed for opioid use disorder to provide both relief from withdrawal and block the  $\mu$ -receptor agonist effects of most other opioids. Jackson, man in his 20s injecting for 9 years, valued the potency of FASH for its ability to ‘break through’ Suboxone’s blocking effects. Hector reported that some of his customers complained when they detected the presence of fentanyl while others specifically requested it:

Q: And do customers notice when it’s fentanyl?

A: After they inject. Some people already know. Some people open the bag and go “Ahhh... this has that shit...” and complain. Ahh but let me tell you something. Some people are getting addicted to that shit, so heroin [alone] isn’t doing what they want it to do. They ask for that shit [fentanyl].

An array of idiosyncratic physiological effects, e.g. a ‘flushing’ effect in the face, shortness of breath, blurry vision and skin tingling led some users to recoil from FASH. Bud noted:

It's hard to explain fentanyl but it's just a different feeling. It's like a mucky, dirty feeling almost... Your whole face, it feels like your face is almost turning red like when you're embarrassed a little bit, but it's like more intense than that, man.

Some respondents mentioned feelings of numbness, tingling or pins and needles in the back of the head and neck. Rebecca found these sensations uncomfortable, even sickening: "I don't like the feeling of it. I don't like the high of it. I don't like nothing about fentanyl" (Rebecca, in her late twenties, injecting for 2 years). Fear of fentanyl-related overdose was also a significant consideration in users' preferences and purchasing strategies.

### **FASH-related overdose**

Now the dope is fentanyl and it's killing people left and right. I have over the years, I've watched friends—but on average, it was three a year. Now the last 3 years it's been an average of 20 [per year]. I feel like I'm back in a combat state and I feel like I'm fighting for my life right now.

(Jerry, man in his 40s using on and off for 20 years)

The presence of death as an imminent threat was often mentioned and many users attributed their own overdoses to FASH. Several respondents believed that fentanyl was singularly responsible for overdoses, while others attributed the overdose crisis in the region to both heroin and fentanyl, albeit with fentanyl taking the central role:

Dope in general is killing people, but the fentanyl is something different. It's a different animal completely and it really is killing people. One little fuckin', one little mistake and you're fuckin' dead.

(Bud)

Few disputed the dangers of overdosing from FASH and while some tried to avoid FASH, others sought it out similar to reports from Baltimore (Mars forthcoming). Even those who attempted to avoid FASH were not always able to make that choice when overcome by withdrawal symptoms: "I don't like fentanyl. I don't like it. I try to stay away from it. I try to, but when you're sick and you need that fix you'll take anything." (Julie) Here, Julie eloquently expresses the harsh position faced by dependent heroin users, where even reliable identification of the drugs on sale can only help to a limited extent if they lack choice of an alternative. Sebastian, a man in his 20s and a long-term heroin user, described the dangers of a strong soporific effect from perceived fentanyl:

It doesn't get you high; it puts you to sleep. And it's dangerous because if you fall asleep, you can go, you can die or you can suffer paralysis, because it's like your body is falling asleep, you know – your system is like – the drug shuts it down, you don't think, you just let go...

Angel, a man in his 30s injecting for 6 months gave a depiction of the sudden respiratory difficulties sometimes associated with fentanyl overdose "You feel like this [points to throat] is going to close." (Çoruh, Tonelli, and Park 2013, Suzuki 2017, Fahnenstich et al. 2000). This also corresponds with published findings from eastern Massachusetts, where a minority of respondents described sudden respiratory effects as well as seizure symptoms (Somerville

N J 2017). The speed at which fentanyl overdose can occur may result in a smaller window for intervention.

### Towards a typology of new ‘heroin’

Heroin of historic characteristics (light to medium brown powder that in solution is iced tea to dark brown) is still available in the region, alongside FASH of varying appearances. Respondents identified four contemporary ‘heroin’ types classified according to solid and solution appearance and perceived composition and based on users’ sensory experiences and physiological effects: A) a dark powder heroin, B) a light powder heroin, C) fentanyl and D) a heroin-fentanyl mixture.

**A. Dark powder heroin**—Respondents indicated that brown powder heroin was still prevalent in the region and of good quality: according to Bob, a man in his 30s using heroin for 4 years, “There is a lot of still regular just dope out there...And it’s actually pretty good.” Other respondents reported that dark powder heroin procured within the last year was the *best heroin they had ever used*. This is unusual given most users’ increasing tolerance over time. Proponents touted the relative potency, long duration, identifiable characteristics and other advantages of a dark powder heroin over other products. Users also believed that dark powder heroin was of higher purity than heroin products of other colors:

Q: [C]an you tell the difference by the powder?

A: Yeah. The really dark is just pure heroin.

(Liz, woman in her late twenties, injecting heroin for 1 year)

This dark powder heroin was distributed across the three cities in northeastern Massachusetts, with some respondents ascribing to it a bitter taste and medicine-like smell. Users described it as being either rocky or powdery, with the powder requiring little or no heating to go into solution—some saw this as proof of heroin quality.

The dry powder color was variable within a range of tan to dark brown, while solution color ranged from iced tea to cola. As with the dry powder, some believed that darker solution colors indicated purer heroin. Rachel, from New Hampshire, who commuted to Lawrence to buy heroin, reported a solution so dark that she had difficulty seeing her blood register in the syringe. Respondents agreed that this heroin had the best duration of action, “holding” even long-term users for 4–8 hours. Warm sensations throughout the body, a strong rush, and longer relief from opioid withdrawal symptoms characterized the embodied experience of using this heroin.

**B. Light powder heroin**—Darryl reported using a new heroin product that had only been available in the last one or two years. Users described it as an off-white or gray powder that turned into a dark brown solution of high potency (see Figure 1). He indicated that this heroin kept him well for between 6–8 hours and was confident that he was using a heroin that was not adulterated with fentanyl. Darryl purchased from a trusted dealer, a common mechanism in the region for determining heroin quality. Later the same day as this interview, the ethnographic team video recorded an injection sequence with Liz, of a light gray, mortar-

colored powder that became a dark brown solution. Other respondents indicated that gray or off-white powder heroin became solutions of lighter shades of brown, and could be semi-translucent or milky in appearance. If this pale powder is in fact heroin, it may be more prone to fentanyl adulteration due to its white or off-white powder color.

**C. Fentanyl**—While some believed in the presence of ‘white heroin’ in the supply, others were skeptical, considering it nothing more than fentanyl trying to pass as heroin. Kristin expressed the widely held view that pale powder sold as heroin was likely to be fentanyl, ranging from bright white to off-white and light gray when dry and even more distinguishable in solution:

Q: So you said [fentanyl] looks different?

A: Yeah, it’s lighter [...] When you add the water to it and pull it back it’s almost like clear. Sometimes like a yellowy color.

Q: What about heroin?

A: Heroin’s dark and brown. It’s brown. ...but the fentanyl is like, like water kinda, like a little bit yellowish tint. The regular heroin is like it can be dark brown or light brown but it’s never yellow like that.

Those who wanted to avoid fentanyl sold as heroin often expressed confidence that they could detect it by its light color, both dry and in solution. The latter was described as clear like water, at times tinted yellow (see Figure 2), or milky white but others were less sure. Dana reflected on this confusion:

A: Everybody tries to claim the fentanyl here as China White, which is supposed to be some really good dope [heroin]. And I’m sorry, if you’re going to give me a white bag of dope, don’t.

Q: You prefer the brown? Anything that is brown?

A: Yeah because in my experience fentanyl comes white. Pure fentanyl comes white in my experience.

**D. Heroin-Fentanyl Mixture**—The last type of heroin in this typology is a heroin-fentanyl mixture. Since fentanyl is often sold *as* heroin, when users refer to ‘fentanyl’, they could be referring to a single opioid substance (fentanyl), or a mixed product (heroin *and* fentanyl). However, some users specifically described a substance that contained both drugs. They described this mixture as lighter than brown heroin, but darker than fentanyl alone when dry. In solution, it varied from brown to yellowish and/or milky. The ethnographic team witnessed an injection in Lawrence of a reputed heroin-fentanyl mixture that changed from a gray powder into a yellowish brown, milky solution (see Figure 3).

There were hints that for some users, this mixture represented an *ideal opioid*—comprising the “best-of-both-worlds”: the intense rush of fentanyl with the longer duration and ‘warm fuzziness’ of heroin. Angela described her experience:

A: It’s weird because now with a lot of people the newest thing is the real dope that is actually mixed also with fentanyl. So that way they get the intense feeling with

also the shelf life – trying to get the best of both worlds type thing so that you don't get sick so often.

Q: So they're mixing the fentanyl into the heroin to get a good fentanyl rush and the legs of the heroin?

A: Exactly.

Q: How long does it last then?

A: Well you'll feel the fentanyl mixed with just the basic high anyway so it's like intense at first. And then it'll wear off but at least when it does completely wear off and you're just functioning you're not, you know [...] you won't be sick after.

Versus if it was straight fentanyl you would probably start to feel sick as close as 20 minutes to 30 minutes [...] right after.

Liz suffered from painful physical conditions for which she had previously been prescribed opioid pills. She favored the mixture for much the same reasons as Angela, but also credited it with more favorable pain-relieving qualities beyond the rush:

Q: We're getting into the high or how it feels in your body, what happens after the rush?

A: I get energy. A lot of people nod out and shit but I get energy because I'm not in pain.

Given the widely observed phenomenon of patients transitioning from prescribed opioid pills to heroin, as well as illicit pill users (Mars 2014, Unick et al. 2013), it would be interesting to find out whether fentanyl is commonly found to be particularly effective for pain relief compared with heroin.

### **Can users tell heroin types by appearance?**

Physical appearance was often relied upon to help distinguish between products and gauge their relative strengths. Without testing the substances being used, it is impossible to know whether users' identifications of heroin and fentanyl are accurate. The confidence with which users believed they could detect the ingredients of substances sold as heroin before use spanned the range from strong conviction to complete uncertainty. Some, like Liz above, considered they could tell from the color of the dry powder alone, with "pure heroin" a dark brown color and fentanyl a lighter color. Others thought only the solution color was a true indication and so detectable only after purchase, with heroin mixing to a clear brown solution. A colorless or yellow tinted clear liquid was often identified as fentanyl, whatever name it was sold under. Moreover, the mixed product in solution was often seen as yellowish brown but also with a milky as opposed to clear/transparent appearance.

Nevertheless, for some, physical appearance, whether dry or in solution, provided vague, inconsistent information about purity, adulterants and potency at best: "It's like the color doesn't matter" (Arthur, a man in his 50s, using for 35 years). Moreover, Hector threw doubt on the brown color as a reliable guide to heroin unadulterated by fentanyl, explaining that the 'heroin' he sold, pre-mixed with fentanyl at the wholesale level, was colored to look brown, explaining, "The dope I just showed you is a little brown right? That's the cut they

add to give it that color, but the dope we buy is actually gray.” It is unclear the intentions behind coloring heroin powder and whether this was a widespread practice.

## Discussion

Participants reported an increased diversity of heroin-like products beginning around 2013. This timing corresponds with national reports of rises in fentanyl in the drug supply (Drug Enforcement Administration 2015b) and synthetic opioid overdose deaths (Gladden 2016). Discernment of FASH by users is possible although a diversity of opinion existed among users over how reliably they could distinguish different ‘heroin’ types and the presence of fentanyl. A hierarchy of perceptibility emerges from users’ accounts where physiological effects were generally considered the most reliable indicator, followed by physical taste, then drug solution color and last of all powder color. A DEA report attests that color is not predictive of heroin source-type (Drug Enforcement Administration 2016a), but is referring to drug powder not solution or perceived physiological effects.

A range of opinion was also found regarding the desirability of fentanyl and fentanyl-heroin mixtures with those preferring them endorsing fentanyl’s “rush” and potency in overcoming their heroin tolerance or opiate receptor-blocking medication. Some suggested type D, the heroin-fentanyl mix, as the ideal opioid with the fentanyl providing intensity and the heroin a longer lasting effect for the “best of both worlds”. Detractors cited the high risk of overdose, other detrimental physiological reactions and fentanyl’s short duration compared with heroin as major concerns. While some believed they could choose to avoid or seek out fentanyl, recognizing it by appearance or taste, or by choosing their source of supply, others considered it ubiquitous and unavoidable. Dealers are almost exclusively selling their drug as ‘heroin’ regardless of the presence of fentanyl; thus choice may only happen through user discernment.

New types of heroin, including FASH, represent a significant change in the risk environment for persons who inject drugs. The structural risk environment (Rhodes 2009) includes heroin source and form (Ciccarone 2005, 2009). Heroin source-forms differ in their characteristics: color, physical form, water solubility, pH balance, heat stability, weight/volume and purity; they demand different usage patterns from users and carry differential health risks (Strang, Griffiths, and Gossop 1997, Ciccarone 2009, Ciccarone and Harris 2015), including HIV (Ciccarone and Bourgois 2003), overdose (Unick et al. 2014, Mars 2015) and skin and soft-tissue infections (Ciccarone 2016, Ciccarone and Harris 2015).

Since the early 1990s, the eastern US has primarily been supplied with Colombian-sourced powder heroin, a tan-to-brown powder that dissolves easily in water and is readily mixed with other substances (Ciccarone 2005, 2009, Ciccarone, Unick, and Kraus 2009). The addition of synthetic powders, including fentanyls, into powder heroin appears more feasible than the adulteration of ‘black tar’ heroin, a solid form of heroin more common in the western states (Ciccarone 2009). Overdose is the foremost health risk amplified by the introduction of fentanyl into the powder heroin supply due not just to its potency at the mu receptor but also vicissitudes in potency at retail. Heroin purity (Unick et al. 2014) and fluctuations in purity (Darke et al. 1999) are both independent risk factors for overdose.

Combining fentanyl with heroin compounds the overdose risk from variations in potency of these two powerful opiates. In addition, fentanyl overdoses appear to begin and progress more rapidly than heroin overdoses (Somerville N J 2017).

Alongside these major changes in the adulteration of heroin, seizures of a novel high purity 'white' heroin have recently been on the rise, now believed to be a Mexican-sourced 'mimic' of Colombian-sourced heroin produced from Mexican poppies using South American chemical processing (Drug Enforcement Administration 2016a); and competing in the same retail space as the source-form it mimics. We hypothesize, based on our heroin typology above, that the traditional Colombian-sourced product is type A: dark brown powder heroin, while the new Mexican-sourced powder is type B: light grey powder heroin, which may have appeared in the last few 2 years; both were well regarded by users and considered potent heroin forms. The characteristics and particular health risks of this innovative Mexican-sourced heroin have yet to be understood.

Historically the appearance of FASH has been a temporary phenomenon. In 2005–7 the largest US episode to date occurred in the North East and Mid-West resulting in over 1000 fentanyl-related deaths (Algren et al. 2013, Schumann et al. 2008, Centers for Disease Control and Prevention 2008). Before that, smaller outbreaks of fentanyl-related overdose deaths occurred in Pennsylvania in 1986–88 (Hibbs, Perper, and Winek 1991) and in Baltimore in 1992 (Smialek et al. 1994). It is unclear whether the heroin typology suggested above will disappear or become a permanent feature of the heroin retail market. Several possibilities exist for the future: fentanyl supplies could diminish as has happened in the past or if fentanyl persists and users are able to distinguish these 'heroin' types accurately, then choice may prevail – perhaps even connoisseurship (Mars et al. 2016). Alternatively, if the mixed product dominates or if users are unable to distinguish its presence from heroin types A and B, then choice declines and increasing user adaptation, harm reduction strategies and structural interventions are essential.

The potential usefulness of this heroin typology is two-fold: one, as a descriptive tool for research and public health use and two, to aid users in discernment, choice of products and to protect themselves through use of harm reduction strategies. At present the uncertainty in its use arises from a rapidly changing drug supply environment as well as variations in users' agreement regarding discernment.

Validation of this typology is necessary and can be done by correlating users' perceptions and discernment with drug toxicological testing. In addition, the usefulness of this tool as a method to prevent overdose could be tested epidemiologically, with measures of users' discernment as predictors in models of overdose. If validated, this typology would be a valuable harm reduction tool. Discernment of FASH may be a foundational step in users' decisions regarding safer routes of administration (eg insufflation), amount of heroin used (partial) and time taken to consume it (longer). It may also be used as an indicator of market shifts and user preferences between these products.

A public health response to the problems imposed by FASH should include approaches involving both use reduction through treatment and harm reduction e.g. through the

expansion of naloxone access (Frank and Pollack 2017). Surveillance, a keystone concept within public health, requires further exploration when discussing illicit substances. Lack of access to up-to-date data on the drugs in circulation is a persistent problem when trying to inform users and emergency and healthcare workers. Surveillance strategies remain 'backwards', by relying solely on toxicological testing of the deceased and not including testing of the contaminated consumable, i.e. heroin. The problem is one of jurisdiction: information obtained from the deceased is accessible to public health officials but detailed data from seized drugs remains under the control of criminal justice authorities. While collective reports are made public, they often have long time lags to publication and limited distribution.

A more advanced strategy, with real-time drug surveillance and transparent disclosure to the public, is necessary to understand the distribution and implications of these highly variable products. Real-time surveillance would benefit from including information from multiple sources including qualitative longitudinal panels in which lay experts routinely report insider knowledge of drug availability and use patterns (Mountney and Leirvåg 2004, Korf 2002, Harris, Forseth, and Rhodes 2015). It is important to understand the attraction of fentanyl so as to predict users' behavior moving forward and to assist in the development of interventions. Point of use testing of drugs has been used to inform users of adulterations to their drug of choice (Schroers 2002) and while the technology exists for rapid fentanyl testing, its accuracy, utility and acceptance by users is wholly unknown. Harm reduction strategies also include the use of partial doses, referred to as 'tastes', 'slow' or 'tester' shots, prior to full intake of the drug, as a means to self-test its strength. During a period of rapidly changing heroin quality in the UK, some research participants reported employing sensory testing strategies to judge heroin quality and alternative routes of ingestion, eg, smoking, when quality was questionable (Harris, Forseth, and Rhodes 2015). The powder heroin in the eastern US is not smokable but can be insufflated (snorted) (Ciccarone 2009). The use of partial doses, while widely advocated for (Sorge 1998, Australian Injecting & Illicit Drug Users League 2013) and chronicled in some recent fieldwork among heroin users (Mars forthcoming), will require more real world exploration regarding their feasibility, acceptability and success.

One structural risk reduction approach involves the use of supervised injection facilities (SIF) as part of a continuum from prevention to harm reduction to treatment. SIFs provide a more rapid and effective response to overdose. Given the risks arising from potency variability and the shorter window for intervention they may be particularly suited to respond to this FASH epidemic. A review of the evidence base for supervised injection services shows that they reduce harms for both users and the wider public, reducing overdose and nuisance such as publically discarded paraphernalia, increasing access to clinical and substance treatment uptake by its clients and producing no increase in new users or use frequency (Potier et al. 2014). There is growing interest in developing SIF in several areas of the US (Gutman 2017, Foderaro 2016, Associated Press 2017) inspired by the crisis of FASH and rising overdose fatalities.

Qualitative research is explorative and has some inherent limitations due to convenience sampling and unmeasured biases. The data provides a snapshot of views and experiences



that can generate hypotheses. Furthermore, qualitative inquiry increases the “social plausibility” of epidemiological research (Ciccarone and Bourgois 2003, Ciccarone and Bourgois 2016) and can lead to better public health interventions (Messac et al. 2013). It is possible that carrying out interviews in a health care or public health setting may have influenced respondents to answer in ways deemed desirable by service providers. However, most of the interviews took place outside of these environments, allowing cross-checking of responses.

Persons who use heroin are trying to adapt to the new world represented by the diversification of ‘heroin’ types, including FASH. Choice and safety are intertwined and affected by knowledge of the drugs consumed. FASH may persist and even expand in the US drug supply and if so, public health will need to combine indigenous knowledge and safety strategies with structural and policy interventions to reduce risk. Successful heroin overdose prevention, as exemplified by the peer-distribution of naloxone, has deep roots in the combination of indigenous and expert knowledge ((Seal et al. 2003, Seal et al. 2005, Doe-Simkins et al. 2009, Strang et al. 1999).

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**Fig 1.**



**Fig 2.**



**Fig 3.**