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Prescription opiate analgesics, heroin, HIV and HCV among persons who inject drugs in New York City, 2016-2018

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ABSTRACT

Objectives: Assess relationships among non-medical use of prescription opioid analgesics (POAs), heroin use, and HIV and hepatitis C (HCV) infection among persons who inject drugs (PWID) in New York City, 2016–2018.
Methods: PWID (N = 134) were recruited from Mount Sinai Beth Israel drug treatment programs. HIV seropositive persons were oversampled. A questionnaire was administered, and serum samples were collected for HIV and HCV testing. Analyses were stratified by HIV serostatus and compared those who had used POAs to those who had not used POAs.
Results: Among the participants, 97% reported injecting heroin, 44% reported injecting cocaine, and 47% reported smoking crack cocaine in the 6 months prior to the interview. There were 66% who reported oral non-medical use of POAs, with 42% using oral POAs in the previous 6 months. There was a clear historical pattern in median year of first injection for different groups: HIV seropositive persons (1985), HIV seronegative persons who never used POAs (1999), and HIV seronegative persons who used POAs (2009). By the time of interview (2016–2018), however, almost all participants (97%) reported injecting heroin. All PWID who reported using POAs also reported injecting heroin.
Conclusions: Non-medical POA use among PWID was very common and should not be considered a separate drug use epidemic, but as an additional component of the continuing heroin/poly-drug use epidemic, itself a part of the syndemic of opioid use, stimulant use, overdose, HCV and HIV occurring in New York City.

1. Introduction

The current opioid epidemic has involved non-medical use of oral prescription opioid analgesics (POAs), transitions from POA use to heroin use and transitions from oral and intranasal drug use to injecting drug use. The consequences of this epidemic have included increased transmission of blood-borne viruses (hepatitis C virus (HCV) and HIV) and a very substantial increase in fatal drug overdoses. The overlapping epidemics of opioid use, overdose, HCV infection and HIV infection, may be productively be viewed as a syndemic, or aggregation of two or more concurrent or sequential epidemics or disease clusters in a population with biological interactions, which exacerbate the prognosis and burden of disease (Perlman and Jordan, 2018; Singer and Clair, 2003). During the recent years of the opiate epidemic (2004–2014), there has been a substantial, simultaneous increase in HCV infections (133%) (Centers for Disease Control and Prevention, 2017). Most recently, the opioid epidemic has included the addition of illicitly manufactured fentanyl added to heroin and other illicit drugs, which has dramatically increased the rate of fatal drug overdoses in some areas of the US (Rudd, 2016).

The opioid epidemic has received considerable attention in small cities and rural areas, particularly in Appalachia (Becker, 2016; Quinones, 2015). This attention is certainly well-deserved, but the opioid epidemic has also been occurring in many large urban areas including Baltimore (Baltimore City Health Department, 2018), Boston (Kaafarani et al., 2017), Philadelphia (Umapathy et al., 2018), and Washington DC (Jamison, 2018) where it has added to pre-existing high rates of heroin use. In this report, we examine POA use, heroin use, and HCV and HIV infection among persons who inject drugs (PWID) in New York City.

The overarching question is the extent to which POA use among PWID should be considered a drug use epidemic separate from other

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patterns of drug use in New York City, or whether POA use has simply merged with, and expanded the range of drugs used by PWID in New York City. Separate epidemics, occurring in different social groups, with different rates of use and different rates of adverse consequences, would imply a need for highly differentiated prevention and treatment strategies, while a "merged epidemic" (i.e., closely interdigitating and interconnected epidemics of the use of multiple drugs, (Perlman and Jordan, 2018; Singer and Clair, 2003)) would suggest that similar but broadly encompassing prevention and treatment strategies should be employed regardless of whether or not PWID use POAs.

For the purposes of this analysis, we operationally defined "completely separate POA and heroin epidemics" as a situation in which PWID use either POA or heroin but not both, and a "fully merged POA epidemic with an ongoing heroin epidemic" as a situation in which all PWID who have ever used POAs have also used heroin.

2. Methods

2.1. Data collection

The data presented here were collected between June 2016 and March 2018 as part of a long-running study of persons entering Mount Sinai Beth Israel drug detoxification and methadone maintenance programs in New York City. The methods for this "Risk Factors" study have been previously described (Des Jarlais et al., 2009, 1989) so only a summary will be presented here. The programs serve New York City as a whole and there were no changes in the requirements for entrance into the program over the study period.

Research staff visited the general admission wards of the detoxification program in a preset order. Potential study participants were recruited among recent (past 3 days) admissions to the ward. All of the recent admissions to the specific ward were asked to participate in the study. After all recent admissions had been asked to participate, the staff rotated to the next ward in a pre-set order. As there was no relationship between the assignment of patients to wards and the order that the staff rotated through the wards, these procedures should produce an unbiased sample of persons entering the detoxification program. In the methadone program, newly admitted patients (those admitted in the previous month) from two selected clinics were asked to participate in the research. This should also provide an unbiased sample for persons entering these clinics.

2.2. Oversampling of HIV positive PWID

In June 2016, we modified the recruitment procedures to oversample HIV seropositive persons entering the detoxification program. The prevalence of HIV among persons entering the programs had fallen to such a low level (approximately 7%) that oversampling of HIV seropositive persons was required in order to have sufficient seropositive participants for statistical analyses. Beginning in June 2016, we alternated between two sampling strategies in the detoxification program—our standard sampling procedure (described above) for two weeks, followed by two weeks of recruiting only HIV seropositive persons on the ward where staff were working. This over-sampling procedure also should have produced an unbiased sample of HIV seropositive participants.

2.3. Honoraria and informed consent

Participants were paid $20 for their time and effort. In both programs, approximately 95% of those asked agreed to participate. Common reasons for non-participation included medical appointments or other scheduled activities that would not permit study completion in a single visit.

Written informed consent was obtained and a trained interviewer administered a computer-assisted structured interview covering demographics, non-medical psychoactive drug use, risk behavior, and use of HIV prevention services. Participants were asked if they had ever injected drugs for non-medical reasons, and if they replied that they had, they were asked when they first injected, the first drug they injected, and when they had last injected. For the purposes of this report we operationally defined persons currently injecting drugs as persons who reported ever injecting during the 6-month period prior to their interview.

2.4. Prescription opiate use questions

In June 2016, we added questions specific to the use of prescription opioid analgesics in order to capture more detail on the use of these drugs. In the section on non-medical use of psychoactive drugs, we asked, "Have you ever used opiate analgesics such as prescription painkillers/opioid analgesics—Oxycontin, Vicodin, Codeine, Dilaudid, Percocet?" For participants who replied that they had ever used any prescription opioid analgesic, we then asked if they had ever user these drugs through oral, intranasal or injecting administration. We then asked how frequently they had used prescription opioid analgesics during the last 6 months, on a 9-point scale from no use to multiple times per day.

2.5. Serostatus testing for HIV and HCV

After the interview, participants were seen by counselors for HIV and HCV pretest counseling and serum collection. HIV testing was conducted at the New York City Department of Health laboratory using a commercial, enzyme-linked, immunosorbent assays (EIA) test with Western blot confirmation (BioRad Genetic Systems HIV-1-2 + 0 EIA and HIV-1 Western Blot, BioRad Laboratories, Hercules, CA). HCV testing was also conducted at the New York City Department of Health laboratory using the Abbott HCV enzyme immunoassay (EIA) 2.0 test. HIV prevalence and incidence among PWID entering the Mount Sinai Beth Israel treatment programs have previously been reported (Des Jarlais et al., 2011, 2016; Jordan et al., 2015) and will not be analyzed here.

Subjects were permitted to participate on multiple occasions, though only once per year. For these analyses, however, we utilized only the last interview for persons who participated multiple times.

2.6. Data analyses

We used proportions for categorical variables and means with standard deviations for describing the characteristics of the participants. Chi-square tests and Fisher's exact test were used for comparisons of categorical variables, and t-tests were used for comparisons on continuous variables. We did not utilize multivariable logistic regression analyses because of potential complex patterns of causation that might be distorted in standard multivariable logistic models. We studied historical trends through examination of dates of first drug injection for different groups. Stata software (STATACorp, 2015) was used for statistical analyses.

2.7. Ethics approval

The study was approved by the Mount Sinai Beth Israel Institutional Review Board.

3. Results

There were 134 persons recruited between June 2016 and March 2018 who reported injecting illicit drugs in the previous 6 months; 122 were recruited from the detoxification programs and 12 were recruited from the methadone maintenance program. The small number from the methadone program precluded meaningful statistical comparisons.

Table 1
Demographic, drug use characteristics and sexual behaviors by HIV serostatus among PWID entrants to Mount Sinai/Beth Israel drug treatment programs in New York City.from 2016 to 2018.

	Total		HIV Serostatus				Test value	P value
			Negative		Positive			
	N	%	N	%	N	%		
Total	134	100	108	81	26	19		
Average age (Mean, SD)	43 (11)	–	41(10)	–	52 (9)	–	t=-5.4	< 0.001
Years injecting (Mean, SD)	17 (14)	–	14 (12)	–	30 (16)	–	t=-5.6	< 0.001
Gender								
Male	117	87	95	88	22	85	χ^2=0.3	0.56
Female	16	12	12	11	4	15		
Race/Ethnicity								
White	54	40	50	46	4	15	χ^2 = 9.3	< 0.05
African-American	19	14	15	15	4	14		
Latinx	56	42	39	36	17	65		
Other	5	4	4	4	1	4		
First Drug injected								
Speedball	13	10	8	7	5	19	χ^2=3.3	0.07
Heroin	113	84	93	86	20	77	χ^2=1.3	0.25
Cocaine	4	3	4	4	0	0	χ^2=1.0	0.32
Ever injected opiate analgesic	35	26	34	31	1	4	χ^2 = 8.3	< 0.01
Ever used oral opiate analgesic	88	66	69	64	19	73	χ^2=0.8	0.38
Last 6 months								
Injecting opiate analgesic	8	6	8	7	0	0	χ^2=2.1	0.15
Oral opiate analgesic	56	42	44	41	12	46	χ^2=0.3	0.62
Speedball injected	58	43	50	46	8	31	χ^2=2.1	0.15
Speedball intranasal/smoked	12	10	11	11	1	4	χ^2=1.1	0.29
Heroin injected	126	95	104	97	22	85	χ^2 = 6.6	< 0.05
Heroin alone-sniff/snorted	81	61	68	64	13	50	χ^2=1.6	0.20
Cocaine injected	59	44	50	46	9	35	χ^2=1.2	0.28
Cocaine alone-sniff/snorted	39	29	32	30	7	27	χ^2=0.1	0.79
Crack injected	7	5	6	6	1	4	χ^2=0.1	0.73
Crack smoked	63	47	51	47	12	46	χ^2=0.01	0.92
Daily injection	91	68	76	70	15	58	χ^2=1.6	0.21
Injected w/ used needles	25	19	24	22	1	4	χ^2 = 4.7	< 0.05
Lent/sold used needles	22	16	22	20	0	0	χ^2 = 6.3	< 0.05
Sex w/ primary partner	57	43	51	47	6	23	χ^2 = 5.0	< 0.05
Sex w/ casual partner	37	28	32	30	5	19	χ^2=1.1	0.29
Condom use w/ primary sex partner	9	16	6	12	3	50	χ^2 = 5.9	< 0.05
Condom use w/ casual sex partner	16	43	13	41	3	60	χ^2=0.7	0.42
Multiple sex partners	35	26	31	29	4	15	χ^2=1.9	0.17
HCV prevalence	79	63	61	60	18	75	χ^2=1.9	0.17

Among the participants, 97% reported injecting heroin, 44% reported injecting cocaine, and 47% reported smoking crack cocaine in the 6 months prior to the interview. 108 (81%) were HIV seronegative and 26 (19%) were HIV seropositive.

3.1. Analysis by HIV serostatus

Table 1 presents demographic characteristics, drug use, sexual behaviors, and HCV seroprevalence separately for all subjects, for HIV seronegative subjects and for HIV seropositive subjects (with statistical comparisons of the HIV seronegative subjects to HIV seropositive subjects). There were multiple statistically significant differences in demographic characteristics, drug use histories, and in HIV risk behaviors. The HIV seropositive participants were older, had longer times since first injection, and were more likely to be Latinx. The HIV seropositive participants were less likely to have ever injected a POA, though there were no significant differences in the percentages of having ever used POAs through oral administration or in past 6-month oral use of POAs. There were consistent differences in injecting and sexual risk behaviors, with fewer HIV seropositive participants reporting risk behaviors. The HIV seropositive participants did have higher HCV seroprevalence (75% among HIV seropositive participants versus 60% among HIV seronegative participants) but this difference was not statistically significant (p = 0.17 by chi square test).

3.2. Analysis by POA use history

Two-thirds (72/108) of the HIV seronegative PWID reported that they had ever used a POA; of these, 68 reported that they had used POAs orally, and 34 reported that they had injected POAs. Almost all who had injected a POA had also used a POA orally—there were only 4 who reported having injected a POA without having used a POA orally.

Table 2 presents comparisons of demographic characteristics, drug use, injecting and sexual risk behavior and HCV prevalence among the HIV seronegative PWID by ever use of POAs. There are important differences and similarities in these comparisons. Those who had ever used POAs were more likely to be White, and less likely to be African-American or Latinx. Those who had ever used a POA were younger, had shorter injecting careers, with a mean of 12.2 years since first injection compared to a mean of 18.8 years since first injection for those who had never used POAs, though both groups had the same mean age (26 years) at first injection. Those who had ever used a POA started injecting later with a median year of first injection equal to 2009 versus a median year of first injection equal to 1999 for those who had never used a POA.

There were, however, relatively few differences in past 6-month drug use. Those who had used POAs were more likely to report non-injecting (intranasal/smoking) use of speedball (mixture of heroin and cocaine, 17% versus 0%, p < 0.05), and a higher percentage reported injecting cocaine among those who had ever used POAs (53% versus

Table 2
Demographic, drug use characteristics and sexual behaviors by history of using opioid analgesics among HIV Negative PWID entrants to Mount Sinai/Beth Israel drug treatment programs in New York City.2016–2018.

	Total		Ever used opioid analgesics				Test value	P value
			No		Yes			
	N	%	N	%	N	%	–	–
Total	108	100	36	19	72	81	–	–
Average age (Mean, SD)	41	10	44	10	39	10	t = 2.8	< 0.01
Years injecting (Mean, SD)	14	12	18	12	12	12	t = 2.3	< 0.05
Gender								
Male	95	88	31	86	64	89	χ^2=0.0	0.96
Female	12	11	4	11	8	11		
Race/Ethnicity								
White	50	46	9	25	41	57	χ^2 = 9.9	< 0.05
African-American	15	14	7	19	8	11		
Latinx	39	36	18	50	21	29		
Other	4	4	2	6	2	3		
Year of 1st injection								
Pre-2000	41	38	20	56	21	29	χ^2 = 8.6	< 0.05
2000-09	24	22	8	22	16	22		
2010-18	43	40	8	22	35	49		
First Drug injected								
Speedball	8	7	4	11	4	6	χ^2=1.0	0.30
Heroin	93	86	31	86	62	86	χ^2=0.0	1.0
Cocaine	4	4	1	3	3	4	χ^2=0.1	0.72
Last 6 months								
Injecting opiate analgesic	8	7	–	–	8	11	–	–
Oral opiate analgesic	44	41	–	–	44	61	–	–
Speedball injected	50	46	13	36	37	51	χ^2 = 2.3	0.13
Speedball intranasal/smoked	11	11	0	0	11	17	χ^2 = 6.7	< 0.05
Heroin injected	104	97	35	97	69	97	χ^2=0.0	0.99
Heroin alone-sniff/snorted	68	64	22	61	46	65	χ^2=0.1	0.71
Cocaine injected	50	46	12	33	38	53	χ^2=3.7	0.06
Cocaine alone-sniff/snorted	32	30	10	28	22	31	χ^2=0.1	0.77
Crack injected	6	6	1	3	5	7	χ^2=0.8	0.37
Crack smoked	51	47	16	44	35	49	χ^2=0.2	0.68
Daily injection	76	70	23	64	53	74	χ^2=1.1	0.30
Injected w/ used needles	24	22	11	31	13	18	χ^2=2.2	0.14
Lent/sold used needles	22	20	9	25	13	18	χ^2=0.7	0.40
Sex w/ primary partner	51	47	16	44	35	49	χ^2=0.2	0.68
Sex w/ casual partner	32	30	10	28	22	31	χ^2=0.1	0.77
Condom use w/ primary sex partner	6	12	0	0	6	17	χ^2=3.1	0.08
Condom use w/ casual sex partner	13	41	5	50	8	36	χ^2=0.5	0.47
Multiple sex partners	31	29	8	22	23	32	χ^2=1.1	0.29
HCV prevalence	61	60	27	79	34	50	χ^2 = 8.2	< 0.01

33%, p = 0.06). Past 6-month heroin injection was a notable similarity, with 97% of both groups reporting this.

There were 5 PWID who reported non-medical use of POAs as their first non-medical drug use (exclusive of marijuana and alcohol use). Two were White, 2 were Latinx, and 1 was African-American. All of these 5, however, reported heroin as their first drug injected. They had a mean of 5 years since their first injection, and their year of 1 st injection ranged from 2009 to 2015. There was only a single participant who reported POAs as first drug injected, and this person also reported injecting heroin in the 6 months prior to interview.

Of the 88 PWID who had ever used POAs in this sample, all of them had injected heroin at some point, and all but 2 reported that they were injecting heroin in the 6 months prior to the interview.

3.3. Sexual and injection risk behaviors

There were no statistically significant differences in either injecting or sexual risk behaviors. The participants who had ever used POAs also had a lower HCV seroprevalence (50%) compared to those who never used POAs (79%).

3.4. Years of injection by HIV serostatus and POA use

Fig. 1 shows box and whisker plots for the years of first injection by HIV seropositive participants who had never versus ever used POAs, and HIV seronegative participants who had never versus ever used POAs. There was a clear order in the median years of first injection. The median years were earliest for the HIV seropositive participants, with no difference by use of POAs. This was followed by the median year of

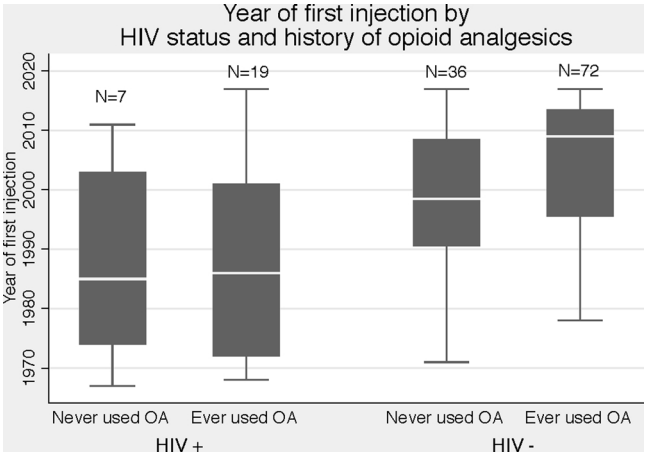

Fig. 1. Years of first injection by HIV status and history of opioid analgesics.

first injection among HIV seronegative participants who had never used POAs, followed by the median year of first injection among the HIV seronegative participants who had ever used POAs. Wilcoxon rank-sum test was statistically significant for the difference between median years of first injection, when comparing HIV seropositive participants to HIV seronegative participants who never used POAs ($z = -3.0$; $p < 0.05$), and when comparing never used versus ever used POAs among HIV seronegative participants ($z = -2.3$; $p < 0.05$).

4. Discussion

The overarching question for these analyses was whether POA use should be considered as a separate epidemic among these PWID in New York City, with needs for separately targeted prevention and treatment interventions, or whether POA use should be considered as simply another form of drug use that was integrated into the continuing heroin/cocaine/poly-drug use among PWID in New York City.

4.1. Comparison of PWID entering drug treatment and PWID utilizing a syringe exchange

All of the subjects in this report were recruited from entrants into the Mount Sinai Beth Israel drug treatment programs. In order to assess potential generalizability of pattern of POA and heroin use we observed in this treatment entry sample, we compared the drug use pattern to the drug use pattern in a sample of PWID recruited from a syringe exchange program in the borough of Staten Island, New York City. Staten Island is the most "suburban" borough of the New York City and has experienced a very substantial POA/opioid epidemic (NYC Health, 2018a). Until very recently, Staten Island had the highest per capita rate of fatal drug overdoses New York City (NYC Health, 2018b). The 103 PWID recruited at the Staten Island syringe exchange program had a mean age of 44, had been injecting for a mean of 17 years, 61% were male, 39% female, 51% White, 21% African-American, 13% Latinx, and 16% "other/mixed."

HIV and HCV testing were not conducted in the Staten Island study and HIV seropositive participants were oversampled in the drug program entry sample. The syringe exchange does provide voluntary HIV testing, and estimates that the HIV prevalence among the participants is less than 10%. We therefore compared the patterns of past 6-month drug use among the HIV seronegative participants in the drug treatment entry sample to all participants in the syringe exchange sample.

The data are presented in Table 3. While oral POA use was significantly higher in the syringe exchange sample, it is clear that in both samples: 1) almost all participants were injecting heroin, 2) about 40% were injecting cocaine, 3) about half were using oral POAs, and 4) a modest percentage, about 10% were injecting POAs. As noted above, all of the participants who had ever used POAs in the treatment entry sample reported that they had injected heroin. In the syringe exchange sample, all of the participants who reported oral use of POAs in the previous 6 months also reported injecting heroin in the previous 6 months.

Table 3
Drug use comparison of PWID entrants to Mount Sinai/Beth Israel drug treatment programs in New York City and participants in Staten Island syringe exchange.

	HIV Negative Treatment Entry		Syringe Exchange	
	N	%	N	%
Total	108	100	103	100
Last 6 months				
Oral POA	44	41	57*	55
Heroin injected	104	97	98	95
Cocaine injected	50	46	38	37
POA injected	8	7	15	15

[p] = .04 by Fisher's exact test.

4.2. POA versus heroin epidemics

In the introduction, we operationally defined "completely separate POA and heroin epidemics" as a situation in which PWID use either POA or heroin but not both, and a "fully merged POA epidemic with an ongoing heroin epidemic" as a situation in which all PWID who have ever used POAs have also used heroin. The data from both the treatment entry and the syringe exchange samples clearly reject the "completely separate POA and heroin epidemics" hypothesis, and strongly support a "fully merged POA epidemic with an ongoing heroin epidemic." All of the PWID who reported using POAs in the combined samples also reported injecting heroin.

4.3. Reconceptualizing the "Opioid epidemic" in urban areas

It may be helpful to reconceptualize the "opioid analgesic" epidemic in New York City. There clearly has been historical change, with greatly increased non-medical use of POAs. However, our data suggest that the increased use of POAs has been fully integrated into the ongoing epidemic of heroin and other drug use in New York City.

The integration of POA use and heroin/cocaine use among our participants was bi-directional. All of the modest number (5) of participants in the treatment entry sample whose first illicit drug use was POAs reported injecting heroin in the 6 months prior to the interview, and more than half (58%) of the treatment entry participants whose first non-medical drug use was heroin or cocaine reported ever using POAs.

4.4. POAs, and HIV, HCV

The HIV seropositive PWID in this the drug treatment sample had long histories of injecting drug use, with a mean of 30 years since their first injection. It is likely that they were infected with HIV prior to the large-scale introduction of either combination HIV and HCV prevention or of POA use in New York City. The HIV seropositive PWID generally did not add injection of POAs to their drug use—only 4% (1) reported having ever injected POAs, but they clearly did add oral POA use, as 73% reported ever oral POA use, and 46% reported past 6-month oral POA use.

Among the HIV seropositive PWID, 75% were also HCV seropositive. Given the age (mean = 52 years) and the long histories of injecting drug use (mean of 30 years since first injection), it is likely that this 75% HCV seroprevalence reflects both the lesser impact of combined prevention on HCV infection than on HIV prevention, the more limited rollout of HCV treatment than HIV antiretrovirals, and the loss of dually HIV/HCV seropositive PWID to active drug injecting over the last several decades.

Among the HIV seronegative PWID in the treatment entry sample, HCV prevalence was significantly lower among those who had ever used POAs (50%) than among those who had never used POAs (79%). This difference remained statistically significant when we controlled for length of time since first injection. Additional research on HCV among PWID is clearly needed before concluding that oral POA use might protect against HCV infection, the 50% prevalence among the POA users is still unacceptably high from a public health perspective.

4.5. Differential interventions

One of the questions posed in the introduction was whether different interventions are needed for PWID who do and do not use POAs. Almost all the PWID in both samples who had ever used POAs in this study were currently injecting heroin, about half were also injecting cocaine, and many were also using drugs through non-injecting routes of administration. Clearly, standard evidence-based interventions such

as syringe service programs (SSP)/syringe exchange programs and medication-assisted substance use treatment (MAT) are needed for addressing substance use disorders for both PWID who do and do not use POAs. Development of better treatments for persons with stimulant use disorders and poly-drug use disorders are also clearly needed.

About half of the PWID in both samples reported oral use of POAs in the 6 months prior to the interview. Many of them are likely to be in contact with persons who use POAs and heroin through non-injecting routes of administration and may be likely to assist non-injectors with first drug injections (Kermode et al., 2007). PWID who use POAs may thus be an important group for interventions like "Break the Cycle" which can reduce the likelihood that a current PWID would initiate others into injecting drug use (Hunt et al., 1998; Des Jarlais et al., 2019).

Antiretroviral treatment (ART) should be offered to all HIV seropositive PWID regardless of whether they use POAs. Screening patients for substance use disorders by ART providers is not systematic and coordination of ART and substance use treatment is often weak in New York City (Campbell et al., 2016). Screening for non-medical POA use may be particularly important for HIV seropositive patients who experience chronic pain, as non-medical POA could complicate pain management (note that nearly 50% of HIV positive PWID reported POA us in the last six months).

New York State has recently initiated an effort to "Eliminate HCV" in the state (New York State Department of Health, 2018). Attention has been given to the increase in HCV infection among PWID who have used POAs. However, it may also be very important to also devote special attention to PWID who have not used POAs. Our data suggest that PWID who have not used POAs are older, have much longer histories of injecting drugs, and may be closer to developing late-stage HCV induced liver disease than PWID who have used POAs. Thus, providing treatment for HCV infection for this group may be an immediate matter of life or death. (Liver disease is currently the leading cause of death among patients in the methadone program where we recruited subjects. The program is currently scaling up treatment for HCV infection.)

4.6. Limitations

Several limitations of this study should be noted. The respondents were recruited from persons entering a single set of substance use programs. However, HIV and HCV infection among persons entering the Mount Sinai Beth Israel drug treatment programs are similar to samples of PWID from other recruitment sites in New York City, including community-based no-treatment sites (Amesty et al., 2010; Jordan et al., 2015). The comparison with PWID using a syringe exchange program in Staten Island also showed similar patterns of past 6-month heroin injecting, cocaine injecting, oral POA use and POA injecting.

Neither sample included persons whose drug use was at a sufficiently low level that they had not sought substance use treatment (or syringe exchange services for the comparison sample) and neither sample included persons who use drugs but do not inject. We would therefore not want to generalize to opioid users whose opioid use has not been sufficiently problematic that they sought health services or opioid user users who do not inject. We would expect, however, that for persons whose opioid use progresses from non-problematic to problematic or from non-injecting to injecting use, the patterns of POA use and heroin injecting described herein will likely apply.

Several questions on drug use and associated behaviors were based on self-report, so social desirability bias should be considered in some of the responses.

We had a modest sample size, and, even with oversampling, we did not have sufficient HIV seropositive participants for comparisons within the group. We also did not have information on the date of first POA use or timing of HIV diagnosis among the PWID in the sample.

We did ask questions about fentanyl use; however, other research that we have conducted in New York state using hair analyses indicates that many PWID use fentanyl without being aware of using it. Fentanyl is commonly added not only to heroin preparations but also to cocaine and other drug preparations. Fentanyl use is not central to our question of the POA and heroin injecting epidemics, and including reports of fentanyl use that missed much of such use would not have contributed meaningfully to the analyses presented here.

These are important limitations, but they would not seem to have generated the strong patterns in the data—particularly the data on current heroin and cocaine injection and current oral POA use. Indeed, it would seem that these strong patterns of concurrent heroin injection and oral POA use emerged despite any limitations in the data.

5. Conclusions

Non-medical prescription opioid analgesic use has become quite common among PWID in New York City. In this study, two thirds of the PWID reported ever having used POAs, and approximately half reported POA use within the last 6 months. There was a clear historical pattern in median year of first injection for different groups: HIV seropositives persons (1985), HIV seronegative persons who never used POAs-(1999), HIV seronegative persons who used POAs-(2009). By the time of the interview, however, almost all participants (97%) were injecting heroin and approximately half were using oral POAs. POA use among these PWID is best conceptualized not as a separate drug use epidemic, but as an addition to the continuing heroin/poly-drug use injecting drug use epidemic in New York City, itself a part of the broader syndemic of opioid use, overdose, HCV infection and HIV infection.

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Contributors

Don Des Jarlais conceived the study; Courtney McKnight managed data collection; Kamyar Arasteh performed statistical analysis; Jonathan Feelemyer worked with data analysis and managed final editing of manuscript; Susan Tross and David Perlman contributed to editing of the manuscript. All authors reviewed the full study and results prior to submission to the journal.

All authors read and approved the final manuscript.

Declaration of Competing Interest

No conflict of interest declared.

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