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Perceptions about Fentanyl-Adulterated Heroin and Overdose Risk Reduction Behaviors among Persons Seeking Treatment for Heroin Use

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Abstract

Background: Fentanyl-adulterated heroin supply chains are increasing risks for fatal overdose in the U.S.

Objective: The current study examined the use of overdose risk reduction behaviors among persons seeking treatment for heroin use and whether perceptions about the presence of fentanyl in one's heroin are associated with overdose risk reduction behaviors.

Method: We recruited persons with opioid use disorder entering a managed withdrawal program. We used multiple linear regression to estimate the adjusted associations of participant characteristics and perception of fentanyl exposure with the frequency of engaging in each of five overdose reduction behaviors.

Results: Participants (n=239; 75.3% male, 81.2% White, 67% injectors) estimated that 69.2% of the heroin they use contains fentanyl, and 94.6% knew that fentanyl increases overdose risk. Approximately 30% of respondents reported usually or always making sure others are around

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when they use heroin, carrying naloxone, taking “tester” doses of heroin or intentionally using in reduced amounts. While a majority of the sample reported never carrying naloxone or taking tester doses, and 70.2% reported never making sure that others around them carry naloxone, 84.5% had implemented one or more behavior at least rarely. Past month injection drug use was associated with making sure others are around, but perceptions about fentanyl in one’s heroin was not associated with use of harm reduction behaviors.

Conclusions: In this sample of people who use heroin, although overdose risk reduction behaviors were not usually used, a majority had tried at least one behavior. That perceived exposure to fentanyl-adulterated heroin was not associated with the use of such behaviors provides important implications for public health education and intervention programming.

Keywords

Fentanyl; Heroin; Overdose; Harm Reduction

1.0 INTRODUCTION

Fentanyl, a synthetic opioid analgesic 30-50 times more powerful than heroin (Ciccarone, Ondocsin, & Mars, 2017) is the most commonly involved drug in overdose deaths in the U.S. (Hedegaard, Bastain, Trinidad, Spencer, & Warner, 2018). Fentanyl and fentanyl analogs have infiltrated national heroin supplies (Gladden, Martinez, & Seth, 2016; Warner, Trinidad, Bastian, Minino, & Hedegaard, 2016); of the estimated 72,000 drug overdose fatalities in 2017, the sharpest increase over the prior year occurred among 30,000 fentanyl-related deaths (National Institute on Drug Abuse, 2018).

This public health crisis is particularly concerning in Massachusetts. In the first six months of 2016, just prior to the current study’s data collection, 74% of available opioid overdose toxicology reports tested positive for fentanyl (Massachusetts Department of Public Health, 2017), and our own research in the state showed that 91% of patients entering short-term inpatient heroin withdrawal management tested positive for fentanyl (Kenney, Anderson, Conti, Bailey, & Stein, 2018).

Public health initiatives have focused on overdose risk reduction strategies in an effort to reduce burgeoning fentanyl-related overdose fatality rates. For example, naloxone kits, targeted at people who use opioids or potential bystanders and distributed through community-based programs and retail pharmacies offer a safe and effective antidote for reversing the effects of opioid overdose (Clark, Wilder, & Winstanley, 2014; Coffin & Sullivan, 2013; Doyon, Aks, & Schaeffer, 2014; Frank & Pollack, 2017; McDonald & Strang, 2016). Other strategies advocated in overdose risk reduction education include making sure others are around when using in case overdose occurs, reducing the amount of heroin used, and taking a partial or “tester” dose—a small “hit” or “taste”—prior to use as a way to perceive if fentanyl is present (e.g., New York City Municipal Drug Council, 2018; The Harm Reduction Coalition, 2018). Although not yet FDA-approved, rapid test strips, another risk reduction strategy that enables people to test for the presence of fentanyl in heroin, are becoming more widespread (Leins, 2018). However, research suggests that

awareness about the prevalence of fentanyl and its overdose risk in personal supply chains may not alter heroin-using behaviors (Ciccarone et al., 2017; Somerville et al., 2017).

1.1 Study Goals and Hypotheses

Public harm reduction policy and clinical experience suggests that persons who use heroin may implement at least five strategies to reduce their overdose risk. These include using a "tester" dose of heroin before a use episode, although the accuracy of such "testing" remains unclear; using smaller amounts of heroin; using only in the presence of others; carrying naloxone (e.g., naloxone administration; Kenney, Anderson, Bailey, & Stein, 2018); and checking that others nearby are carrying naloxone, hence ensuring its availability in the case of an overdose. This study is the first to assess, in a single cohort, the use of these five overdose reduction behaviors by people using heroin. The current study aims to assess the frequency of overdose risk reduction behaviors and shed light on the promise of public health education that traditionally aims to raise awareness in order to promote behavior change. We hypothesized that an individual's perception about the presence of fentanyl-adulterated heroin in their supplies would be associated with risk reduction behaviors. When considering these five behaviors, we controlled for history of medication-assisted treatment (MAT), past month injection drug use (IDU), and past year overdose, which are associated with fentanyl exposure and risk reduction behaviors (Arfken, Suchanek, & Greenwald, 2017; Hayashi et al., 2018; Kenney, Anderson, Conti, et al., 2018).

2. Material and methods

2.1 Recruitment

The current sample was drawn from patients seeking inpatient opioid withdrawal management at Stanley Street Treatment and Resources, Inc. (SSTAR) in Fall River, Massachusetts. SSTAR provides evaluation, supervised symptom management using a methadone taper schedule, individual and group education and counseling, and aftercare case management (mean length-of-stay is 5.2 days).

A total of 318 patients were admitted to SSTAR during the recruitment period (October 2017-May 2018). Patients 18 years or older, English-speaking, and able to provide informed consent as approved by the Butler Hospital Institutional Review Board were invited to participate in a survey research study. Twenty-six refused study participation or were discharged before staff could perform an interview. Of 292 persons completing a 15-minute non-incentivized, face-to-face interview administered by non-treating research staff, 27 were missing responses to the harm reduction items. The 239 (81.9%) persons who reported last month heroin use constituted the study sample.

2.2 Measures

In addition to age, gender, years of education, and IDU in the past month we assessed the following variables.

2.2.1 Past year overdose.—

Respondents were asked if they had overdosed in the past year. We defined overdose (on any drug) as "you were unarousable (couldn't be woken) with shaking or calling your name because of the drugs you consumed."

2.2.2 History of Medication-Assisted Treatment.—

Respondents were asked if they had ever been prescribed buprenorphine or naltrexone or been enrolled in a methadone program. Persons answering "yes" to any of these were considered to a history of MAT.

2.2.3 Fentanyl exposure perceptions.—

Respondents were asked if they think fentanyl increases risk for overdose: "yes," "no," or "don't know."

2.2.4 Perceptions about fentanyl-adulterated heroin.—

Respondents were asked to estimate what percent (from 0-100%) of heroin they use has fentanyl in it.

2.2.5 Overdose risk reduction behaviors.—

Respondents were asked how often they engage in five behaviors while using heroin, on a six-point ordered-response scale: "never" to "always." Behaviors included "making sure other people are around," "use in small doses," "carrying naloxone (narcan)," "making sure others around them have naloxone (narcan) with them," "taking a small hit first (a tester shot)."

2.2.6 Knowledge about fentanyl test strips.—

Respondents were asked if they had "ever heard of fentanyl test strips (thin piece of plastic that can be dipped in a drug sample) that you can use to see, within five minutes, if fentanyl is in a batch of heroin before you use." Response options were "yes" or "no." Respondents familiar with fentanyl test strips were asked how often they engaged in "testing drugs before using with a rapid test strip."

2.3 Analytical Methods

We present descriptive statistics to summarize sample characteristics and frequency of engaging in harm reduction behaviors. We used multiple linear regression to test the hypothesis that perceived percentage of heroin containing heroin is positively associated with increased use of harm reduction behaviors after adjusting for background characteristics, history of MAT, past month IDU, and past year overdose. We report fully-standardized regression coefficients for continuous covariates, and y-standardized coefficients for categorical covariates. All tests of significance were based on the Huber-White variance estimator which is robust to estimate heteroskedasticity.

We conducted auxiliary analysis to determine if past month IDU moderated the association between perceived percentage of heroin containing fentanyl and harm reduction behaviors. These were tested by including the first-order interaction of these two variables in a linear regression model.

3. Results

Participants averaged 33.6 (± 8.8) years of age, 75.3% were male, 81.2% were White, and 11.3% were Latino/a. Mean years of education was 11.8 (± 1.70). About 76.0% had a lifetime history of MAT, 65.9% reported IDU in the past 30 days, and 37.2% reported a drug

overdose within the past year. On average, participants estimated that 69.2% (± 32.1, Median = 80%, Range 0% - 100%) of the heroin they use contains fentanyl. In all, 94.6% of respondents believed fentanyl increases overdose risk; this variable was omitted from subsequent analyses because of little variation.

Distributions of individual harm reduction items are given in Table 1. On an ordered response scale of 0-5, mean and median scores on the harm reduction behaviors were at or near the lower limit. Nearly half (47.7%) said they never made sure others were around when they used. Moreover, 51.9% said they never carried naloxone and 70.2% said they never made sure other persons around them were carrying naloxone. Over half (51.3%) said they never took tester shots and 43.1% said they never used in small doses. Thirty-seven participants (15.5%) answered “never” to all five overdose reduction behaviors; that is, 84.5% had tried one or more behavior at least “rarely.” Twenty-eight participants (11.7%) reported they had heard of fentanyl test strips and only three of these respondents said they ever used rapid test strips. Because of the very low frequency of endorsement, this behavior was not evaluated in subsequent analyses.

The data did not support our hypothesis that the perceived percentage of heroin containing fentanyl would be associated with increased use of harm reduction behaviors (Table 2). After adjusting for background characteristics, history of MAT, past month IDU, and past year overdose, the associations of perceived percentage of heroin containing fentanyl with harm reduction behaviors were not statistically significant, and not directionally consistent across all harm reduction behaviors.

A few of the associations evaluated in this study were statistically significant (Table 2). Males were significantly less likely than females to say they carried naloxone with them ($\beta_{yx} = -0.53$, $p < .01$). Education was positively associated with frequency of taking tester shots ($\beta_{yx} = 0.19$, $p < .05$). Past month IDU was positively and significantly associated with making sure others were around when using drugs ($\beta_{yx} = 0.34$, $p < .05$).

We also estimated models to determine if past month IDU moderated the association between perceived percentage of heroin containing fentanyl and harm reduction behaviors. The mean perceived percentage of heroin containing fentanyl was significantly ($t_{236} = -2.57$, $p = .011$) higher among those who had recently injected drugs (72.7, ± 30.0) than non-injectors (61.5, ± 34.8). However, there was no statistically significant evidence that the relationship between perceptions about fentanyl and harm reduction behaviors was moderated by recent IDU; p-values for all tests of first-order interaction were > .20.

4. Discussion

Consistent with extant research (Macmadu, Carroll, Hadland, Green, & Marshall, 2017), this sample showed a strong awareness that fentanyl exposure increases overdose risk. Yet even in the midst of an overdose epidemic, overall, respondents did not report implementing overdose risk reduction behaviors “usually.” A majority of respondents reported never taking tester shots or carrying naloxone, and a majority (70.2%) report never ensuring others carry naloxone when they use heroin. On the other hand, a majority of participants (84.5%)

reported using one or more harm reduction behaviors at least “rarely,” with approximately one in three respondents reporting usually or always making sure others are around, personally carrying naloxone, taking tester hits, and using in small doses when using heroin.

The current study does not support our hypothesis that respondent’s perceptions about the presence of fentanyl in their heroin impacts their use of overdose risk reduction behaviors. Rather, these results support prior research showing that increasing awareness about overdose risks may have limited impact on promoting protective drug use behaviors among people who use heroin (Kerr, Small, Hyshka, Maher, & Shannon, 2013). In fact, even though respondents reporting (versus not reporting) past month IDU were more likely to report making sure others are around when they use and perceive higher levels of fentanyl in their heroin, IDU did not moderate the relationship between these perceptions and the risk behaviors assessed in this study. These findings indicate that leveraging general education about fentanyl risks alone may be ineffective. More intensive interventions that educate people about harm reduction behaviors while targeting underlying cognitive or psychological barriers associated with substance misuse (cognitive behavioral therapy; Rohsenow, 2016) or that establish goals for change and enhance motivation to modify behaviors (motivational interviewing; R. Miller & Rollnick, 2002) may be warranted. Using peers who are pursuing self-protective behaviors to train other injectors could perhaps also change community standards. Still, to date, structural and environmental programs, such as MAT (Connery, 2015 for review) and naloxone distribution (Clark et al., 2014; McDonald & Strang, 2016), are demonstrated to be most effective in reducing overdose risk.

It is important to note that given the unique effects of fentanyl, which rapidly accelerate the risk of overdose death, it is unclear how effective traditional strategies may be in preventing overdose. For example, the most commonly endorsed risk reduction behavior assessed was using heroin in small doses (30.1% reported engaging in this behavior usually or always). However, a miniscule dose of fentanyl can lead to overdose, putting into question the effectiveness of small doses or even tester hits. Moreover, standard naloxone dosing is less effective in cases of fentanyl overdose. People perceiving that fentanyl is involved in an overdose may also believe that certain harm reduction strategies are ineffective and, in turn, not use such strategies. Research that accounts for this complex interplay between fentanyl-related perceptions and beliefs is needed.

Only a few people in this sample used rapid test strips. This finding likely reflects the novelty of rapid test strips that are not yet available through syringe exchange programs or for consumers to purchase in Massachusetts. In fact, only 28 (11.7%) respondents had ever heard of fentanyl test strips. Examining the use of rapid test strips in other states and as they become more widely disseminated may be an important avenue for future investigation.

4.1 Limitations

This study has several limitations. First, respondents were seeking heroin withdrawal treatment at a single site and might not apply to individual not in treatment, those receiving maintenance opioid use disorder medication, or prescription opioid misusers. Second, data were based on self-reports which may not reflect actual harm reduction behaviors (P. G. Miller, 2007). Moreover, although there was no specific time frame offered for the harm

reduction questions, questions were posed in the present tense for these active heroin users. Therefore, we presume that responses capture current practices and not lifetime use of harm reduction behaviors, for example. Third, an overarching assumption in this study was that respondents knew about these risk reduction strategies. It is possible that some participants were not aware of these potential overdose reduction strategies. Conversely, it may be the case that some participants were aware that two strategies (tester shots and small doses) may not necessarily reduce overdose risk and therefore they chose not to use these strategies. Fourth, respondents reported their use of protective behaviors but not their desire to avoid fentanyl. Research demonstrates that some people who use heroin try to avoid fentanyl (Carroll, Marshall, Rich, & Green, 2017), while others are ambivalent or intentionally use fentanyl-adulterated heroin (Ciccarone et al., 2017; Macmadu et al., 2017). Fifth, other covariates that might moderate the outcomes such as duration of heroin use, fatalism, impulsivity, and education about harm reduction behaviors, were not measured. Finally, it is beyond the scope of these data to assess the effectiveness of these strategies in preventing overdose.

4.2 Conclusion

In this sample of persons using heroin, a majority believed their heroin contained fentanyl and while a majority had at least tried one of the assessed harm reduction behaviors, only a minority always used protective behaviors. Our findings suggest that “universal precautions” against overdose by people who use heroin is a distant hope. Reminding persons who continue to use heroin about these overdose risk reduction behaviors and enhancing their self-efficacy to implement protective behaviors could reduce overdose mortality. But until heroin users’ norms about using these protective behaviors change, this population will remain at high risk of overdose death. To date, entering and maintaining effective MAT for opioid use disorder remains the preferred course of care for this at-risk population.

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Highlights

- Treatment-seeking heroin using participants estimated that most heroin they use (69.2%) contains fentanyl.
- Nearly all (94.6%) participants knew that fentanyl increases overdose risk.
- 15.5% of participants reported never using any of the assessed overdose reduction behaviors.
- A majority (84.5%) had used one or more behavior at least “rarely.”
- Beliefs about the presence of fentanyl in personal heroin supplies was not associated with frequency of individual overdose reduction behaviors.

Table 1.

Response Distributions on Harm Reduction Behavior Items (n = 239).

Item	Mean (± SD)	Median	Never 0	Rarely 1	Occasionally 2	Sometimes 3	Usually 4	Always 5
I make sure other people are around when I use.	1.8 (± 2.0)	1	47.7%	10.5%	5.0%	7.1%	13.0%	16.7%
I carry naloxone (narcan) with me.	1.8 (± 2.1)	0	51.9%	8.0%	1.7%	7.5%	10.5%	20.5%
I make sure others who are around me have naloxone (narcan) with item.	0.9 (± 1.6)	0	70.2%	7.6%	4.2%	5.5%	5.9%	6.7%
I take a small hit first (a tester shot).	1.8 (± 2.1)	0	51.3%	5.5%	3.4%	8.0%	13.9%	18.1%
I use in small doses.	1.9 (± 2.0)	1	43.1%	10.0%	4.6%	12.1%	15.9%	14.2%

Table 2.

Multiple Linear Regression Models Estimating the Adjusted Associations of Background Characteristics, Past Month IDU, Past Year Overdose, and Perception of the Proportion of Heroin that Contains Fentanyl.

	HARM REDUCTION OUTCOME				
	Make Sure Others Are Around	**Carry Naloxone**	**Others Around Carrying Naloxone**	**Take Tester Shot**	**Use in Small Doses**
	β_{yx} (SE)[a]	β_{yx} (SE)[a]	β_{yx} (SE)[a]	β_{yx} (SE)[a]	β_{yx} (SE)[a]
Years Age	−.013 (0.072)	−0.101 (0.062)	−.0.077 (0.072)	−.0.117 (0.073)	0.025 (0.075)
Sex (Male)	−.0.235 (0.172)	−.0.526** (0.166)	−.0.005 (0.192)	0.151 (0.170)	0.014 (0.156)
Years Education	−.0.022 (0.076)	0.131 (0.075)	0.137 (0.079)	0.189** (0.073)	0.094 (0.076)
Ever MAT	−.0.301 (0.081)	0.253 (0.147)	0.186 (0.138)	0.182 (0.151)	−.0.233 (0.165)
Past Month IDU	0.344* (0.146)	0.205 (0.137)	0.130 (0.141)	−.0.091 (0.146)	0.013 (0.149)
Past Year Overdose	0.172 (0.148)	0.268 (0.138)	0.229 (0.165)	0.028 (0.141)	−.0.213 (0.139)
Perceived %w Fentanyl	−.0.010 (0.067)	0.060 (0.058)	0.050 (0.071)	−.0.062 (0.068)	−.0.030 (0.070)
Constant	0.008	−.0.034	−.0.307*	−.0.187	0.239
Observations	239	239	238	238	239

* p < .05,

** p < .01,

*** p < .001

[a] Coefficients are fully standardized for continuous covariates and y-standardized for categorical covariates. Robust Huber-White standard errors.