

2019

Individual and social network correlates of recent treatment for substance use disorders

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BOSTON UNIVERSITY
SCHOOL OF PUBLIC HEALTH

Thesis

**INDIVIDUAL AND SOCIAL NETWORK CORRELATES OF
RECENT TREATMENT FOR SUBSTANCE USE DISORDERS**

by

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B.S., University of Massachusetts – Lowell, 2013

Submitted in partial fulfillment of the
requirements for the degree of
Master of Science

2019

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ACKNOWLEDGEMENTS

My sincere appreciation to my thesis committee:

Abby Rudolph, PhD, MPH

Ann Aschengrau, ScD

Janice Weinberg, ScD

And to *Angela Bazzi, PhD, MPH*

For serving as the outside reader.

My deepest gratitude to my family and friends as well, for supporting me in reaching this goal.

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ABSTRACT

Substance use disorders (SUDs) result in numerous negative outcomes, with only a minority of those with a SUD ever seeking treatment. A more complete understanding is needed of the factors that impact treatment enrollment. The purpose of this analysis was to identify individual and social network correlates of treatment enrollment for substance use disorders among a sample of 330 persons who used drugs and resided in Baltimore, MD between 2014 and 2017. Models were built using multivariable logistic regression and sub-analyses were performed among subsets of individuals based on type of drug use and available treatment options for that type.

In the overall sample, the number of network members currently enrolled in drug treatment was positively associated with treatment enrollment, with an increase in odds of treatment enrollment of 122% for each additional network member currently enrolled in treatment (95% CI: 1.48, 3.34). The number of network members who used heroin, cocaine, and/or crack was not associated with treatment enrollment (OR: 1.07, 95% CI: 0.88, 1.37); however, the number of network members who used drugs and provided emotional, financial, instrumental or material support (i.e., network members he/she could talk to, socialize with, who pitched in to help him/her, who were willing to provide financial support, or who he/she stayed with) reduced the odds of treatment enrollment by 38% for each additional person who used drugs in the could support network (95% CI:

0.42, 0.92).

It appears to be the nature, rather than the number, of ties with other people who use drugs (PWUD) that impacts an individual's probability of treatment enrollment. The implication may be that, rather than encouraging PWUD to distance themselves from all PWUD in their network, that they focus on fostering close relationships with sober individuals, and that they attempt to transfer sources of emotional and financial support to people who do not use drugs.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	<i>iv</i>
LIST OF TABLES	<i>viii</i>
ABBREVIATIONS	<i>x</i>
INTRODUCTION	<i>1</i>
HYPOTHESIS	<i>6</i>
METHODS	<i>7</i>
STATISTICAL ANALYSIS	<i>10</i>
RESULTS	<i>11</i>
<i>Sample Characteristics</i>	<i>11</i>
<i>Bivariate Analysis of Total Sample</i>	<i>15</i>
<i>Multivariable Analysis of Total Sample</i>	<i>16</i>
<i>Additional Analyses</i>	<i>18</i>
<i>Disaggregated Treatment</i>	<i>18</i>
<i>Bivariate Analysis of Disaggregated Treatment</i>	<i>20</i>
<i>Multivariable Analysis of Disaggregated Treatment</i>	<i>21</i>
<i>Drug Use Patterns</i>	<i>22</i>
<i>Bivariate Analysis of Drug Use Patterns</i>	<i>24</i>
<i>Multivariable Analysis of Drug Use Patterns</i>	<i>26</i>
DISCUSSION	<i>29</i>
BIBLIOGRAPHY	<i>34</i>
VITA	<i>39</i>

LIST OF TABLES

Table 1: Individual and network correlates of treatment enrollment (MAT, detox, outpatient, and/or self-help) within the past 6 months in a sample of PWUD in Baltimore, 2014 - 2017	13
Table 2: Number of modalities treatment recipients were enrolled in during past 6 months in a sample of PWUD in Baltimore, 2014 - 2017	14
Table 3: Overlap in modalities of treatment enrollment during past 6 months in a sample of PWUD in Baltimore, 2014 - 2017	15
Table 4: Unadjusted odds ratios for individual and network correlates of any treatment receipt in past 6 months in a sample of PWUD in Baltimore, 2014 - 2017	16
Table 5: Adjusted odds ratios for individual and network correlates of any treatment receipt in past 6 months in a sample of PWUD in Baltimore, 2014 - 2017	17
Table 6: Individual and network correlates of disaggregated treatment enrollment (none, MAT, and non-MAT) within the past 6 months in a sample of persons who use heroin in Baltimore, 2014 - 2017 (N = 218)	19
Table 7: Unadjusted odds ratios for Individual and network correlates of disaggregated treatment enrollment (none, MAT, and non-MAT) within the past 6 months in a sample of persons who use heroin in Baltimore, 2014 - 2017	21
Table 8: Adjusted odds ratios for Individual and network correlates of disaggregated treatment enrollment (none, MAT, and non-MAT) within the past 6 months in a sample of persons who use heroin in Baltimore, 2014 - 2017	22
Table 9: Individual and network correlates of treatment enrollment (methadone maintenance, detox, residential, outpatient, and/or meetings/self-help) within the past 6 months for heroin use vs. use of drugs other than heroin in a sample of PWUD in Baltimore, 2014 - 2017	23
Table 10: Individual and network correlates of treatment enrollment (methadone maintenance, detox, residential, outpatient, and/or meetings/self-help) within the past 6 months for use of only one drug vs. polysubstance use in a sample of PWUD in Baltimore, 2014 - 2017	24
Table 11: Unadjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for heroin use vs. use of drugs other than heroin in a sample of PWUD in Baltimore, 2014 - 2017	25

Table 12: Unadjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for use of only one drug vs. polysubstance use in a sample of PWUD in Baltimore, 2014 - 2017	26
Table 13: Adjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for heroin use vs. use of drugs other than heroin in a sample of PWUD in Baltimore, 2014 - 2017	28
Table 14: Adjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for use of only one drug vs. polysubstance use in a sample of PWUD in Baltimore, 2014 - 2017	28

ABBREVIATIONS

ACASI	Audio computer-assisted self-interview
CAPI	Computer assisted personal interviewing
CI	Confidence interval
IQR	Interquartile range
KPNC	Kaiser Permanente Northern California
MAT	Medication-assisted therapy
NIDA	National Institute on Drug Abuse
OR	Odds ration
PWUD	People who use drugs
SAMHSA	Substance Abuse and Mental Health Service Administration
SIMOR	Social Identity Model of Recovery
SUD	Substance Use Disorder

INTRODUCTION

Substance use disorders (SUDs) result in numerous negative outcomes in the form of lost productivity, decreased life expectancy, and increased risk of a number of serious medical conditions. According to the Substance Abuse and Mental Health Services Administration, in 2017, 7.2% of people in the United States had a substance use disorder in the past year [SAMHSA]. A 2010 study of 90,922 members of Kaiser Permanente Northern California (KPNC) found that individuals with SUDs (particularly those using opioids) were more likely than patients without SUDs to be diagnosed with 19 major medical conditions, most commonly hypertension, chronic pain, acid-peptic disorders, arthritis, and injuries, poisonings, and overdoses. These individuals had a higher number of medical comorbidities and higher overall disease burden [Bahorik, et al.]. These findings are particularly important given that KPNC members are mostly privately insured and have access to an integrated healthcare delivery system, suggesting that this increased disease burden is not due solely to lack of access to medical care.

Much of the research on SUDs focuses on demographic, historical, psychological, and situational factors that influence an individual's risk of developing a SUD. One meta-analysis that investigated individual predictors of opiate use during and after treatment for a SUD found a number of predictive variables, including high levels of pretreatment use, prior treatment for opiate addiction, depression, unemployment/employment problems, and associating with others who use substances [Brewer, et al.]. However, no single variable was strongly predictive (i.e., they had weak longitudinal associations), and

the study authors stressed the need for treatments that address the multiple factors that can increase an individual's risk of a SUD.

In more recent years the impact of characteristics of an individual's social network have been investigated in relation to SUDs. The characteristics of the overall network, those in an individual's personal network and the time spent with specific people or types of people can be predictive of substance use. Among women post-treatment for a SUD, belonging to networks composed of higher numbers of persons who use drugs (PWUD) was predictive of renewed substance use [Tracy, et al.]. Time spent with peers who used substances was also predictive of relapse in young adults post-treatment, while time spent with peers who did not use substances decreased risk of relapse [Eddie & Kelly]. This study found that relapse was more strongly correlated with the amount of time spent with PWUD network members than it was with the number of PWUD network members. Studies of social networks conducted on alcohol use disorders are also informative. Alcohol-specific support, a composite measure defined as the amount of drinking by peers within an individual's network as well as decreased peer opposition to drinking, was positively predictive of heavy drinking days following treatment [Longabaugh, et al.].

Treatments for SUDs are underutilized, with estimates that as low as 10% of those with a SUD ever access treatment [Bahorik, et al.]. Numerous studies have looked at the association between individual variables and treatment entry. Having previously received

treatment for a SUD, more problematic/higher dose substance use, possessing a greater awareness of the degree/severity of one's substance use, and past treatment of psychiatric disorders are all associated with treatment entry [Blanco, et al., Davey, et al., Booth, et al., Epstein, et al., Ferri, et al., Gyarmathy & Latkin]. Other associated variables include seropositive HIV status, contact with the criminal justice system, and heroin use [Davey, et al., Booth, et al., Epstein, et al.]. In contrast, problematic drinking and crack smoking, early age of SUD onset, belonging to an earlier birth cohort, and having achieved a higher level of education have all been shown to decrease the probability of treatment entry for a SUD [Blanco, et al., Booth, et al., Ferri, et al.]. Those with alcohol and drug dependence are less likely to enter treatment than those with alcohol dependence alone [Weisner, et al.].

Social network studies have investigated the various stages of substance use, including initiation, ongoing use, cessation, and relapse. Fewer studies have investigated the correlation between social network characteristics and individual treatment entry. Davey et al. found that having a higher number of social network members in treatment for SUDs and fewer network members who smoked crack was positively associated with treatment receipt [Davey, et al.]. Individuals whose friends encouraged drug treatment were more likely to attend both 12-step programs and receive methadone maintenance therapy [Gyarmathy & Latkin]. Associating with fewer drug-using friends has also been associated with increased entry into methadone maintenance therapy [Booth, et al.]. More interactions with an outreach worker was positively associated with treatment entry

[Corsi, et al.]. Women without social support were more likely to receive treatment in a study by Epstein, et al. in 2004, but this finding is contradictory to most other study findings [Epstein, et al.]. Interventions that utilize an individual's social network or aid in creating a network that is more supportive of abstinence have been effective in reducing substance use as well as successfully used for health interventions to reduce smoking, enhance mental health, and reduce HIV-related risk behaviors [Latkin & Knowlton]. Twelve-step programs are arguably the primary example related to alcohol and substance use disorders, where individuals build new relationships with others who are also focused on abstinence from substance use. Best, et al. conceptualizes this as a process of "socially negotiated identity transition" that occurs through changes in the composition of a treatment-seeking individual's social network, a theory known as the social identity model of recovery, or SIMOR [Best, et al.]. Members of an individual's social network have also been directly engaged in recovery efforts, indicating a promising direction for network-supported interventions [Kidorf, et al.].

Kidorf, et al. discussed the lack of knowledge about the characteristics of the drug-free members of a PWUD's personal social network, and whether these members would be perceived as willing to assist in network-supported recovery methods. It is also unknown how social network variables may predict entry into different treatment modalities, as treatment receipt is often investigated as a whole rather than being disaggregated into separate treatment modalities [Davey, et al.]. There exists a need for replication of existing studies and for investigation of how predictors vary between diverse populations

of PWUD who differ with respect to geographical location (e.g. rural vs. urban), race, income, etc. As the strength of predictors may vary depending on these characteristics, a more comprehensive body of work is needed to lay the foundation for new and effective interventions.

Because of the high individual and societal costs of SUDs, it is imperative that treatment modalities, including approaches to treatment enrollment, are designed that maximize an individual's chances of successful outcomes, as one-size-fits-all approaches are less likely to be effective. According to the National Institute on Drug Abuse, "treatment approaches must be tailored to address each patient's drug use patterns and drug-related medical, psychiatric, and social problems" [NIDA]. A more complete framework is needed to aid in understanding the risks and motivations of SUD treatment entry, which will in turn inform effective intervention design and potentially increase retention in treatment. Although the factors that relate to treatment retention are complex, some studies indicate that retention is influenced by treatment setting [Greenfield, et al.]. Understanding an individual's needs when it comes to treatment setting could increase treatment retention. Understanding an individual's social network including the presence of social support can help providers design successful interventions. Social network members are shown to be important in the decisions that PWUD make but are not yet widely incorporated by providers. Challenges exist in the form of an as yet incomplete understanding of how various individual and social network characteristics impact treatment entry, and whether these factors change over the life course. An incomplete

understanding also exists between the type of substance(s) used and how this may inform treatment enrollment decisions.

The purpose of this analysis was to identify individual and social network characteristics correlated with recent treatment enrollment for a SUD among PWUD in Baltimore, Maryland and to determine whether these correlates varied by type(s) of drugs used, and characteristics of the individual's drug use and support networks.

HYPOTHESIS

We hypothesized that higher levels of social support, fewer drug using network members, fewer drug using network members who provide social support, and the presence of network members who were also receiving treatment would correlate with higher odds of enrollment in SUD treatment. As these relationships may differ according to patterns of drug use, we conducted additional sub-analyses. We hypothesized that persons who used opioids would be more likely to enroll in treatment due to the presence of effective, medication-based treatment options, while those using drugs other than opioids would be less likely to enroll in SUD treatment. For the same reason, because of its availability to opioid users, those using heroin would be more likely to enroll in medication-assisted therapy (MAT) versus other treatment modalities.

METHODS

This study is a secondary analysis of baseline data from a prospective intervention study focused on HIV prevention and care which enrolled 568 participants between May 2014 and June 2017 in Baltimore, Maryland. The study was conducted by Lighthouse Studies at Peer Point, a community-based research center located at the Johns Hopkins Bloomberg School of Public Health. Of the 568 individuals, half (“index participants”) were recruited by targeted street outreach and another half were referred by index participants. Eligible index participants were 18 years of age or older, were not currently participating in other intervention studies at the research site, were HIV positive, and had a history of drug use, including marijuana use. Index participants also reported HIV risk behaviors (e.g., sharing injection equipment), were residents of the Baltimore metro area with no plans to move and reported a willingness to participate in group sessions and to talk to people about HIV. Peer referred participants were not necessarily HIV+ but were eligible if they were at least 18 years of age and had received a peer referral coupon from a verified index participant. See Rudolph, Tobin, Rudolph, & Latkin for complete details. The current analysis was restricted to 330 individuals who reported using crack, cocaine, and/or heroin within the past 6 months.

Computer-assisted personal interviewing (CAPI) was used to collect network data from study participants and audio computer-assisted self-interviews (ACASI) were used to collect more sensitive data on sexual and drug use behaviors. A participant’s social network includes the number and nature of ties that an individual has to other people. For

example, a participant may be asked to list those individuals with whom they use drugs, have sex, or who provide them with different forms of support (emotional, financial, instrumental, and material). Questions can also be asked about a network member listed. Most relevant to the etiology of SUD, individuals can be asked to describe each network member with respect to demographic characteristics, relationship type, relationship strength, relationship duration, and the network member's risk behaviors (i.e., the types of substances used by each network member). Participants could name up to 25 people (i.e., network members) with whom they had sex (within the past 90 days), with whom they used drugs or drank alcohol (within the past 6 months), and/or from whom they had received social support (within the past 6 months).

The initial analysis examined the aggregate sample for associations with treatment enrollment. Treatment enrollment was identified as enrollment in any of the following modalities within the past 6 months: medication-assisted therapy (MAT), here confined to methadone maintenance, detox, residential, outpatient, and meetings/self-help. Because the outcome incorporated disparate modalities, we wanted to determine whether participants were actually segregated by treatment modality and potentially differed on other measures as well. After conducting an additional analysis examining patterns of treatment enrollment, we saw that participants tended to enroll in more than one treatment modality concurrently, and concluded that it was reasonable to aggregate treatment modalities rather than analyze them individually.

We also wanted to account for the fact that individuals who use opioids have MAT available as a treatment option. It is possible that the variables under investigation have different associations with non-MAT treatment than with MAT and so we disaggregated the treatment outcome. In this analysis we included only individuals who used heroin (n = 218), since they are the only people eligible for MAT.

Finally, we investigated the associations above by pattern of drug use. We wanted to determine if these relationships depended on, for instance, whether a person uses one drug or multiple drugs. We compared those using heroin to those not using heroin, and those using only one drug to those using multiple substances. There was overlap across these variables, with the presence or absence of heroin use being one type of classification, and single versus multiple drug use being a separate type of classification.

Outcome variable: Treatment enrollment within the past 6 months was treated as a categorical variable determined via self-report. For most of the analyses, treatment enrollment was a dichotomous yes/no outcome. For the analysis restricted to those using heroin, the outcome comprised three levels of treatment receipt within the 6 months prior to data collection: participant enrolled in MAT, participant enrolled in any other treatment modality (including self-help), and participant did not enroll in treatment.

Covariates: Social network variables included: number of network members who use heroin, cocaine, or crack, number of network members currently enrolled in drug

treatment, number of network members who could provide support (i.e., emotional, financial, instrumental, or material), and number of people in the could support network who used heroin, cocaine, or crack. The could support network is comprised of network members who the participant could talk to about things that were personal and private, socialized with, who pitched in to help him/her, who let him/her stay with them, and who was willing to provide him/her with financial support. Treatment entry may vary depending on the substance used and the existence or lack of effective treatment options. Heroin use (yes/no) was analyzed for associations with treatment outcomes in the initial analysis.

Confounding Variables: Sex, race, age, HIV status, insurance, level of education, marital status, unemployment, and homelessness within the past 6 months were evaluated as potential confounders of the association between social network variables and treatment enrollment.

STATISTICAL ANALYSIS

Bivariate (logistic regression) analyses were conducted to determine which individual and network characteristics were associated with treatment enrollment. Potential individual confounders were identified based on support from the literature and results from the analysis and are included in the final logistic multivariable model if they appeared to differ between groups by more than 10% and were significant in the unadjusted model. Network variables were included in the final model based on support

from the literature as well as on the premise that PWUD who belonged to the could support network would be more strongly associated with treatment enrollment than PWUD who belonged to the larger social network. Network variables were included as linear variables, while individual variables were categorical. For the analysis that examined disaggregated treatment, the outcome measure had three categories: no treatment, treatment enrollment other than MAT, and treatment enrollment that included MAT. A multinomial logistic regression model was used for the analysis, where “no treatment” is the reference for both MAT and non-MAT treatment. All associations were measured using odds ratios and 95% confidence intervals were used to measure their precision. All analyses were performed using SAS 9.4.

RESULTS

Sample Characteristics

The sample was 60.6% male, 89.4% black, with a median age of 49.2 years (IQR 44 – 55). Half were index participants and half were peer referrals. Over half of the sample was HIV positive, nearly 30% had experienced homelessness in the past 6 months, and almost 90% had been unemployed within the past 6 months. The majority (86.9%) had some form of insurance, and 62.7% had at least a high-school education (including GED). In this sample, 66.4% used heroin, 46.4% used cocaine, and 79.1% used crack within the past 6 months.

The total sample was disaggregated into those who had or had not enrolled in treatment within the past 6 months, and individual characteristics were examined for these separate

groups. Of the sample of 330, 214 (64.9%) had been enrolled in some form of treatment in the past 6 months. Although the two groups were similar, differences were noted with respect to the proportion male (56.5% in the treatment group vs. 68.1% in the non-treatment group), the proportion HIV+ (53.7% in the treatment group vs. 62.9% in the non-treatment group), who experienced homelessness in the past 6 months (30.4% in the treatment group vs. 19.0% in the non-treatment group), who currently had health insurance (91.6% in the treatment group vs. 77.6% in the non-treatment group), and who reported any heroin use within the past 6 months (72.4% in the treatment group vs. 55.2% in the non-treatment group). Individual and social network characteristics are shown in Table 1. Overall, participants reported a median of 4 individuals in their social network. Of these, the median value was 1 for network members who used heroin, cocaine, and/or crack. Participants reported a median of 3 network members in their could support network, with differences in the number of individuals in the support network using heroin, cocaine, and/or crack. The treatment group reported a median of 0 (IQR: 0 – 1) network members in their could support network who used drugs, while the no-treatment group reported a median of 1 individual (IQR: 0 – 1).

Table 1: Individual and network correlates of treatment enrollment (MAT, detox, outpatient, and/or self-help) within the past 6 months in a sample of PWUD in Baltimore, 2014 - 2017

	Entire sample (n = 330)	Treatment in past 6 mo. (n = 214; 64.9%)	No treatment in past 6 mo. (n = 116; 35.2%)
Individual	n (%)	n (%)	n (%)
Male	200 (60.6)	121 (56.5)	79 (68.1)
Age, median (IQR)	49.2 (44 - 55)	49.5 (43 - 55)	48.7 (44 - 55)
Race/ethnicity			
Black	295 (89.4)	189 (88.3)	106 (91.4)
White	32 (9.7)	23 (10.8)	9 (7.8)
Other	3 (0.9)	2 (0.9)	1 (0.9)
HIV positive	188 (57.0)	115 (53.7)	73 (62.9)
High school education/GED or higher	207 (62.7)	132 (61.7)	75 (64.7)
Married/committed relationship	158 (47.9)	106 (49.5)	52 (44.8)
Homeless during past 6 months	87 (26.4)	65 (30.4)	22 (19.0)
Currently unemployed	290 (87.9)	192 (89.7)	98 (84.5)
Currently have health insurance	286 (86.9)	196 (91.6)	90 (77.6)
Any heroin past 6 months	219 (66.4)	155 (72.4)	64 (55.2)
Any cocaine past 6 months	153 (46.4)	101 (47.2)	52 (44.8)
Any crack past 6 months	261 (79.1)	167 (78.0)	94 (81.0)
Heroin/cocaine only past 6 months	19 (5.8)	15 (7.0)	4 (3.5)
Heroin/crack only past 6 months	63 (19.1)	46 (21.5)	17 (14.7)
Cocaine/crack only past 6 months	36 (10.9)	19 (8.9)	17 (14.7)
Heroin/cocaine/crack past 6 months	95 (28.8)	67 (31.3)	28 (24.1)
Network	Median (IQR)	Median (IQR)	Median (IQR)
Number in network	4.0 (3 - 6)	4.0 (3 - 6)	4.0 (3 - 6)
Number in network who use heroin, cocaine, or crack	1.0 (0 - 2)	1.0 (0 - 2)	1.0 (0 - 2)
Number in network currently enrolled in drug treatment	0.0 (0 - 1)	0.0 (0 - 1)	0.0 (0 - 0)
Number in could support network	3.0 (2 - 4)	3.0 (2 - 4)	3.0 (2 - 4)
Number in could support network who use heroin, cocaine, or crack	0.0 (0 - 1)	0.0 (0 - 1)	1.0 (0 - 1)

Table 2 presents the number of different treatment types the participant reported using in the past 6 months for each of the five treatment classifications. Of note, only 40 individuals participated in only one type of treatment over this period and nine individuals participated in all five types. Very few individuals had enrolled in just one treatment modality. Eleven participants were enrolled only in MAT, while 29 individuals were only participating in meetings/self-help. Over 80% of individuals reported enrollment in at least 2 modalities within the past 6 months.

Table 2: Number of modalities treatment recipients were enrolled in during past 6 months in a sample of PWUD in Baltimore, 2014 - 2017

Number of Treatments	Methadone Maintenance N=117 (54.7%) n (%)	Detox N=62 (30.0%) n (%)	Residential N=54 (25.2%) n (%)	Outpatient N=99 (46.3%) n (%)	Meetings/Self-Help N=188 (87.9%) n (%)
1 N=40 (19.0%)	11 (9.5)	0	0	0	29 (15.6)
2 N=67 (31.8%)	41 (35.3)	6 (9.8)	6 (11.3)	18 (18.4)	63 (33.9)
3 N=61 (28.9%)	37 (31.9)	26 (42.6)	17 (32.1)	45 (45.9)	58 (31.2)
4 N=28 (13.3%)	18 (15.5)	20 (32.8)	21 (40.0)	26 (26.5)	27 (14.5)
5 N=9 (4.3%)	9 (7.8)	9 (14.8)	9 (17.0)	9 (9.2)	9 (4.8)

Table 3 shows the overlap in treatment modalities. Meetings and self-help options were reported by 188 (87.9%) individuals; of these, 159 individuals had also enrolled in at least one additional type of treatment. Because the majority of participants had enrolled in multiple types of treatment, we aggregated treatment modalities into a single outcome. This sub-analysis addresses Davey's concern mentioned above that treatment receipt is often investigated as a whole rather than being disaggregated into separate treatment modalities [Davey, et al.].

Table 3: Overlap in modalities of treatment enrollment during past 6 months in a sample of PWUD in Baltimore, 2014 - 2017

Treatment Type	Methadone Maintenance (N=117), n(%)	Detox (N=62), n(%)	Residential (N=54), n(%)	Outpatient (N=99), n(%)	Meetings/ Self-help (N=188), n(%)
Methadone Maintenance	/	25 (40.3)	26 (48.2)	57 (57.6)	99 (52.7)
Detox	25 (21.4)	/	31 (57.4)	43 (43.4)	57 (30.3)
Residential	26 (22.2)	31 (50.0)	/	32 (32.3)	52 (27.7)
Outpatient	57 (48.7)	43 (69.4)	32 (59.3)	/	92 (48.9)
Meetings/ Self-help	99 (84.6)	57 (91.9)	52 (96.3)	92 (92.9)	/

Bivariate Analysis of Total Sample

The results of the bivariate associations between individual and social network factors and any treatment enrollment are presented in Table 4. For every increase of one network member in treatment, the odds of treatment enrollment increase by 108% (95% CI: 1.43, 3.02). Females have 1.64 (95 % CI: 1.02, 2.64) times the odds of any treatment enrollment as males. Compared to those who had not been homeless in the past 6 months, those who had were 1.86 times more likely to have enrolled in SUD treatment (95% CI: 1.08, 3.22). Those with insurance have 3.15 (95%: CI: 1.64, 6.03) times the odds of treatment enrollment as those without insurance. Individuals who used heroin have 2.14 times the odds of treatment enrollment (95% CI: 1.33, 3.43).

Table 4: Unadjusted odds ratios for individual and network correlates of any treatment receipt in past 6 months in a sample of PWUD in Baltimore, 2014 - 2017

Individual	Odds Ratio (95% CI)
Females vs. males	1.64 (1.02, 2.64)
HIV+	0.68 (0.43, 1.09)
Highschool/GED or higher	0.88 (0.55, 1.41)
Married/committed relationship	1.21 (0.77, 1.90)
Homeless during past 6 months	1.86 (1.08, 3.22)
Currently unemployed	1.60 (0.82, 3.13)
Currently have health insurance	3.15 (1.64, 6.03)
Any heroin use during past 6 months	2.14 (1.33, 3.43)
Any cocaine use during past 6 months	1.10 (0.70, 1.73)
Any crack use during past 6 months	0.83 (0.47, 1.46)
Network	
Number of members in network	1.04 (0.96, 1.13)
Number of network members who use heroin, cocaine, and/or crack	0.98 (0.84, 1.14)
Number in network who do not use heroin, cocaine, or crack	1.05 (0.95, 1.17)
Number of network members currently enrolled in drug treatment	2.08 (1.43, 3.02)
Number of network members in <i>could</i> support network	0.97 (0.85, 1.10)
Number of female network members in <i>could</i> support network	1.11 (0.92, 1.33)
Number of network members who could support and use heroin, cocaine, and/or crack	0.85 (0.68, 1.08)
Number in could support network who do not use heroin, cocaine, or crack	1.01 (0.88, 1.17)

Multivariable Analysis of Total Sample

The multivariable model included demographic variables that differed between groups by more than 10% and were statistically significant in the unadjusted model. Network variables were included in the final model based on support from the literature as well as on the premise that PWUD who belonged to the could support network would be more strongly associated with treatment enrollment than PWUD who belonged to the larger social network. Network variables were included as linear variables, while individual variables were categorical.

Table 5 presents our final model. There was no association between the number of network members who used heroin, cocaine, and/or crack and treatment enrollment (OR: 1.07, 95% CI: 0.83, 1.37). However, the odds of treatment enrollment decrease by 38% for each additional PWUD in the could support (95% CI: 0.42, 0.92). For each additional network member currently enrolled in treatment, the odds of treatment enrollment increase by 122% (95% CI: 1.48, 3.34).

Females have 1.72 (95% CI: 1.02, 2.93) times the odds of treatment enrollment as males. Homelessness in the past six months increases the odds of treatment enrollment by 90% (95% CI: 1.03, 3.50). Those with insurance have 3.33 (95% CI: 1.64, 6.76) times the odds of treatment enrollment as those without insurance. Heroin use continues to show an effect, with those who had used heroin in the past 6 months having 2.25 (95% CI: 1.33, 3.83) times the odds of treatment enrollment as those not using heroin.

Table 5: Adjusted odds ratios for individual and network correlates of any treatment receipt in past 6 months in a sample of PWUD in Baltimore, 2014 - 2017

Individual	Odds Ratio (95% CI)
Females vs. males	1.72 (1.02, 2.93)
Homeless during past 6 months	1.90 (1.03, 3.50)
Currently have health insurance	3.33 (1.64, 6.76)
Any heroin use during past 6 months	2.25 (1.33, 3.83)
Network	
Number of network members who use heroin, cocaine, and/or crack	1.07 (0.83, 1.37)
Number of network members currently enrolled in drug treatment	2.22 (1.48, 3.34)
Number of network members who could support and use heroin, cocaine, and/or crack	0.62 (0.42, 0.92)

Additional Analyses

Disaggregated Treatment

The individual and social network characteristics of this sample are presented in Table 6. The MAT treatment group had a lower proportion of males (57.4%) than the non-MAT treatment group (66.7%). The MAT group also had a lower proportion of black participants compared to the non-MAT group (83.5% vs. 90.5%). A far higher number of the MAT group were married or in a committed relationship compared to the non-MAT group (58.2% vs. 39.7%). There was a higher proportion of cocaine use in the MAT group (56.0% vs. 49.2% in the non-MAT group) and a lower proportion of crack use (69.2% in the MAT group vs. 79.4% in the non-MAT group). Network characteristics were similar across groups.

Table 6: Individual and network correlates of disaggregated treatment enrollment (none, MAT, and non-MAT) within the past 6 months in a sample of persons who use heroin in Baltimore, 2014 - 2017 (N = 218)

	No treatment in past 6 mo. (n = 64; 29.4%) n (%)	Non-MAT treatment in past 6 mo. (n = 63; 28.9%) n (%)	MAT in past 6 mo. (n = 91; 41.7%) n (%)
Individual			
Male	41 (64.1)	42 (66.7)	52 (57.4)
Age, median (IQR)	51.0 (44-55)	51.0 (45-55)	50.0 (43-56)
Race/ethnicity			
Black	56 (87.5)	57 (90.5)	76 (83.5)
White	7 (10.9)	5 (7.9)	14 (15.4)
Other	1 (1.6)	1 (1.6)	1 (1.1)
HIV positive	31 (48.4)	34 (54.0)	45 (49.5)
High school education/GED or higher	36 (56.3)	38 (60.3)	57 (62.6)
Married/committed relationship	26 (40.6)	25 (39.7)	53 (58.2)
Homeless during past 6 months	17 (26.6)	21 (33.3)	28 (30.8)
Currently unemployed	57 (89.1)	55 (87.3)	84 (92.3)
Currently have health insurance	51 (79.7)	59 (93.7)	82 (90.1)
Any cocaine past 6 months	32 (50.0)	31 (49.2)	51 (56.0)
Any crack past 6 months	45 (70.3)	50 (79.4)	63 (69.2)
Network			
Number in network	4 (3 - 6)	4 (3 - 7)	4 (3 - 7)
Number in network who use heroin, cocaine, or crack	1 (0 - 2)	1 (1 - 2)	1 (0 - 2)
Number in network currently enrolled in drug treatment	0 (0 - 0)	0 (0 - 1)	0 (0 - 1)
Number in could support network	3 (2 - 4)	3 (2 - 3)	3 (2 - 4)
Number of females in could support network	2 (1 - 2)	1 (1 - 2)	2 (1 - 3)
Number in could support network who use heroin, cocaine, or crack	1 (0 - 1)	1 (0 - 1)	1 (0 - 1)

Bivariate Analysis of Disaggregated Treatment

Although the width of the confidence intervals and size of effect vary, the pattern previously seen appears to hold true. The number of network members currently enrolled in drug treatment has a positive association with treatment enrollment, with a 54% increase in the odds of non-MAT treatment enrollment for each additional network member currently in treatment (95% CI: 0.96, 2.45) and an 86% increase in the odds of MAT treatment enrollment (95% CI: 1.20, 2.88). The number of network members who use drugs has no association, with an odds ratio of 1.06 (95% CI: 0.84, 1.33) for the non-MAT treatment group and 0.88 (95% CI: 0.69, 1.11) for the MAT treatment group. The number of could support members who use drugs has a negative association with treatment enrollment, with a 15% decrease in the odds of non-MAT treatment enrollment for each additional PWUD in the could support network (95% CI: 0.62, 1.18) and a 24% decrease in MAT treatment enrollment (95% CI: 0.56, 1.05).

Table 7: Unadjusted odds ratios for Individual and network correlates of disaggregated treatment enrollment (none, MAT, and non-MAT) within the past 6 months in a sample of persons who use heroin in Baltimore, 2014 - 2017

	Non-MAT n = 63	MAT n = 91
Individual	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Females vs. males	0.89 (0.43, 1.85)	1.34 (0.69, 2.58)
HIV+	1.25 (0.62, 2.51)	1.04 (0.55, 1.97)
High school Education/GED or higher	1.18 (0.58, 2.40)	1.30 (0.68, 2.50)
Married/committed relationship	0.96 (0.47, 1.96)	2.04 (1.06, 3.90)
Homeless during past 6 months	1.38 (0.65, 2.97)	1.23 (0.60, 2.50)
Currently unemployed	0.84 (0.29, 2.49)	1.47 (0.49, 4.43)
Currently have health insurance	3.76 (1.15, 12.26)	2.32 (0.93, 5.82)
Any cocaine use during past 6 months	0.97 (0.48, 1.94)	1.28 (0.67, 2.42)
Any crack use during past 6 months	1.62 (0.72, 3.66)	0.95 (0.47, 1.91)
Network		
Number of network members who use heroin, cocaine, and/or crack	1.06 (0.84, 1.33)	0.88 (0.69, 1.11)
Number of network members currently enrolled in drug treatment	1.54 (0.96, 2.45)	1.86 (1.20, 2.88)
Number of network members in <i>could</i> support network	0.91 (0.76, 1.09)	0.98 (0.83, 1.15)
Number of female network members in <i>could</i> support network	0.99 (0.75, 1.30)	1.11 (0.87, 1.42)
Number of network members who could support and use heroin, cocaine, and/or crack	0.85 (0.62, 1.18)	0.76 (0.56, 1.05)

Multivariable Analysis of Disaggregated Treatment

The results of the multivariable analysis are shown in Table 8. Having a higher number of network members who also use drugs increases the odds of non-MAT treatment enrollment with an increase of 39% for each additional PWUD in the network (95% CI: 0.93, 2.06), while it has no effect for MAT treatment enrollment (OR: 0.95, 95% CI: 0.62, 1.45). Number of network members also enrolled in treatment continues to have a positive effect on treatment enrollment, with a 52% increase in the odds of non-MAT

treatment enrollment for every additional network member currently in treatment (95% CI: 0.93, 2.49) and an increase of 105% (95% CI: 1.28, 3.28) for MAT treatment enrollment. Each additional network member who uses drugs who also could support him/her decreases the odds of non-MAT treatment enrollment by 44% (95% CI: 0.32, 0.98) and by 31% for MAT treatment enrollment (95% CI: 0.39, 1.23). Currently having health insurance for the non-MAT treatment group is the only statistically significantly individual variable associated with treatment enrollment.

Table 8: Adjusted odds ratios for Individual and network correlates of disaggregated treatment enrollment (none, MAT, and non-MAT) within the past 6 months in a sample of persons who use heroin in Baltimore, 2014 - 2017

	Non-MAT n = 63	MAT n = 91
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Individual		
Females vs. males	0.92 (0.43, 1.99)	1.32 (0.65, 2.66)
Homeless during past 6 months	1.62 (0.73, 3.61)	1.44 (0.67, 3.07)
Currently have health insurance	3.59 (1.08, 11.94)	2.30 (0.88, 5.92)
Network		
Number of network members who use heroin, cocaine, and/or crack	1.39 (0.93, 2.06)	0.95 (0.62, 1.45)
Number of network members currently enrolled in drug treatment	1.52 (0.93, 2.49)	2.05 (1.28, 3.28)
Number of network members who could support and use heroin, cocaine, and/or crack	0.56 (0.32, 0.98)	0.69 (0.39, 1.23)

Drug Use Patterns

Table 9 shows demographic characteristics of participants in this analysis. Of those who used heroin, 52.1% also used cocaine and 72.2% also used crack. Over 90% of those who didn't use heroin, used crack, and crack was the sole drug used by 59.8% of those who use only one drug. Of those who use multiple substances, heroin was used by 81.2%.

Table 9: Individual and network correlates of treatment enrollment (methadone maintenance, detox, residential, outpatient, and/or meetings/self-help) within the past 6 months for heroin use vs. use of drugs other than heroin in a sample of PWUD in Baltimore, 2014 - 2017

	Heroin use N = 219 (66.4%)	Use of drugs other than heroin N = 111 (33.6%)
Individual	n (%)	n (%)
Male	136 (62.1)	64 (57.7)
Age, median (IQR)	50 (43-55)	52 (44-57)
Race/ethnicity		
Black	190 (86.8)	105 (94.6)
White	26 (11.9)	6 (5.4)
Other	3 (1.4)	0
HIV positive	110 (50.2)	78 (70.3)
High school/GED or higher	132 (60.3)	75 (67.6)
Married/committed relationship	105 (48.0)	53 (47.8)
Homeless in past 6 months	66 (30.1)	21 (18.9)
Currently unemployed	197 (90.0)	93 (83.8)
Currently have health insurance	193 (88.1)	93 (83.8)
Any heroin past 6 months	219 (100.0)	0
Any cocaine past 6 months	114 (52.1)	39 (35.1)
Any crack past 6 months	158 (72.2)	103 (92.8)
Network	Median (IQR)	Median (IQR)
Number in network	4 (3 - 6)	4 (2 - 6)
Number in network who use heroin, cocaine, or crack	1 (0 - 2)	1 (0 - 1)
Number in network currently enrolled in drug treatment	0 (0 - 1)	0 (0 - 1)
Number in could support network	3 (2 - 4)	3 (2 - 4)
Number of females in could support network	2 (1 - 2)	1 (1 - 2)
Number in could support network who use heroin, cocaine, or crack	1 (0 - 1)	0 (0 - 1)

Table 10: Individual and network correlates of treatment enrollment (methadone maintenance, detox, residential, outpatient, and/or meetings/self-help) within the past 6 months for use of only one drug vs. polysubstance use in a sample of PWUD in Baltimore, 2014 – 2017

	Use of only one drug N = 112 (33.9%)	Polysubstance use N = 218 (66.1%)
Individual	n (%)	n (%)
Male	71 (63.4)	129 (59.2)
Age, median (IQR)	51.0 (44.4-55.5)	50.0 (43-55)
Race/ethnicity		
Black	107 (95.5)	188 (86.2)
White	5 (4.5)	27 (12.4)
Other	0	3 (1.4)
HIV positive	65 (58.0)	123 (56.4)
High school/GED or higher	67 (59.8)	140 (64.2)
Married/committed relationship		
Homeless in past 6 months	29 (25.9)	58 (26.6)
Currently unemployed	95 (84.8)	195 (89.5)
Currently have health insurance	96 (85.7)	190 (87.2)
Any heroin past 6 months	42 (37.5)	177 (81.2)
Any cocaine past 6 months	3 (2.7)	150 (68.8)
Any crack past 6 months	67 (59.8)	194 (89.0)
Network	Median (IQR)	Median (IQR)
Number in network	4 (2.5 - 5.5)	4 (3 - 6)
Number in network who use heroin, cocaine, or crack	1 (0 - 1)	1 (0 - 2)
Number in network currently enrolled in drug treatment	0 (0 - 1)	0 (0 - 1)
Number in could support network	3 (2 - 4)	3 (2 - 4)
Number of females in could support network	1 (1 - 2)	2 (1 - 2)
Number in could support network who use heroin, cocaine, or crack	0 (0 - 1)	1 (0 - 1)

Bivariate Analysis of Drug Use Patterns

The results of the bivariate analysis are shown in Table 10. Number of network members enrolled in treatment has a stronger effect for those not using heroin, increasing the odds of treatment enrollment by 232% for each additional network member currently in treatment (95% CI: 1.49, 7.37); however, the effect was present across all drug use patterns. For those using drugs other than heroin there was an increase in odds of

treatment enrollment of 72% (95% CI: 1.13, 2.61), for those using only one drug there was an 86% increase (95% CI: 1.05, 3.29), and for those using multiple substances there was a 123% increase in odds of treatment enrollment (95% CI: 1.34, 3.70). It is worth noting the greater precision in the results for those using heroin, where the sample size was nearly twice that as for those not using heroin. Females are more likely to enroll in treatment for use of a single drug and use of drugs other than heroin. The effect of homelessness is also greater for those using drugs other than heroin.

Table 11: Unadjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for heroin use vs. use of drugs other than heroin in a sample of PWUD in Baltimore, 2014 - 2017

	Heroin use (N = 219)	Use of drugs other than heroin (N = 111)
	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Individual		
Females vs. males	1.13 (0.62, 2.06)	3.45 (1.55, 7.67)
HIV+	1.11 (0.62, 1.98)	0.37 (0.16, 0.89)
Highschool/GED or higher	1.27 (0.70, 2.29)	0.52 (0.23, 1.18)
Married/committed relationship	1.52 (0.84, 2.74)	0.84 (0.40, 1.78)
Homeless during past 6 months	1.28 (0.67, 2.45)	3.50 (1.18, 10.36)
Currently unemployed	1.15 (0.44, 2.96)	1.99 (0.71, 5.60)
Currently have health insurance	2.78 (1.21, 6.40)	3.60 (1.19, 10.93)
Network		
Number of network members who use heroin, cocaine, and/or crack	0.96 (0.78, 1.17)	0.94 (0.73, 1.21)
Number of network members currently enrolled in drug treatment	1.72 (1.13, 2.61)	3.32 (1.49, 7.37)
Number of network members in <i>could</i> support network	0.95 (0.82, 1.10)	0.93 (0.72, 1.20)
Number of female network members in <i>could</i> support network	1.06 (0.84, 1.33)	1.19 (0.87, 1.65)
Number of network members who could support and use heroin, cocaine, and/or crack	0.80 (0.61, 1.06)	0.78 (0.46, 1.31)

Table 12: Unadjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for use of only one drug vs. polysubstance use in a sample of PWUD in Baltimore, 2014 - 2017

	Use of only one drug (N = 112)	Polysubstance use (N = 218)
Individual	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Females vs. males	2.34 (1.05, 5.25)	1.31 (0.72, 2.37)
HIV+	0.29 (0.13, 0.65)	1.12 (0.62, 2.00)
Highschool/GED or higher	0.54 (0.25, 1.16)	1.14 (0.63, 2.07)
Married/committed relationship	0.75 (0.36, 1.58)	1.68 (0.93, 3.04)
Homeless during past 6 months	2.17 (0.89, 5.32)	1.71 (0.85, 3.45)
Currently unemployed	1.48 (0.53, 4.17)	1.56 (0.64, 3.80)
Currently have health insurance	4.58 (1.38, 15.25)	2.65 (1.18, 5.94)
Network		
Number of network members who use heroin, cocaine, and/or crack	0.97 (0.71, 1.32)	0.93 (0.77, 1.11)
Number of network members currently enrolled in drug treatment	1.86 (1.05, 3.29)	2.23 (1.34, 3.70)
Number of network members in <i>could</i> support network	1.07 (0.84, 1.35)	0.90 (0.77, 1.05)
Number of female network members in <i>could</i> support network	1.27 (0.88, 1.84)	1.03 (0.83, 1.28)
Number of network members who could support and use heroin, cocaine, and/or crack	0.86 (0.48, 1.56)	0.77 (0.59, 1.01)

Multivariable Analysis of Drug Use Patterns

Effects were similar for people who used heroin and people who used multiple drugs.

Likewise, effects were similar for people who used drugs other than heroin and people who only used a single drug, suggesting that the pairs, while grouped differently, could be characterized by severity of drug use. The association with number of network members enrolled in treatment and the outcome is greatest for those using drugs other than heroin but is also the least precise measurement (OR: 4.65, 95% CI: 1.74, 12.45).

For those using heroin the odds ratio is 1.78 (95% CI: 1.14, 2.79), for use of a single drug

the odds ratio is 2.04 (95% CI: 1.11, 3.74), and for polysubstance use the odds ratio is 2.50 (95% CI: 1.44, 4.35). The number of network members who used drugs did not have a meaningful effect for any of the groups, while the number of PWUD in the could support network did have a negative effect, although confidence intervals were less precise both for people who did not use heroin and for single drug use. For heroin use, each additional PWUD in the could support network decreases odds of treatment enrollment by 38% (95% CI: 0.38, 1.02), for use of drugs other than heroin treatment the decrease is 54% (95% CI: 0.19, 1.15), for use of a single drug the decrease is 33% (95% CI: 0.29, 1.54), and for polysubstance use the odds of treatment enrollment are decreased by 38% (95% CI: 0.39, 0.98). Once again, females are more likely to enroll in treatment for use of a single drug (OR: 2.90, 95% CI: 1.16, 7.23) and use of drugs other than heroin (OR: 4.12, 95% CI: 1.56, 10.87). There is no effect on being female for heroin use (OR: 1.13, 95% CI: 0.59, 2.15) or for polysubstance use (OR: 1.20, 95% CI: 0.62, 2.32). Having health insurance increases odds of treatment enrollment for all groups as does the number of network members currently enrolled in drug treatment.

Table 13: Adjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for heroin use vs. use of drugs other than heroin in a sample of PWUD in Baltimore, 2014 - 2017

	Heroin use (n = 219)	Use of drugs other than heroin (n = 111)
Individual	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Females vs. males	1.13 (0.59, 2.15)	4.12 (1.56, 10.87)
Homeless during past 6 months	1.49 (0.74, 2.97)	2.90 (0.77, 10.86)
Currently have health insurance	2.69 (1.14, 6.35)	6.72 (1.57, 28.83)
Network		
Number of network members who use heroin, cocaine, and/or crack	1.16 (0.81, 1.67)	1.01 (0.69, 1.48)
Number of network members currently enrolled in drug treatment	1.78 (1.14, 2.79)	4.65 (1.74, 12.45)
Number of network members who could support and use heroin, cocaine, and/or crack	0.62 (0.38, 1.02)	0.46 (0.19, 1.15)

Table 14: Adjusted odds ratios for individual and network correlates of treatment enrollment within the past 6 months for use of only one drug vs. polysubstance use in a sample of PWUD in Baltimore, 2014 - 2017

	Use of only one drug (n = 112)	Polysubstance use (n = 218)
Individual	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Females vs. males	2.90 (1.16, 7.23)	1.20 (0.62, 2.32)
Homeless during past 6 months	3.34 (1.14, 9.85)	1.84 (0.86, 3.94)
Currently have health insurance	4.94 (1.28, 19.10)	2.93 (1.24, 6.95)
Network		
Number of network members who use heroin, cocaine, and/or crack	1.13 (0.75, 1.70)	1.03 (0.74, 1.43)
Number of network members currently enrolled in drug treatment	2.04 (1.11, 3.74)	2.50 (1.44, 4.35)
Number of network members who could support and use heroin, cocaine, and/or crack	0.67 (0.29, 1.54)	0.62 (0.39, 0.98)

DISCUSSION

We hypothesized that higher levels of social support, fewer drug using network members, and fewer drug using network members who provide social support would correlate with higher rates of enrollment in SUD treatment. While strength of effect and level of precision varied, in general the number of network members enrolled in drug treatment was positively associated with treatment enrollment. Surprisingly, the number of PWUD in a person's network was seen to have a negligible effect. The size of the support network did not appear to change across groups, which was contrary to what we'd expected. The number of network members who used drugs and could also provide social support was significantly associated with decreased treatment enrollment and in the expected direction. The presence of network members who were currently receiving treatment was expected to be positively associated with treatment receipt, which was seen to be the case.

Given the results of prior research, it is unsurprising that having more network members who are currently enrolled in treatment is associated with an individual's own odds of enrolling in treatment. For example, in a study by Davey, et. al., having a greater number of social network members in drug treatment increased entry into drug treatment by 29%. One possible explanation is that having more network members who are enrolled in treatment encourages or facilitates one's own treatment enrollment. This could happen when a network member models recovery oriented attitudes and behaviors, normalizes treatment enrollment, provides emotional support and encouragement, and even through providing instrumental support such as transportation to 12-step meetings. Another

possibility is that enrolling in treatment creates the opportunity to meet others who are also in treatment and thereby enrich one's social network with such individuals, a possible example of the "socially negotiated identity transition" discussed by Best, et al. Since our data is cross-sectional our analysis does not provide evidence to support one theory over the other. Another possibility is that homophily on heroin use is driving the association between network members enrolled in treatment and individual treatment enrollment. However, as with the number of PWUD in the network, the number of people in the network who used heroin was not associated with individual treatment enrollment. An additional finding is that the number of PWUD in a person's social network does not appear to affect treatment enrollment, but the number of PWUD in the could support network does negatively affect odds of individual treatment enrollment. As noted above, Eddie & Kelly found that it is time spent with other PWUD, rather than total number of PWUD in the social network, that affects chances of relapse in young adults post-treatment. Our finding is a corollary to this finding, if we assume that people tend to spend more time with social network members who are also members of their could support network. The implication may be that, rather than encouraging PWUD to distance themselves from all PWUD in their network, they focus on fostering close relationships with sober individuals, and they attempt to transfer sources of emotional and financial support to people who don't use drugs.

In an examination of all individuals who had used drugs in the past 6 months, females were 72% more likely to enroll in treatment compared to males. Currently having health insurance increased enrollment by 233% and experiencing homelessness within the past 6

months increased treatment enrollment by 90%. The finding on homelessness was contrary to what we'd expected. When we examined this finding further, we saw that 41.5% of those with a past-6-month history of homelessness had enrolled in residential treatment, compared to 25.2% of those without a past-6-month history of homelessness. Proportions of treatment enrollment in other treatment modalities were more comparable. In the disaggregated analysis, only health insurance was associated with enrollment in both MAT and non-MAT treatment, with odds ratios of 2.30 and 3.59, respectively. Finally, in the analysis that looked at different patterns of drug use, females were again more likely to enroll in treatment, but this finding was limited to females who used a single drug and/or used drugs other than heroin. Homelessness was significantly associated with treatment enrollment only among those using one drug, only. Currently having health insurance was associated with treatment enrollment for all patterns of drug use.

As hypothesized, persons who use heroin were more likely to enroll in SUD treatment than persons using drugs other than heroin. Those using heroin were more likely to enroll in MAT, with 41.7% of those using heroin who had enrolled in treatment in the past 6 months receiving MAT vs. 28.9% receiving treatment that did not include MAT. Given that medication-assisted treatment for opioid use is a highly effective treatment option available for SUD, it is striking that nearly one third of those using heroin were not receiving MAT. This may be due to recognized barriers to MAT such as a lack of prescribers, regulatory issues, and prevailing attitudes and misunderstandings about the role of medications in treatment [Oliva, et al., Roman, et al.].

Overall, the results of our analysis are consistent with the findings of prior studies. This is important given the distinct features of our sample (largely African American, middle-aged, many who are HIV positive, living in an urban area) that may differ from the samples in other studies.

The main limitation of this study is its cross-sectional nature and therefore we could not determine the temporal relationships between individual and network correlates and treatment enrollment. Many of the individuals enrolled in the study had very low incomes, were on disability, or were receiving SSI, which may not generalize to other populations of PWUD. Treatment program entry also varies from state to state, so findings which may generalize to residents of Baltimore (and possibly also to Maryland residents outside the Baltimore area) may not be generalizable to locations incorporating other treatment structures. Although treatment modalities were disaggregated and examined individually, it may have been more appropriate to define latent classes for treatment utilization, which could be an option for future studies.

An important strength of this study is that a more extensive series of questions were asked pertaining to social networks compared to prior studies, especially in relation to participant's support networks. Drug use patterns were also disaggregated and analyzed individually, which has been noted as an important avenue for future research [Davey, et al.]. This analysis also investigated MAT and non-MAT treatment entry separately for people who use heroin. Due to their smaller samples, these sub-group analyses are likely more valuable for hypothesis-generation than for drawing definitive conclusions. Broadly

speaking, they support the notion that social relationships play a key role in SUD treatment enrollment.

In this analysis, we found that characteristics of a PWUD's social network are associated with the odds of treatment enrollment. As the number of network members who had enrolled in SUD treatment increased, so did individual odds of enrolling in treatment (or similarly, the odds of treatment enrollment increased as the number of network members who had enrolled in treatment increased). Surprisingly, the number of members of a PWUD's social network who used drugs was not associated with treatment enrollment. However, the number of members of the PWUD's support network who used drugs was negatively associated with treatment enrollment. Further analysis is needed to determine the specific nature of these ties (kin, romantic, etc), as well as to understand the temporal relationships between network members enrollment in treatment and a PWUD's own treatment receipt. As posited in recovery models such as SIMOR, the addition of non-using members to an individual's social network can catalyze a shift toward individual recovery efforts [Best, et al.]. Our analysis suggests that interventions focus on building and encouraging new relationships with non-using social network members as a means to begin the recovery process; to deemphasize the removal of members of the social network who use drugs; and to ensure that a consideration of the individual social and support networks are incorporated into all treatment modalities.

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