Dartmouth-Hitchcock

Treating High-Risk Participants with Opioid Use Disorder in Vermont's Hub & Spoke System:

Evaluation of a SAMHSA-Funded Initiative 'VT MAT-PDOA'
Expanding Treatment for People Involved with
the Department of Corrections &/or
the Department of Children and Families

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Submitted to:

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Glossary

Abbreviations

AA	Alcoholics Anonymous
ADAP	Alcohol and Drug Abuse Programs
ARC	Assessment of Recovery Capital
BMT	Buprenorphine Maintenance Treatment
CBT	Cognitive Behavioral Therapy
Chi^2	Chi-squared statistic
CPO	Child Protection Order
CPT	Cognitive Processing Therapy
CSAT	The Center of Substance Abuse Treatment
DCF	Department of Children and Families
DOC	Department of Corrections
EMR	Electronic Medical Record
GPRA	Government Performance and Results Act
HC	Howard Center
HIV	Human Immunodeficiency Virus
H-L	Hosmer-Lemeshow
ICBT	Integrated Cognitive Behavioral Therapy
IDDT	Integrated Dual Diagnosis Treatment
IV	Intravenous
MAT	Medication-Assisted Treatment
MI	Mental Illness
MMS	Modified Mini Screen
MMT	Methadone Maintenance Treatment
MRE	Making Recovery Easier
N/A	Not Applicable
NA	Narcotics Anonymous
NMC-CPC	Northwestern Medical Center Comprehensive Pain Clinic
OBOT	Office-Based Opioid Treatment
OCD	Obsessive-Compulsive Disorder
OST	Opioid Substitution Treatment
OTP	Opioid Treatment Programs
OUD	Opioid Use Disorder
PCL-5	PTSD Checklist for DSM-5
PCMN	Patient-Centered Medical Neighborhood
PDOA	Prescription Drug & Opioid Addiction
PTSD	Post-Traumatic Stress Disorder
ROI	Release of Information
SAMHSA	Substance Abuse and Mental Health Services Administration
SD	Standard Deviation
SUD	Substance Use Disorder
THC	Tetrahydrocannabinol – psychoactive constituent of marijuana

Medication-Assisted Treatment: the use of Methadone, Buprenorphine or Naltrexone that help relieve opioid withdrawal symptoms and cravings.

Hub: Opioid Treatment Programs (OTP's) that provide intensive treatment for opioid use disorder and serve as a support for Spoke providers offering MAT (Vermont Blueprint for Health, 2016)

Spoke: Office-Based Opioid Treatment (OBOT) providers for opioid use disorder. For example, primary care offices providing MAT services.

I. Overview of the VT MAT-PDOA Initiative

Since 2000, the need for treatment of opioid use disorder (OUD) in Vermont has increased eightfold (Simpatico, 2016). In response, in 2014 the Vermont Department of Health's Division of Alcohol and Drug Abuse Programs (ADAP) and the Department of Health Access (DVHA-Vermont Medicaid Authority) created the innovative "Hub and Spoke Model" (Simpatico, 2016). Although the Hub and Spoke Model has been considered successful in engaging Participants in treatment, Vermont identified three high-risk populations that required a more focused effort to increase medication-assisted treatment access and engagement. The high-risk populations of focus are participants involved with the Vermont Department of Corrections (DOC), participants involved with the Vermont Department of Children and Families (DCF) and participants on a waitlist for medication-assisted treatment. The Vermont Medication-Assisted Treatment (MAT) Prescription Drug & Opioid Addiction (PDOA) Initiative was created with the goal to enhance and expand substance use service systems in order to increase access to medication-assisted treatment by building capacity for populations at a higher risk for adverse outcomes. SAMHSA's goal for the grant was to fund medication-assisted treatment and recovery services that are accessible, effective, comprehensive, coordinated and evidence-based.

In an attempt to increase engagement and access to medication-assisted treatment and recovery services, five strategies were implemented within the VT-MAT PDOA Model:

1. Ensure MAT coordinators were available among three Vermont Regions: Chittenden, Franklin and Rutland Counties. A MAT coordinator's role is to ensure participants with OUD have access to medication-assisted treatment and to coordinate care.

2. Peer recovery support guides available at the onset of OUD treatment.

3. Patient-Centered Medical Neighborhood (PCMN) meetings held in each of the three Vermont regions in order to enhance care coordination and improve access to medical, behavioral and social services.

4. Offer Learning Collaboratives to provide evidence-based psychosocial treatments training to substance use providers.

5. Offer Naltrexone in Hubs & Spokes throughout the State of Vermont.

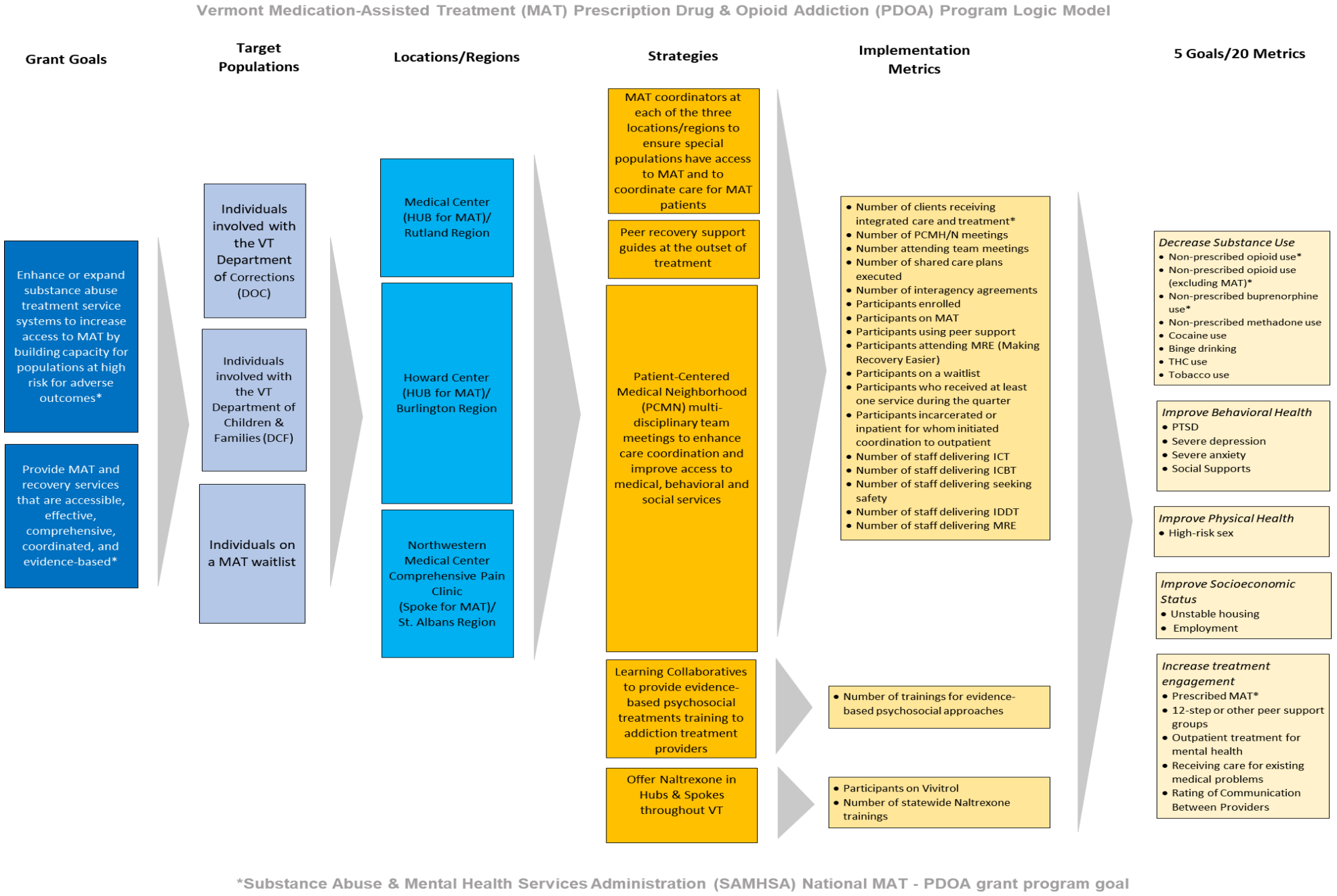
The VT-MAT PDOA Program Evaluation was created to evaluate Vermont's SAMHSA-funded initiative and also to provide actionable information to the Vermont Department of Health with 3 specific aims:

1) Describe high-risk participants entering OUD treatment to help providers/programs assess whether current program designs are meeting needs.

2) Assess participants' progress on study outcomes and identify predictors of non-prescribed opioid use (vs. abstinence), allowing providers/programs to gauge what is working well and areas that may need more attention.

3) Assess whether there is a longitudinal relationship between selected predictors identified in AIM 2 and continued non-prescribed opioid use (versus abstinence).

I. Overview of the VT-MAT PDOA Initiative & Evaluation Aims



II. Results

A. Evaluation AIM 1 Results: Describe High-Risk Participants Entering Hub and Spoke Treatment

Introduction to AIM 1:

Non-Prescribed Substance Use at Treatment Entry

Use of non-prescribed substances can bring many problems to a participant's life and to the community. Use of heroin seems to be on the rise in Vermont between 2010 and 2015, with increased rates of heroin related overdoses (Vandonsel, Livingston, & Searles, 2016). From 2015 to 2016, there was a 30% increase in the number of opioid related fatalities in VT and a 5% increase from 2016-2017. Since 2015, the number of fentanyl related overdoses has more than doubled and is now exceeding the number of heroin related overdoses (Opioid related fatalities in VT, 2017). Since 2000, VT saw an eight-fold increase in the number of participants seeking treatment for opioid use (Simpatico, 2016). MAT is the most effective treatment for OUD, with studies showing decreased use of non-prescribed opioids (Connery, 2015; Gruber, Delucchi, Kielstein, & Batki, 2008; Lee, Friedmann, Kinlock, & Nunes, 2016; Kinlock, Gordon, Schwartz, & O'Grady, 2008; Kakko, Svanborg, Kreek, & Heilig, 2003; Mattick, Breen, Kimber, & Davoli, 2009; Tkacz, Severt, Cacciola, & Ruetsch, 2012; Vogel et al,, 2016; Miller et al., 2017), increased treatment retention (Kakko, Svanborg, Kreek, & Heilig, 2003; Thomas et al., 2014), decreased crime (Kakko, Svanborg, Kreek, & Heilig, 2003) and decreased deaths (Kakko, Svanborg, Kreek, & Heilig, 2003). Some studies suggest that MAT can also reduce rates of use of other substances, including cocaine, benzodiazepines, and marijuana (Kakko, Svanborg, Kreek, & Heilig, 2003; Kinlock, Gordon, Schwartz, & O'Grady, 2008). Through qualitative questions, we learned that many people use non-prescribed "street" MAT prior to entering treatment as a way to stave off withdrawal from opiates and improve day to day functioning, which may be due to both perceived barriers to treatment (myths about treatment, stigma) and actual barriers to treatment (transportation, wait lists, impact on employment).

Understanding use of other substances is important in the treatment of people with OUD. Prior research has shown that many participants who use opioids also use other substances, including tobacco, alcohol, marijuana, cocaine, and methamphetamine (Grigsby & Howard, 2019; Center for Substance Abuse Treatment, 2005; Becker, Sullivan, Tetrault, Desai, & Fiellin, 2008; Back, Lawson, Singleton, & Brady, 2011). The Center for Substance Abuse Treatment of SAMHSA reported over 50% of patients in MAT treatment used substances in addition to opioids, with 23% using alcohol, 13% using marijuana, 23% using cocaine, and 3% using methamphetamine/amphetamines. Between 85 to 92% of people in MAT used tobacco (Center for Substance Abuse Treatment, 2005). Another study found that about 41% of prescription opioid dependent people also used alcohol, 30% used marijuana, 48% used cocaine or heroin, and about 70% smoked cigarettes. With all substances except tobacco, men were more likely to engage in the use of that substance (Back, Lawson, Singleton, & Brady, 2011). In Vermont, The Blueprint for Health reported in 2016 that 48% of Hub & Spoke participants used tobacco, while 42% used other substances (Vermont Blueprint for Health, 2016).

Research has identified several factors related to the co-occurrence of opioid use and other substance use, including mental illness symptoms, identifying as a man, being younger, engaging in criminality, and experiencing suicidality (Center for Substance Abuse Treatment, 2005; Grigsby & Howard, 2019; Becker, Sullivan, Tetrault, Desai, & Fiellin, 2008; Kuramoto, Chilcoat, Ko, & Martins, 2012; Bogdanowicz, Stewart, Boradbent, Hatch, & Hotopf, 2015). Alcohol use among MAT participants is associated with more medical issues and mental health issues, higher rates of criminality, and worse social relationships (among family and peers) (Chatham, Rowan-Szal, Joe, Brown, & Simpson, 1995). Researchers hypothesize several reasons that explain the high rates of using multiple substances, such as self-medicating withdrawal symptoms or mental illness symptoms, and attempting to enhance a high. The relationship between tobacco and opioids has been found to be incredibly strong. This may be because dopamine release induced by nicotine is dependent on facilitation by the opioid system, and the nicotinic-acetylcholine system modulates self-administration of opioids (Yoon, Lane, & Weaver, 2015; Williams, Steinberg, Griffiths, & Cooperman, 2013; Mandal, Jain, Jhanjee, & Sreenivas, 2013). Research also found associations between opioid dependence, alcohol, and cocaine use which is also associated with negative treatment outcomes. There is some evidence suggesting that cocaine may decrease the efficacy of MAT leading to symptoms of underdosage and leaving people vulnerable to opioid relapse (Rowan-Szal, Chatham, & Simpson, 2000; Pennings, Leccese, & Wolff, 2002; Coffin et al., 2003; Tennant & Shannon, 1995).

The co-occurrence of opioid use and other substance use has important implications for both treatment outcome and mortality of patients on MAT. For instance, research has found that patients stabilized on adequate doses of MAT are less likely to abuse other substances. Furthermore, high percentages of people with non-fatal admissions to hospitals were using other substances concurrently. According to SAMHSA, almost 90% of heroin-related deaths involved the additional use of other substances (Center for Substance Abuse Treatment, 2005). Alcohol use among MAT participants has been found to adversely impact treatment outcomes, perhaps due to alcohol consumption being implicated in undermedication. The combination of alcohol and MAT exacerbates health issues such as liver damage from hepatitis C; such concurrent use is a major contributor to fatality among patients (Appel, Joseph, & Richman, 2000). Marijuana use has been found to be consistent throughout the duration of treatment, but data is mixed about the impact of ongoing marijuana use on treatment (Balhara & Jain, 2014; Epstein & Preston, 2003; Wasserman, Weinsein, Havassy, & Hall, 1998). The co-occurrence of benzodiazepine use and MAT has been found to be highly dangerous because of the risk of respiratory depression. Furthermore, research has found that such co-occurrence interferes with consistent attendance at treatment sessions and negatively impacts progress (Center for Substance Abuse Treatment, 2005). The data is conflicting, however, as some studies have found that concurrent use of alcohol and MAT can have no impact on treatment or that MAT can even reduce alcohol consumption among patients (Fairbank, Dunteman, & Condelli, 1993; Hubbard, Craddock, Flynn, Anderson, & Etheridge, 1997; Caputo et al., 2002; Appel, et al., 2001). Some studies have shown that regular counseling predicts a reduction in other substance use among opioid dependent patients (Villano, Rosenblum, Magura, & Fong, 2002; Rosenblum et al., 1995; Maguar, Rosenblum, Fong, Villano, & Richman, 2002).

Co-occurring Mental Health Symptoms and Substance Use

Mental health symptoms are highly prevalent in people with SUD (Lai et al., 2015; Kozhimannil, Dowd, Ali, Novak, & Chen, 2019). Results of a survey reported that providers indicated that the most commonly occurring mental health concerns they see in their clients with SUD, in order of prevalence, are mood, anxiety, PTSD, serious mental illness and personality disorders (McGovern et al., 2006). Utilizing a large national data set, Kozhimannil, Dowd, Ali, Novak, & Chen (2019), found that 40% of respondents with OUD had no mental illness, 36% had mild to moderate mental illness and 24% had serious mental illness. Studies estimate 26-53% of people with substance use disorders (SUD) meet lifetime PTSD criteria and 15-42% meet current criteria (Driessen et al., 2008; Reynolds, Hinchliffe, Asamoah, & Kouimtsidis, 2011; Shäfer & Najavits, 2007; Shäfer et al., 2010).

People with co-occurring mental illness and substance use disorders are prone to a range of negative outcomes, including worse substance use outcomes, (Compton et al., 2003, Lits, 2017; Ferri, Finlayson, Wang, & Martin, 2014; Johnson & Zlotnick, 2012), more family/social problems, greater medical problems (Cacciola, Alterman, Rutherford, McKay, & Mulvaney, 2001), underemployed, and incomes significantly under the federal poverty level (Kozhimannil, Dowd, Ali, Novak, & Chen, 2019). Krawczyk, Feder, Fingerhood, & Saloner (2017) found that participants with OUD who had co-occurring mental illness had significantly higher treatment attrition rates than those without mental illness; however, this was not true for participants who were prescribed MAT. Social support and recovery capital are two factors known to positively influence recovery (Stevens, Jason, Ram, & Light, 2015; Dobkin, Civita, Paraherakis, & Gill, 2002; White & Cloud, 2008). We sought to understand the mental health needs of participants who enrolled in the MAT integration study.

Corrections

National data shows that substance use is very high among people involved in the corrections system. Research shows that post release employment significantly decreases the likelihood of re-incarceration, re-arrest, and relapse (Welsh & Zajac, 2013) and treatment for substance use both while incarcerated and after release from incarceration is associated with reduced criminal activity (Welsh & Zajac, 2013; Sacks, Sacks, McKendrick, Banks, & Stommel, 2004). Nonetheless, people who are released from incarceration face many risks for relapse to opioids, including exposure to substances in temporarily living facilities, psychosocial stressors, and financial strain (Fox et al., 2015). Risk of death among former inmates upon release has been reported as 12.7 times greater than in the general public (Binswanger et al., 2007). A criminal record can make it especially challenging for many with OUD to gain employment and stable housing, which can increase the likelihood of losing custody of their children and serve as triggers for relapse (Tiburcio, 2008) or further criminal activities.

DCF

People with OUD who are involved with DCF also face many challenges. Research shows that cases of suspected child abuse and neglect are more likely to be substantiated when the parents are known to be using substances (Freisthler, Kepple, Wolf, Curry, & Gregoire, 2016; Seay & Kohl, 2015). Parents with OUD are more likely to lose custody of their children (Mayes & Truman, 2002) and children who are removed from homes where parents are using substances tend to have longer stays in foster care (Lloyd & Akin, 2014), though the opposite is true for women who enter treatment quickly and spend more time in treatment (Green, Rockhill, & Furrer, 2007). While substance use has many negative impacts on families and children (Mirick & Steenron, 2016), many parents report feelings related to the impact of their use on their children as a primary motivator for recovery (Best, Gow, Taylor, Knox, & White, 2011).

There is some evidence to suggest that MAT is associated with increased chance of parents regaining custody of their children, with likelihood increasing in relation to the length of treatment (Hall, Wilfong, Huebner, Posze, & Willauer, 2016; Grella, Needell, Shi, & Hser, 2009; Green, Rockhill, & Furrer, 2007). Mothers who attend treatment programs that provide high levels of family related, employment services and educational services are twice as likely to be reunified with their children when compared to programs that provide low levels of these services (Grella, Needell, Shi, & Hser, 2009).Understanding the presenting characteristics and similarities between our study sample and other groups of people with OUD can help inform clinical care and guide program development.

The goal of study AIM 1 is to summarize key characteristics of high-risk participants at entry into Hub and Spoke treatment. The purpose is to help elucidate important client needs with the potential to inform how well existing services synch with such needs. A secondary purpose is to set the stage for understanding results presented in AIM 2 (page 21), where participants' progress towards program goals at post-baseline time points is summarized, along with a list of characteristics that predict non-prescribed opioid use (vs. abstinence). For tables of descriptive statistics, see page 96.

Throughout AIM 1, results are presented for the entire cohort (all study enrollees), and then participant sub-groups where significant differences exist. Note that sub-groups are overlapping, and a single participant may be represented in multiple sub-groups. Study groups include:

- All Participants (entire cohort)
- Department of Corrections-involved (sub-group)
- Department of Children and Families-involved (sub-group)
- Howard Center-involved in Burlington (sub-group)
- NMC – CPC-involved in St. Albans (sub-group)

AIM 1 summarizes baseline case characteristics, demographics & socioeconomic status, non-prescribed substance use, mental/behavioral health, physical health and treatment engagement.

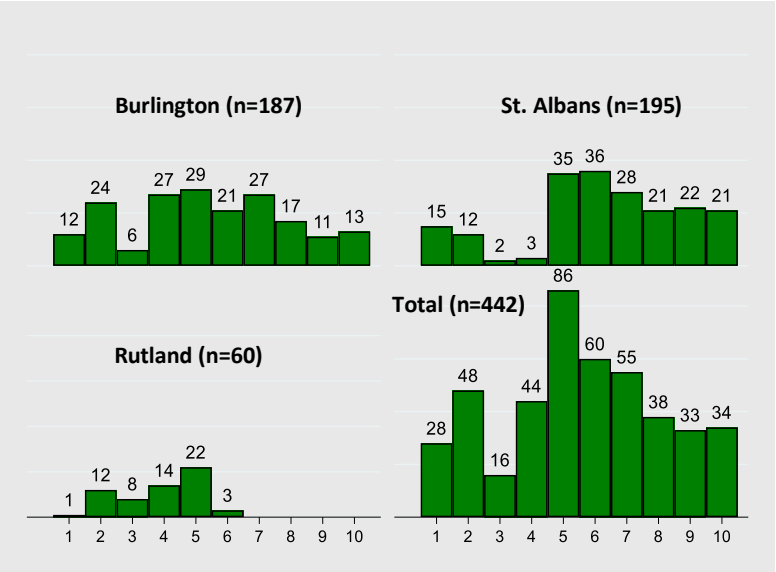
Case Characteristics

442 high-risk participants were enrolled in the study over a 30-month period (2.5 years); enrollment began in February 2016 and ended in July 2018.

Level of care at baseline was 55% hub (most of Burlington and all of Rutland) and 45% spoke (NMC-CPC in St. Albans). Rutland dropped out of the study early, and the number of participants enrolled is lower than for the other two sites. The majority of participants enrolled during calendar year 2017.

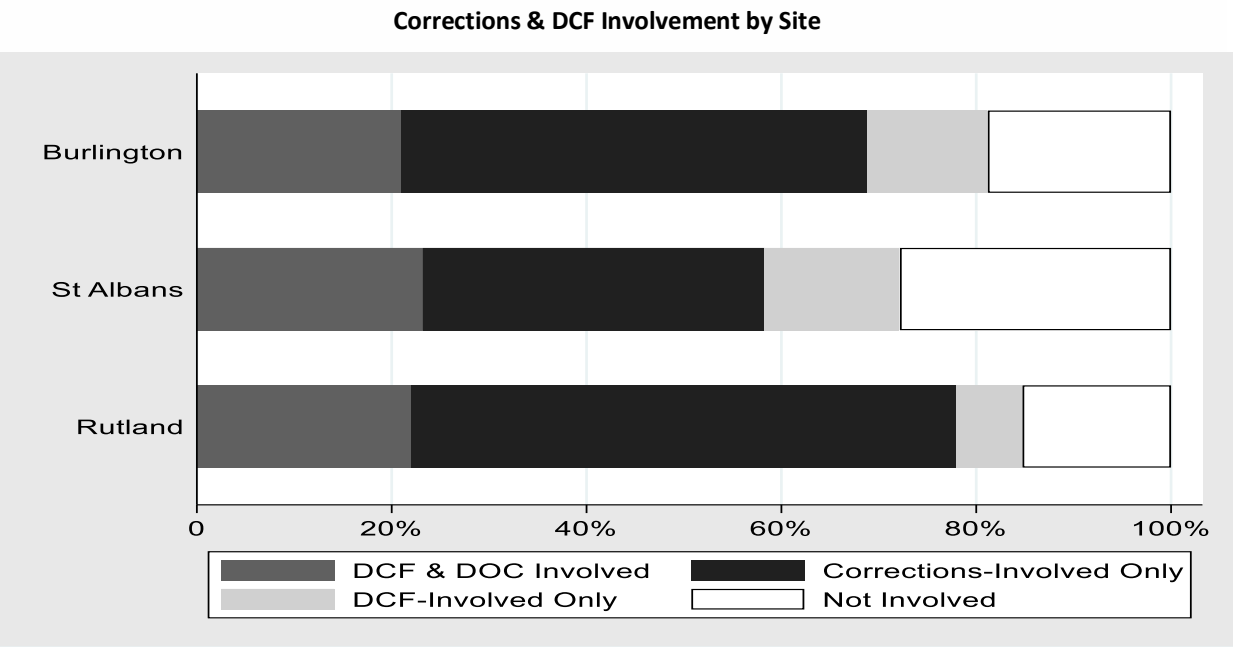
Study Enrollees by Study Quarter and Site*

February 2016 – July 2018



*Note: Final Quarter # 10 includes 4 months: April 2018-July 2018

78% of all participants enrolled were involved with either Corrections, DCF or both. Burlington and Rutland enrolled a disproportionate number of DOC-involved participants compared with St. Albans. Of the 151 participants involved with DCF, nearly 2/3rds (65%) were also involved with corrections. However, of the 289 participants involved with corrections, only about 1/3rd (34%) were involved with DCF.



Over 3/4rs of participants report having children (77%), and 20% or 1/5th of parents report that one or more child is in state custody due to a child protection order. The % of participants with an out of home child placement due to a CPO is slightly higher in Burlington at 23% (vs. 18% in St. Albans). About half (49%) of DCF-involved participants have a child who is not in their care and 62% had met with their DCF worker in the prior 30 days. Just over a ¼ of participants had been in jail in the prior 30 days, and 44% were on probation and parole, with 91% of them having met with their parole officer in the prior 30 days.

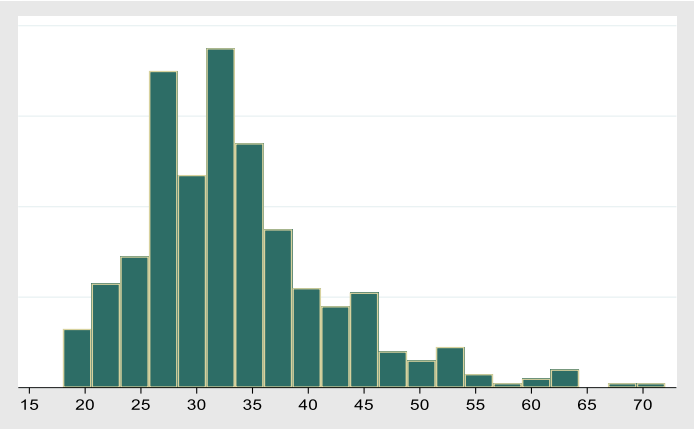
Following are the number of all participants and in each of our study groups (note that participants can be in more than one group):

All-Participants	Corrections-Involved	DCF-Involved	Howard Center	NMC-CPC
442	**289**	**151**	**187**	**195**

Demographics & Socioeconomic Status

Demographics collected include gender, having children, age, race, education and income. Socioeconomic status metrics include employment and housing status. Overall participants are disproportionally male, with 2/3rds men (64%) and 1/3rd women (36%)[1]. In the corrections sub-group, the proportion of males is slightly higher (68%), while in the DCF sub-group there is more gender-balance with 47% women and 53% men.

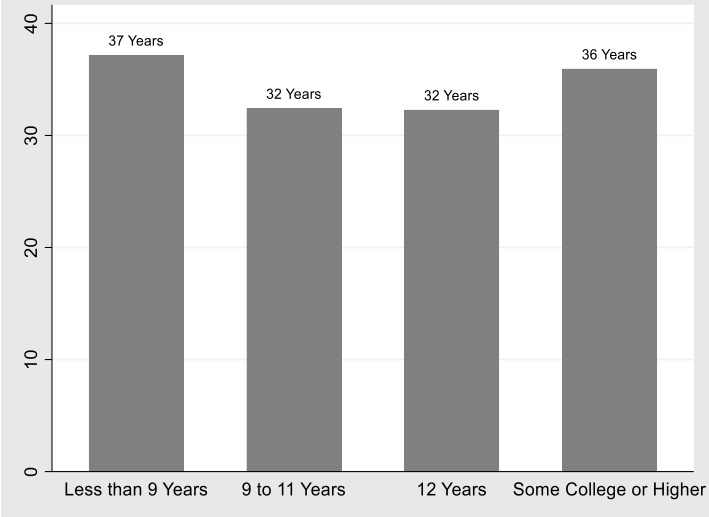
Number of Participants by Age at Study Enrollment



The average age of participants is 33.5 years old, with a range of 18 to 72 (SD 8.8). Burlington participants are slightly older (mean=34), while DCF-involved participants were a little younger (mean=32).

Only 3% (n=15) of the cohort are of non-white race, so no assessment of racial disparities across the study outcomes was possible. Nearly ¼ (24%) report Native American ethnicity. The St. Albans sub-group includes more Native American participants than other groups (29%).

Average Age by Years of Education Completed



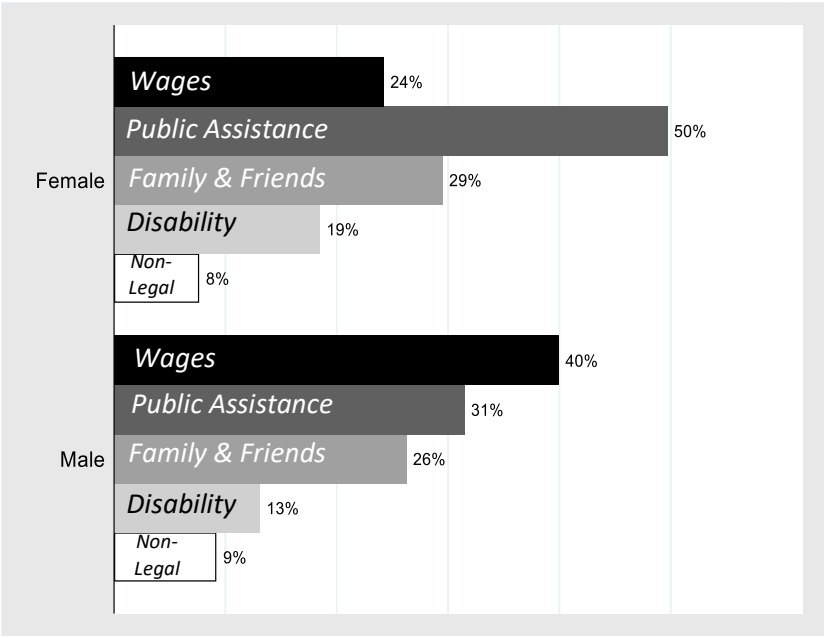
The average number of years of education is 11.8 (SD 2.0; range 6-18). Almost 1/3rd (31%) report less than 12 years of education and nearly ½ (49%) report 12 years. Only 1/5th (20%) report having more than 12 years. There are slightly more participants in St. Albans and DCF-involved sub-groups that have less than 12 years of education 36% and 33% respectively.

Participants who report Native American ancestry are significantly more likely to have <12 years of education, 45% for all participants and corrections, 56% of DCF-involved. The average age is higher for less than 9 years education (37 years old) and decreases to 32 years old across 9-11 and 12 years, and then rises again to 36 for participants with some college education or more.

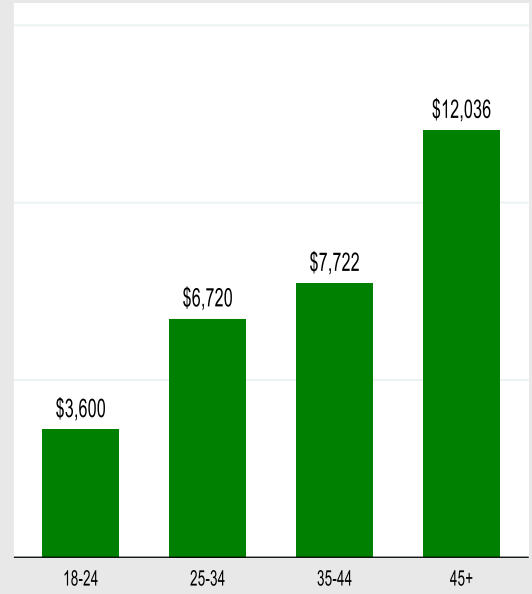
[1] Note that gender=other not reported on due to n<3.

Incomes are generally very low, with a median of $7,269. 64% are living below the federal poverty line ($12,140[2]).

Past 30-Day % Any Income by Type & Gender



Past 30-Day Median Income x 12 by Age Group



The majority of participants in the cohort are men with 12 years of education or less (53%). Over 3/4rs are between ages 25-44 and 2/3rds have income below the federal poverty line. Over 2/3rds of these men and women are parents, and 1/5th of parents have a child currently in state custody.

The two socioeconomic status measures tracked include employment[3] and unstable housing status[4]. Only 1/3rd (37%) of participants are employed at baseline, and corrections-involved and women are more likely to be unemployed. DCF-involved and participants with less education are more likely to be in unstable housing and more homeless are in Burlington. 1/3rd (34%) are unstably housed and 8% (n=37) are living in a shelter or on the street. Participants who are unstably housed are more likely to be using non-prescribed opioids at baseline. In response to unstable housing, one person stated: "*Waking up in a tent trying to follow recovery is not easy*."

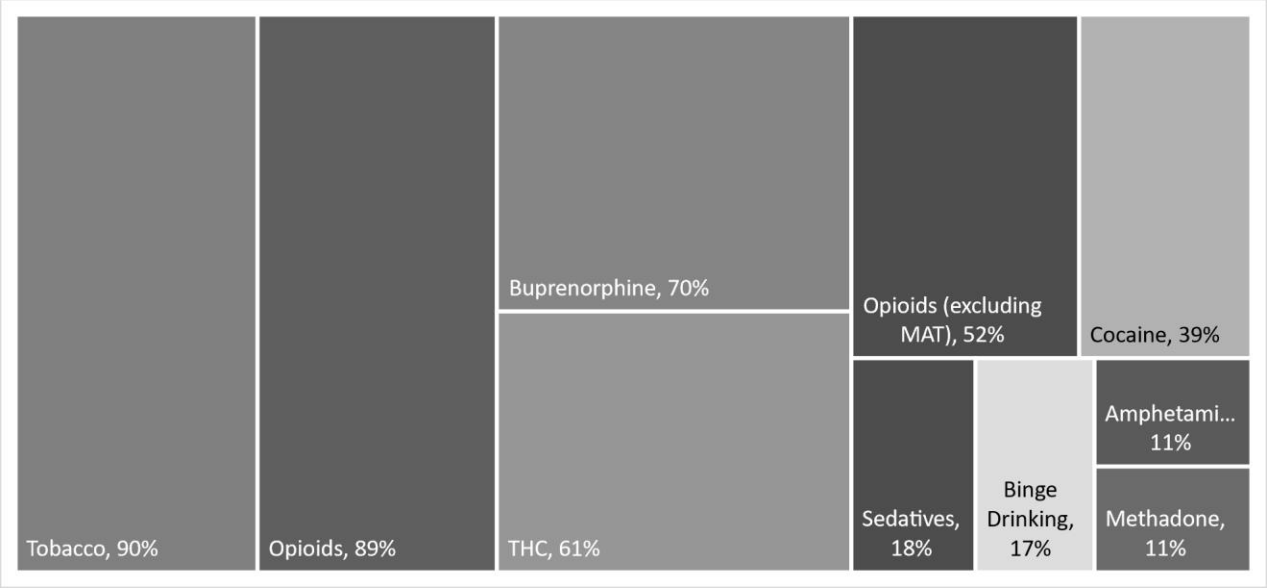
Word Cloud of Baseline Past 30-Day Living Most of the

[2] https://www.thestreet.com/personal-finance/what-is-the-federal-poverty-level-14690998
[3] Note that employment excludes disabled and retired participants.
[4] Note that unstable housing includes shelter, street or living in someone else's apt, room or house and excludes 18-24 years old.

Baseline Non-Prescribed Substance Use

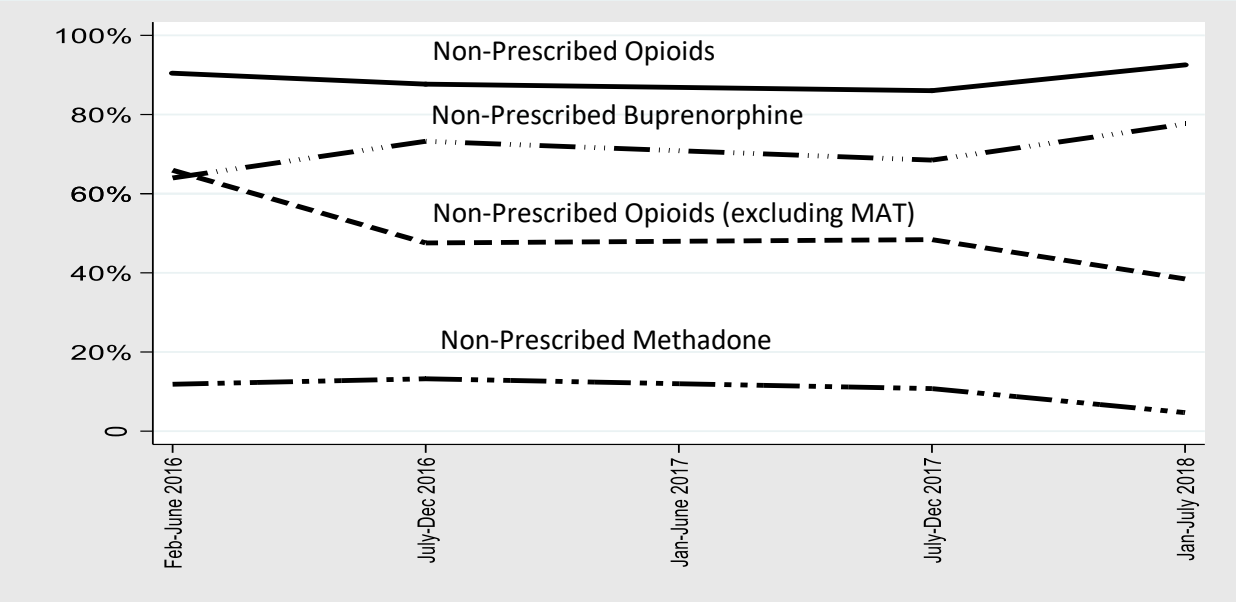
Non-prescribed substances tracked include opioids, alcohol (binge drinking), tobacco, THC, cocaine, sedatives and amphetamines. The following tree maps show the % of participants using non-prescribed substances by type at baseline.

Non-Prescribed Substances, All Participants



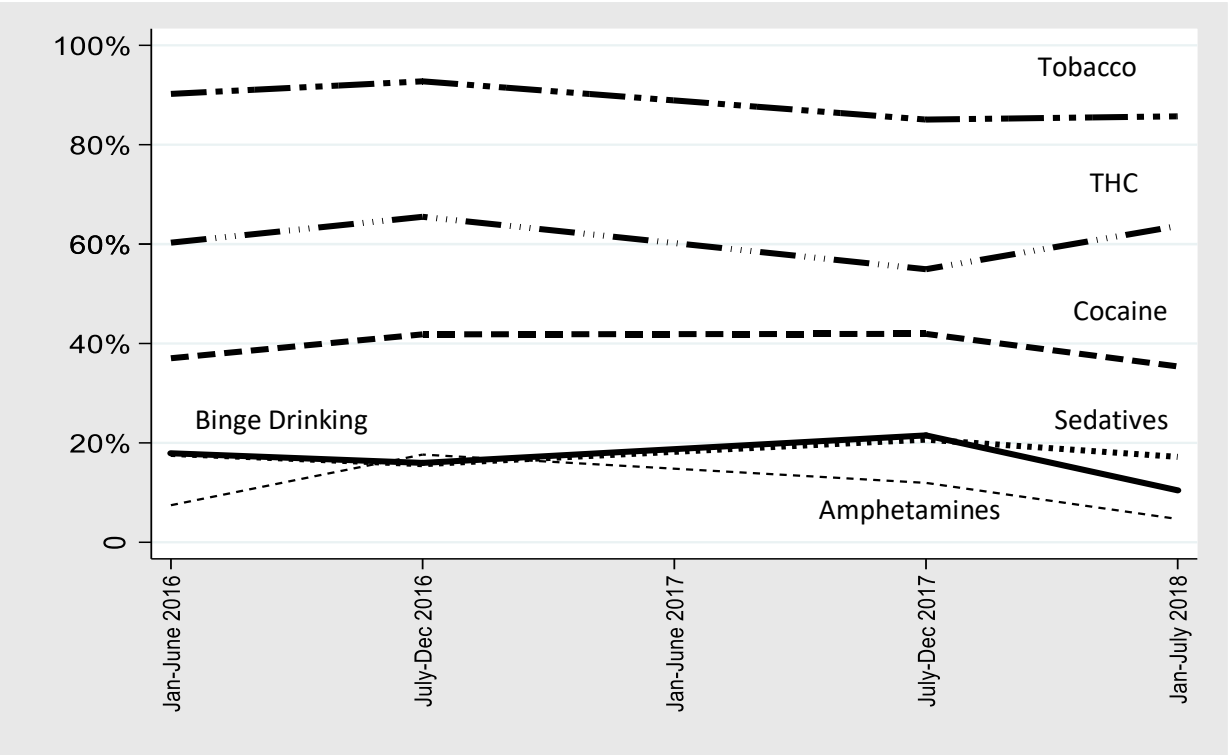
Over 3/4rs use tobacco and opioids including all types. Over half use non-prescribed buprenorphine, THC and opioids excluding MAT. Participants in St. Albans had higher non-prescribed buprenorphine (82%) and amphetamine use (14%) while participants in Burlington were more likely to use non-prescribed methadone (17%) and cocaine (51%).

% of Participants Using Non-Prescribed Opioids at Baseline over the Study Timeline



Baseline use of non-prescribed buprenorphine appears to be increasing over the course of the study time period while non-prescribed opioid use (excluding MAT) appears to be decreasing.

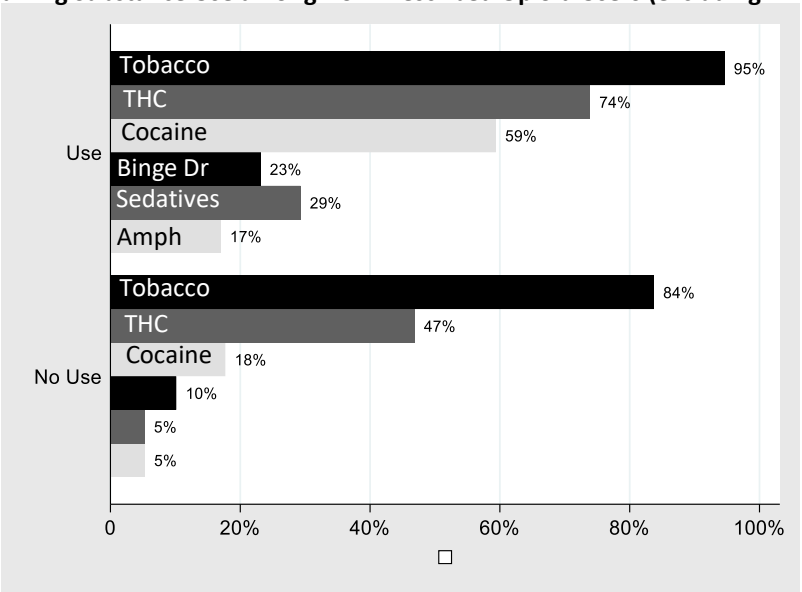
% of Participants Using Other Substances at Baseline during Study Timeline



Women in the cohort were more likely than men to use non-prescribed sedatives (24% vs. 14%) and non-prescribed opioids excluding MAT (59% vs. 48%). 18-24-year-old participants are more likely to use opioids excluding MAT and 45+ adults to use non-prescribed methadone. Corrections-involved participants were less likely to use non-prescribed opioids generally, as well as less THC and sedatives at baseline. A larger % of DCF-involved adults used non-prescribed buprenorphine and methadone.

Of non-prescribed opioid users excluding MAT, 72% use heroin and 23% Oxy or Darvon. Use of tobacco, THC, cocaine, binge drinking, sedatives and amphetamines were significantly higher in participants using non-prescribed opioids (excluding MAT) at baseline vs. no use or non-prescribed MAT only. 41% of non-prescribed opioid users are using non-prescribed MAT and no other opioids at baseline.

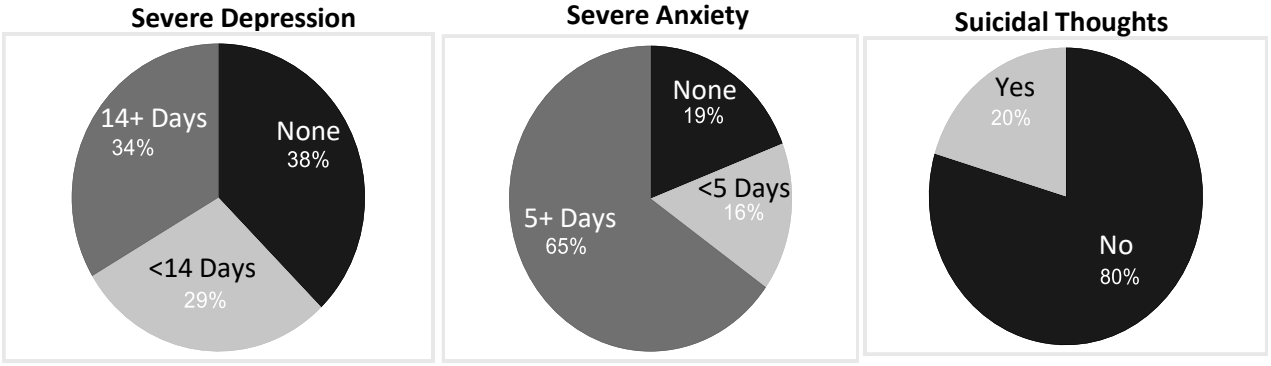
Co-occurring Substance Use among Non-Prescribed Opioid Users (excluding MAT)



Baseline Mental/Behavioral Health Results

Mental/Behavioral health characteristics tracked include depression, anxiety, suicidal thoughts, PTSD, trauma history, social supports, violent behavior and recovery capital domains.

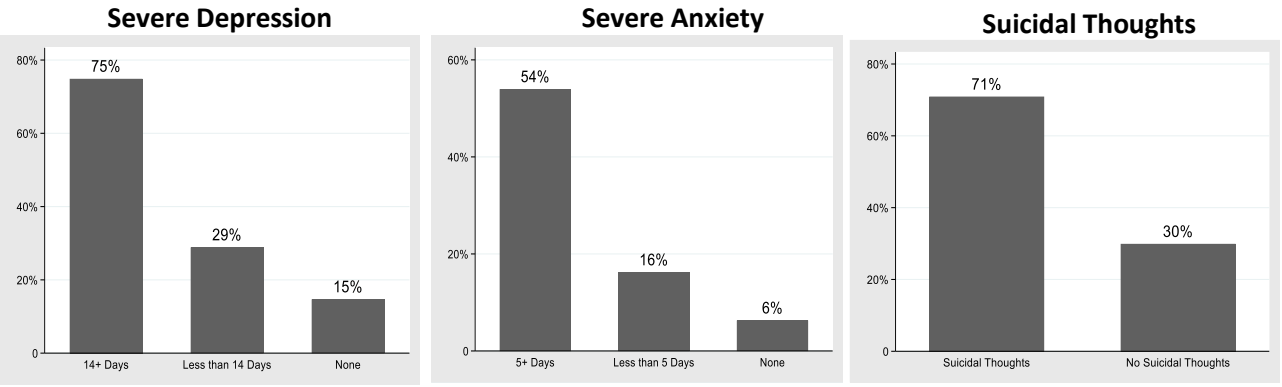
% with Past 30-Day Mental Health Symptoms at Baseline



About 1/3rd of the cohort report severe depression 14+ days, 2/3rds report severe anxiety 5+ days and 1/5th suicidal thoughts. A larger % of women compared to men were depressed, anxious and suicidal, and age 45+ were more likely to report suicidal thoughts. Participants with severe depression, severe anxiety and suicidal thoughts are more likely to use non-prescribed opioids (excluding MAT) at baseline. Participants using non-prescribed buprenorphine are significantly more likely to have suicidal thoughts and participants using non-prescribed methadone are significantly more likely to have depression.

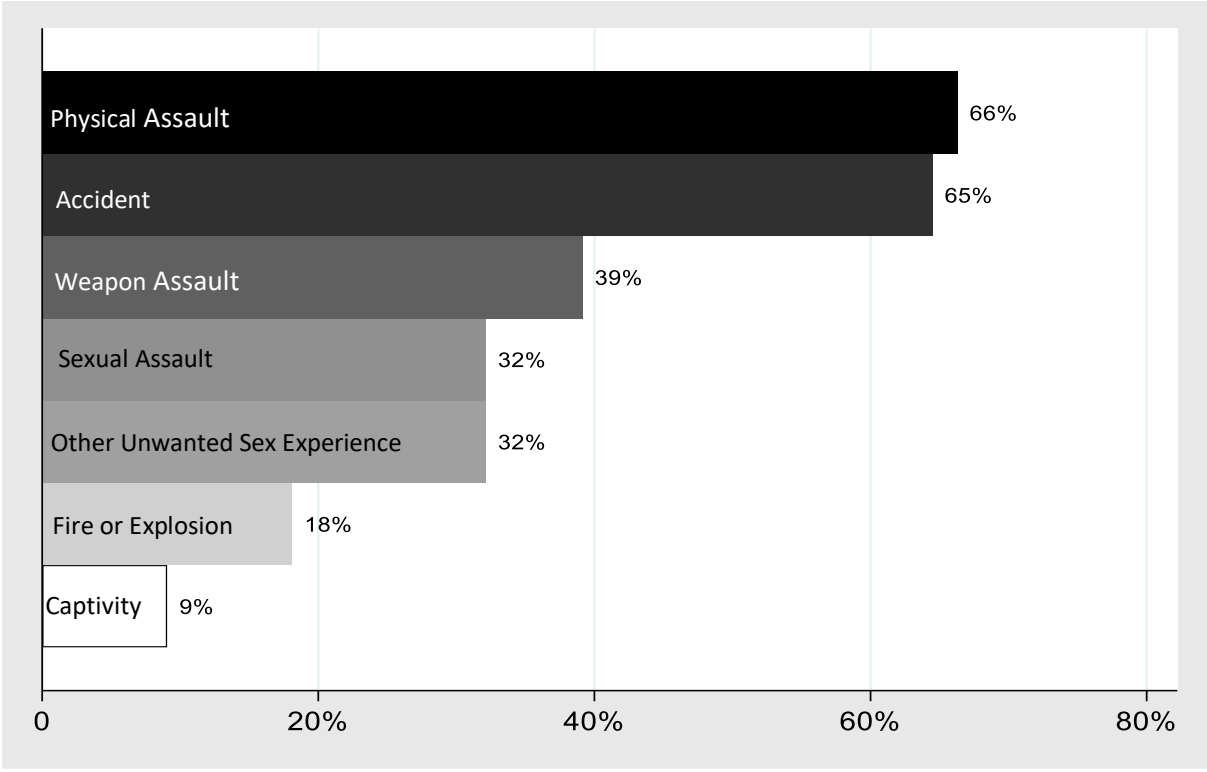
A little over a third (39%) of the cohort screen positive for PTSD using the PCL-5 tool.

% with PTSD (+) Screen by Past 30-Day Mental Health Symptoms



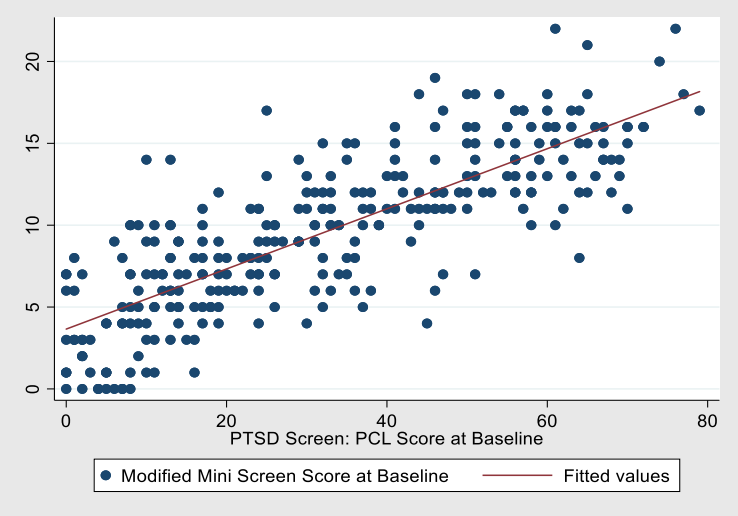
A (+) PTSD screen is strongly associated with mental health symptoms including depression, anxiety and suicidal thoughts. Participants who screen positive for PTSD are disproportionally women and skew slightly older. A positive PTSD screen is not significantly associated with non-prescribed opioid use excluding MAT or buprenorphine at baseline, but is strongly associated with non-prescribed methadone use at baseline.

% Lifetime Trauma by Type



The most common types of lifetime trauma experienced are physical assault, accidents, weapon and sexual assault. Women in the study cohort were significantly more likely to have been physically assaulted and sexually assaulted than men, (78% vs. 60%) and (57% vs. 18%) respectively. Corrections-involved and participants enrolled in Burlington are more likely to have experienced a weapon assault. DCF-involved are more likely to have experienced sexual assault, however that relationship goes away when adjusting for gender. There is no significant relationship between history of trauma and non-prescribed opioid use at baseline.

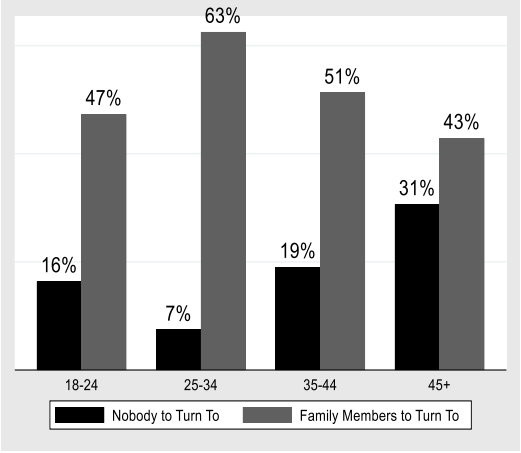
Using the Modified Mini Screen (MMS), over ½ the cohort (52%) screened as having a high likelihood of mental illness, with 27% at moderate risk and 21% at low likelihood. Women are significantly more likely to screen into the high likelihood of mental illness category on the MMS. DCF-involved are also more likely, even when controlling for gender. MMS score and PCL-5 score are positively associated, meaning the higher the PCL-5 score, the higher the MMS score.



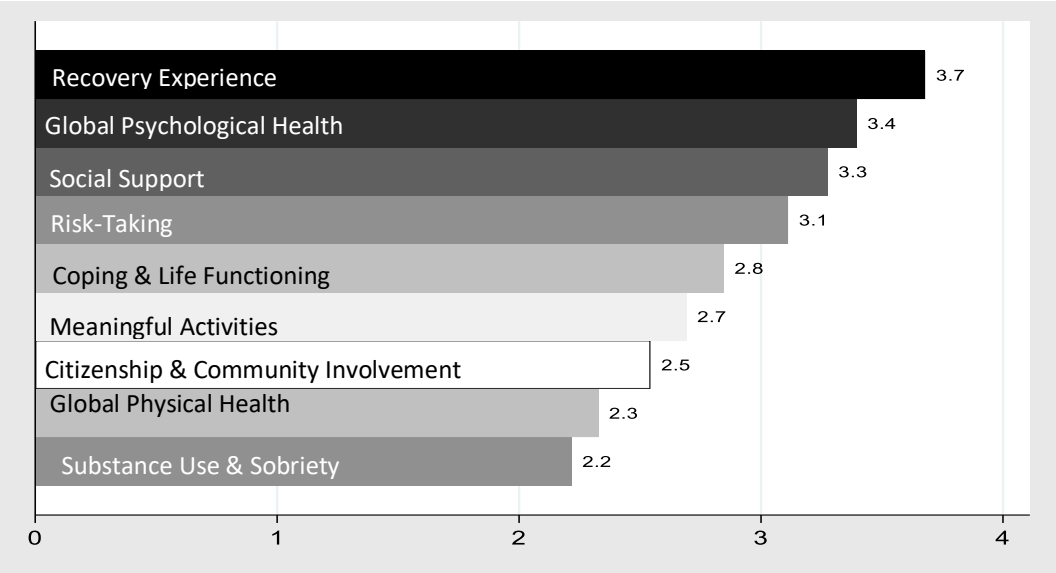
In addition to mental health symptoms and PTSD, levels of social support were measured via asking participants whom they turn to when in trouble. The top three responses were family members (55%), non-married significant others (18%) and no one (14%). Age is significantly associated with social support type; less family supports is more common among 18-24-year-old and 45+ adults, and a higher proportion of 45+ reporting they have nobody to turn to when in trouble.

Word Cloud of Participant Responses to Whom They Turn When in Trouble

% Turn to No One, Turn to Family



About 15% of participants reported having trouble controlling violent behavior at baseline. These participants are significantly more likely to use non-prescribed opioids (excluding MAT) at baseline. Recovery capital was assessed via domains with a score of (0-5, higher better) in each domain.



Scores in every domain were significantly lower among participants using non-prescribed opioids all types and non-prescribed opioids excluding MAT at baseline. Scores were also lower on every domain for non-prescribed methadone use, except for social support and coping and life functioning. Global physical health scores were lower for older participants and women scored lower across the majority of domains.

Physical Health

Nearly ½ (43%) of the cohort reports existing medical problems, with a little over ½ of those with problems receiving care for those problems at baseline. Almost 1/3rd (30%) have Hepatitis C, and only 14% of those with the disease report having ever received Hepatitis C medication. Participants with Hepatitis C in the cohort are more likely to be involved with corrections, older, use non-prescribed methadone and in Burlington.

Nearly ½ (42%) report 'fair to poor' health status, with women, age 45+, less than high school diploma and participants who report non-prescribed opioid use (excluding MAT) more likely to report lower health status. About ½ (51%) report having trouble understanding, concentrating or remembering, with women, DCF-involved, and those using non-prescribed opioids more likely to report the symptom.

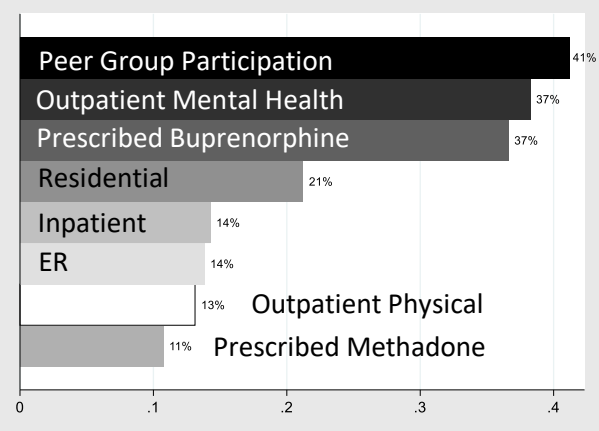
A little over 2/3rd of the cohort are sexually active, with an average of 12 sexual contacts in the prior 30 days and a range of 2-60. Most are having unprotected sex with only 12% reporting no unprotected sex, and 34% reporting unprotected sex with an IV drug user and 35% with someone who is high on a substance. Self-reported STD Testing:

- 69% have been tested for Gonorrhea with 3% positive results.
- 61% have been tested for Chlamydia with 17% positive results.
- 47% have been tested for Syphilis and with <1% positive results.
- 89% of participants have been tested for HIV with <1% positive results.

The three most common reasons cited for not having been tested for HIV are: consider themselves low risk, not liking needles and not knowing where to be tested. The most common locations for having been tested are outpatient clinics and family planning centers. Among participants, 21% of those sexually active engaged in high-risk sex who were more likely to be younger and involved with corrections and less likely to be in St. Albans.

Treatment Engagement

Primary treatment engagement metrics include % prescribed buprenorphine, % prescribed methadone, outpatient mental health use, peer support group participation and client rating of communication between providers. Other utilization metrics collected include emergency room use, inpatient treatment, outpatient physical health and residential/halfway house. Non-MAT prescribed medications include use of sleeping medications, use of non-opioid pain medications and use of medication for psychological/emotional reasons.



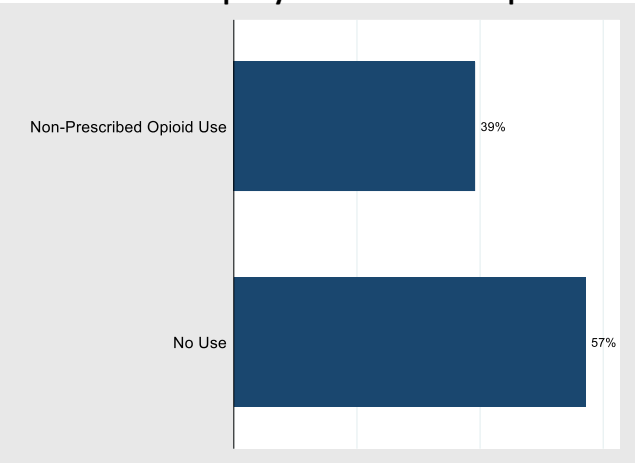
Exclusion criteria includes MAT >15 Days at baseline, thus baseline prescribed MAT represents MAT prescribed early in treatment, 15 days or less prior to baseline interview and up to 30 days after. Between 30-40% are prescribed buprenorphine early in treatment and between 10-20% are prescribed methadone in that timeframe. Seven participants total were prescribed naltrexone. Combining study periods, a little over 1/3rd are in outpatient mental health treatment at baseline which includes participants' treatment in the 30 days prior to baseline interview. %s in outpatient mental health treatment at study entry appears to decline over the study timeframe. Baseline peer group includes peer group participation in the 30 days prior to treatment entry, and also appears to decline over the study period.

Participants prescribed methadone at baseline are more likely to be in Burlington, more likely to use non-prescribed methadone and more likely to use non-prescribed opioids (excluding MAT). Study enrollees prescribed buprenorphine at baseline are more likely to be in Burlington, women, and are less likely to use non-prescribed opioids (excluding MAT).

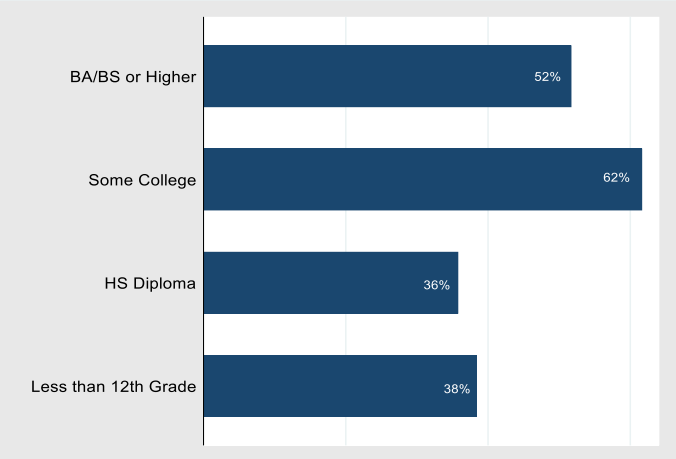
Corrections-involved and participants in Burlington are more likely to be in sober living/residential settings which across all groups are associated with less non-prescribed opioid use. Corrections-involved are also less likely to be in mental health outpatient treatment. Participants in St. Albans are more likely to be in outpatient mental health treatment (treatment model requires participation) with outpatient mental health across all participants skewing slightly older. DCF-involved participants and women are more likely to have used the emergency room in the 30-days prior to study entry, and emergency room visits and inpatient treatment are associated with more non-prescribed opioid use.

41% of participants report having attended 12-step or other peer groups in the 30 days prior to entering treatment. Corrections-involved are significantly more likely to have attended a peer group (47% vs. 30% non-corrections).

% in Peer Groups by Non-Prescribed Opioid Use



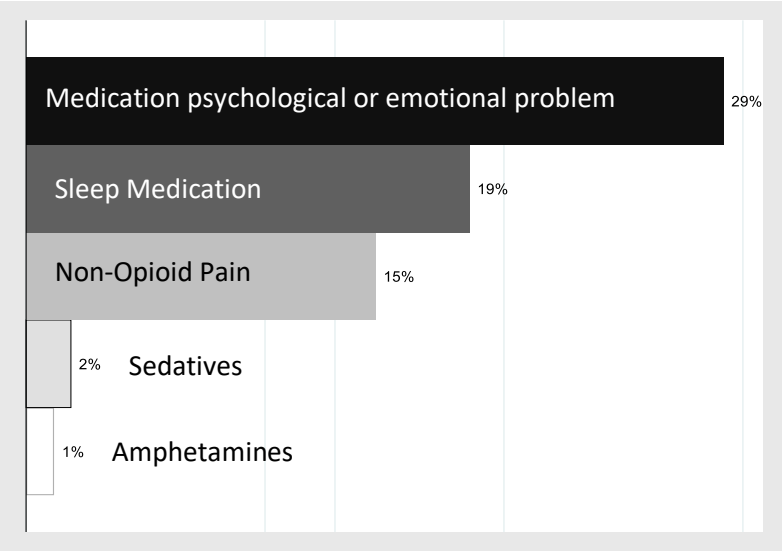
% in Peer Groups by Level of Education



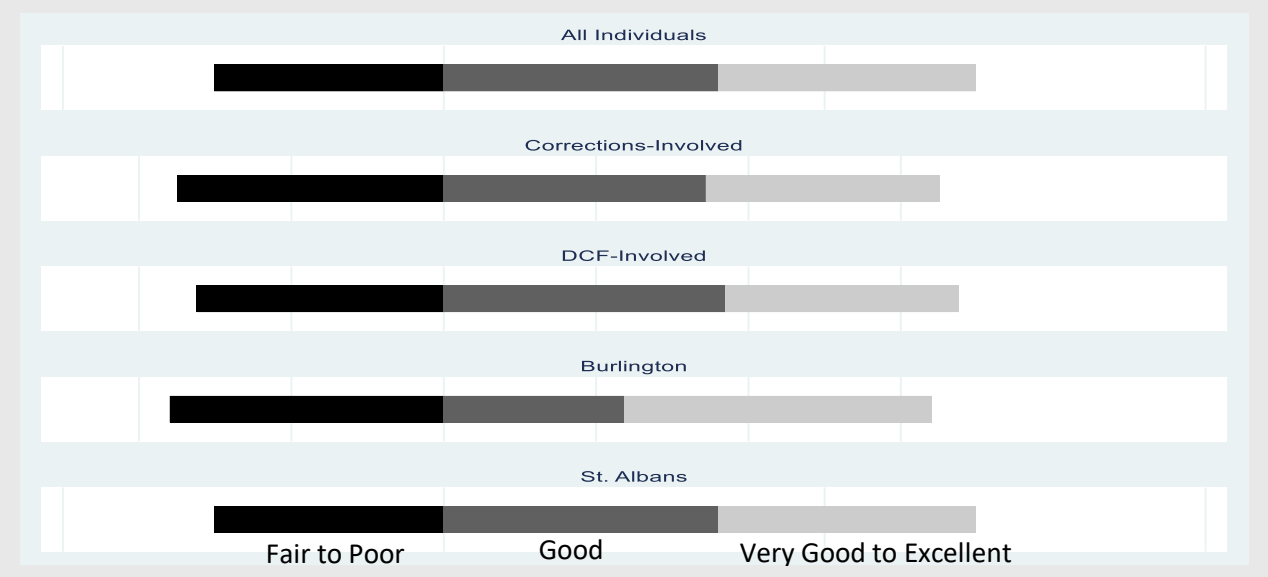
More peer group participation is associated with lower levels of opioid use all types and higher levels of education at baseline. Of those attending peer groups, about ½ (49%) report speaking at or leading meetings and 23% report having a sponsor. Having a sponsor is associated with higher levels of education and speaking at meeting is related to decreased non-prescribed opioid use all types and non-prescribed buprenorphine.

A little over ¼ (29%) are taking prescribed drugs for a psychological or emotional problem at baseline and about 1/5th are taking a medication for sleep. Taking medication for a psychological problem is more likely in women, older age and more years of education. Use of sleep medication is more common among women and participants in Burlington. Participants prescribed non-opioid medication for pain are more likely to be female, older and less likely to use non-prescribed buprenorphine and opioids all types.

% Non-MAT Prescribed Medications at Baseline



Rating of Communication between Providers



32% of all participants report fair to poor communication between providers at baseline. Corrections-involved and participants who enrolled in Burlington report worse communication overall.

AIM 1 Summary

Baseline Non-Prescribed Substance Use

Baseline measurement of substance use shows that many participants (70%) were using buprenorphine at entry into treatment and use of baseline non-prescribed buprenorphine by participants increased over the time-period that data was collected. Consistent with the literature on rates of other substance use in people with OUD, we found high rates of marijuana (61%), cocaine (39%) and tobacco use (90%). Also consistent with national data, younger participants were more likely to be opioid positive at baseline. At baseline, heroin is a commonly used substance among those who are using, leaving people vulnerable for overdose. Of note, the DCF sample were more likely to be using non-prescribed MAT at baseline, perhaps suggesting increased efforts towards recovery prior to initiation of treatment, motivated by child-related concerns, as suggested by the literature on DCF involved women. 41% of participants are using non-prescribed MAT only at baseline, suggesting that this treatment seeking sample may be generally well inclined to make efforts towards recovery prior to initiation of treatment. Many participants were already involved in peer support at baseline, which was associated with decreased non-prescribed opioid use at baseline. Furthermore, participants who are only using non-prescribed MAT are less likely to be using other substances. In qualitative questions on reasons for using non-prescribed MAT, 73% reported using non-prescribed MAT to try to quit on their own.

Physical Health

Our data showed that nearly a third of participants entering the study reported having Hepatitis C, which is nearly double compared to the general Vermont MAT population (16%; Vermont Blueprint for Health, 2016), and only 14% of those participants reported receiving medication for it. At baseline, nearly half reported fair to poor physical health. Having multiple sex partners and unprotected sex was

commonly reported at baseline, as was sex with someone who is an IV drug user or high. Women and DCF involved participants are more likely to have visited an emergency room in the 30 days prior to baseline and ER use is associated with more opioid use at baseline. Research shows that people with chronic substance use are more likely to have acute and chronic health issues and also are less likely to receive treatment for health problems (Chitwood, Sanchez, Comerford, & McCoy, 2001). Addressing the physical health needs and other health related behaviors of people with OUD is important in the promotion of recovery.

Socioeconomic Status

Nearly 2/3 of participants were living below the poverty line at baseline and only a third are employed at baseline, with corrections and women less likely to be employed. Participants involved with DCF are more likely to be unstably housed and those who are unstably housed are more likely to be using non-prescribed opioids at baseline.

Mental Health

In our sample of treatment seeking people with OUD, 34% of participants reported experiencing depression at baseline, which is similar in magnitude to the depression rate amongst Vermont Hub & Spoke participants (33%; Vermont Blueprint for Health, 2016). This is almost 6 times the national prevalence rate of 6.7% (APA, 2015). Similarly, 65% of our sample experienced severe anxiety at baseline, compared to 19.1% of U.S. adults who report experiencing an anxiety disorder. Previous research corroborates the co-occurrence of depression and opioid use disorders, citing depression prevalence rates of 25% among participants with OUD (APA, 2015; McHugh et al., 2017). Research shows as high as 60% of those with opioid use disorder meet diagnostic criteria for an anxiety disorder (McHugh et al., 2017). Our findings are consistent with previous research that suggests that social support may be a protective factor against relapse and is predictive of better treatment outcomes (Chan et al., 2004; Wasserman, Stewart, Delucchi, 2001; Spohr, Livingston, Taxman, & Walters, 2019). *See Appendix B. for Data Brief highlighting PTSD and OUD.*

Treatment Engagement

One third of our sample reported engaging in outpatient mental health treatment at baseline and 41% reported attending peer support in the 30 days prior to baseline. Although these rates of mental health and peer support engagement decrease at baseline during the study time period (ie: across study years), this may be due to the dissolving wait list for MAT in VT. When people with co-occurring SUD and MI engage in community-based treatment and peer support that address both the mental illness and substance use disorder, they can experience many positive outcomes (McGovern, Haiyi, Segal, Siembab, & Drake, 2006; Essock et al., 2006). The New Hampshire Dual Diagnosis Study found that outpatients with COD who received Integrated Dual Disorders Treatment (IDDT) showed improvements in many major areas over the course of several years, including reduced hospitalization, homelessness, employment, and abstinence from substances (McGovern, Haiyi, Segal, Siembab, & Drake, 2006). Integrated treatment helps people with both the substance use difficulties and mental health symptoms simultaneously and with the same provider, rather than treating one disorder at a time, often with separate providers. Integrated treatment avoids duplication of services, increased costs or delaying treating mental health symptoms (McGovern, Haiyi, Segal, Siembab, & Drake, 2006). Education and training of providers in appropriate integrated and specialized treatment approaches is important in addressing co-occurring OUD and mental health symptoms. These findings highlight the importance of ease of access and responsiveness in initiating MAT for people with OUD.

Our AIM 1 results support the following actionable items for consideration:

1. Our data shows high rates of non-prescribed MAT use. Vermont has already taken steps to decrease barriers to accessing MAT. Our data supports continuing these efforts.

2. Our data and national data support the benefits of rapid access to MAT for people seeking treatment.

3. Comorbidity with use of other substances, comorbidity with mental illness- Data supports integrated treatment approaches that target substance use disorders and mental illness simultaneously, with the same team of treatment providers. Programs can assess the level of training of their clinicians in providing integrated treatment and add trainings as identified. For example, this study provided Integrated Dual Diagnosis Treatment and Cognitive Processing Therapy trainings for MAT clinicians in Vermont. These are two examples of integrated treatment approaches.

4. A high percentage of participants have severe depression and anxiety symptoms, suicidal thoughts and screen positive for PTSD which points to a potential indication for PTSD screening protocols for participants with severe mental health symptoms.

5. Heroin is a commonly used opioid and leaves people vulnerable to overdose. This data supports the continued efforts to make rescue medications widely available.

6. High rates of Hepatitis C and few reports of taking medication highlights a system that works well for screening high risk people for Hepatitis C but may not be adequately addressing physical health treatment needs. Coordination of services between MAT providers and primary care providers may influence treatment of Hepatitis C; however, the cost of such treatment may be a preventative barrier for some.

7. The percentage of participants having unprotected, high risk sex supports the need for continuing efforts to educate and provide free or low-cost barrier methods of protection against infectious disease.

8. Our data supports that improving access to affordable housing for people in MAT programs should be a high priority in VT.

9. Our data also suggests that services that enhanced social support and therapy that builds upon social support can be highly beneficial for people in recovery.

B. Evaluation AIM 2: High-risk Participants' Progress after Entering Treatment and Predictors of Continued Non-Prescribed Opioid Use vs. Abstinence

Introduction to AIM 2

Opioid substitution treatments (OST), including methadone and buprenorphine, are considered a first line pharmacologic treatment for OUD (WHO, 2009), as they prevent/eliminate withdrawal symptoms, reduce cravings, and block the euphoric effects of other shorter acting opioids. Research has shown OST to be effective in improving retention in treatment, reductions in non-prescribed opioid use, and improving social functioning (Bart, 2012). There is much evidence that recovery outcomes are much better for people with OUD in OST/MAT treatment than when treatment seekers are detoxed and not maintained on OUD medications (Dolan & Mehrjerdi, 2015). Oviedo-Joekes (2015) found very low rates of abstinence/near abstinence from opioids in people who were detoxed, compared to the 49% of people in OST who achieved abstinence or near abstinence at follow-up. There is some evidence that engaging in counseling along with MAT may also improve substance use related outcomes, (Rong et al., 2016; Gruber, Delucchi, Kielstein, & Batki, 2008), while some research has shown that MAT alone is effective in decreasing opioid use (Fiellin et al., 2014; Schwartz, Kelly, O'Grady, Ghandi, & Haffe, 2012). While supervised dosing is a common practice in MAT programs, MAT medications can still be diverted, sold on the "black market" or used inappropriately. While research has looked extensively at factors that are associated with opioid recovery outcomes, not much is known about factors that predict use of diverted OST medications.

Predictors of treatment retention and relapse: There is a wealth of evidence in the literature that misuse of other substances leaves people with OUD vulnerable to relapse (Rong et al., 2016; Ferri, Finlayson, Wang, & Martin, 2014; Clark et al., 2015; Saxon, Wells, Fleming, Jackson, & Calsyn, 1996). Research has consistently shown an association between cocaine use and poorer opioid recovery outcomes (Heidebrecht, MacLeod, & Dawkins, 2018; Schottenfeld et al., 2005; Eastwood, Strang, & Marsden, 2019). People with co-occurring cocaine and opioid use disorders have more severe drug use and legal problems and cocaine use disorder is a significant risk factor for both heroin and prescription opioid use disorder (McCall Jones, Baldwin, & Compton, 2017). Research has shown that fewer days of cocaine use predicted decreased heroin use (Oviedo-Joekes et al., 2015) and cocaine use is associated with worse psychological health outcomes in people in treatment for OUD, while also lowering the likelihood of successfully completing treatment (Eastwood, Strang, & Marsden, 2019). Baumeister et al. (2014) reported that participants receiving Methadone Maintenance Therapy (MMT) in specialized centers exhibited significantly higher proportions of cocaine use compared to MMT participants in office-based settings. Furthermore, there is some evidence that participants using cocaine during MMT are more likely to drop out, present with a higher HIV risk profile, and have higher heroin use (Baumeister et al., 2014).

Higher amounts of baseline heroin use predicts heroin use at follow-up (Heidebrecht, MacLeod, & Dawkins, 2018). Past research has also found that lifetime heroin use reported at baseline predicted an increased likelihood of meeting criteria for opioid dependence at month 42 post-treatment initiation

(Weiss, 2015). Ovieo-Joekes et al. (2015) showed that very early abstinence from opioids (abstaining in week one) did not predict long-term abstinence; however, abstaining in week 1 and 2 increased the positive predictive value of early abstinence. Ekhtiari et al. (2013) found that duration of opioid use predicted relapse. In injection drug users, Shah et al. (2006) found that shorter time to cessation of injection drug use was predicted by abstinence from cigarettes and alcohol, injecting less than daily, not injecting heroin and cocaine together, and not having an injection drug using partner. Factors that predicted relapse included use of alcohol, cigarettes, non-injection cocaine, and sexual abstinence.

In a meta-analysis of predictors of continued substance use, Brewer et al. (1998) concluded that most variables have weak longitudinal relationships with continued drug use and; therefore, treatment interventions needs to address multiple variables that have been shown to have a moderate longitudinal association. Brewer et al. (1998) found that 10 variables showed a significant predictive longitudinal relationship with drug use: high level of pretreatment opiate/drug use, prior treatment for opiate addiction, no prior abstinence from opiates, abstinence from/light use of alcohol, depression, high stress, unemployment/employment problems, association with substance abusing peers, short length of treatment, and leaving treatment prior to completion. Daily drinking has been shown to predict opioid use at follow-up (Heidebrecht, MacLeod, & Dawkins, 2018; Eastwood, Strang, & Marsden, 2019). Moreover, Teesson et al. (2017) found that heroin users who fell into a "no decreased use" group were more likely to be using benzodiazepines.

Other factors shown to predict decreased heroin use include fewer days of illegal activities at baseline, less money spent on drugs (Oviedo-Joekes et al., 2015; Saxon, Wells, Fleming, Jackson, & Calsyn, 1996), and stable housing (Shah, Galai, Celentano, Vlahov, & Strathdee, 2006). Homelessness has been shown to predict relapse (Shah, Galai, Celentano, Vlahov, & Strathdee, 2006; Dickson-Gomez, Convey, Hilario, Weeks, & Corbett, 2009) and be associated with continued use (Teesson et al., 2017). Heidebrecht et al. (2018) found that choosing methadone over buprenorphine treatment predicted an increased likelihood of heroin use at follow-up. They also found that lower buprenorphine dosing predicted heroin use at follow-up, which is consistent with other research highlighting the importance of adequate dosing in preventing relapse (Ferri, Finlayson, Wang, & Martin, 2014). Length of treatment has also been shown to have a positive association with opioid abstinence (Clark et al., 2015). Other predictors of treatment retention include non-daily use at baseline, no history of arrest (Ekhtiari, Dezfouli, Behnam, Ghodousi, & Mokri, 2013), and employment (Weinstein et al., 2017; Hillhouse, Canaman, & Ling, 2014). Weiss et al. (2015) found that more severe depression at baseline predicted likelihood of being enrolled in opioid agonist therapy at a 42-month follow-up.

Past research has also shown that there are some demographic characteristics that are associated with better outcomes, including female gender and older age (Weinstein et al., 2017; Gossop, Stewart, & Marsden, 2006), though data supporting demographic and baseline characteristics predicting relapse and other outcomes has been mixed (Weiss et al., 2015). Levine et al. (2015) looked at gender specific predictors of abstinence and treatment retention and found that gender by itself did not predict treatment retention or abstinence. Other researchers have reported more mixed gender effects on treatment retention (Ekhtiari, Dezfouli, Behnam, Ghodousi, & Mokri, 2013; Weinstein et al., 2017). While Levine et al. (2015) found that opioid negative urines in month 1 predicted treatment retention and abstinence for men, it did not predict treatment retention for women. Other predictors of

treatment retention for men were marijuana negative urines in month 1 and no cocaine dependence. Other predictors of treatment retention for women were cocaine and marijuana negative urine in month 1 and no history of sexual assault. Negative cocaine urines in month 1 predicted long term abstinence in men but not in women. Opioid negative urine in month 1 was the only predictor of long-term abstinence in women (Levine et al., 2015).

Monico et al. (2015) found that number of peer support meetings attended was positively associated with increased treatment retention in Buprenorphine Maintenance Treatment (BMT) and opiate/cocaine abstinence at 6 months; however, this did not hold true for counselor mandated attendance in peer support. Participants in BMT treatment report concerns over the compatibility of OST and 12-step abstinence based programs, expressing concerns that other 12-step members would not accept them due to their BMT. Many reported avoiding disclosing their use of BMT and only a third of those whose counselors recommended 12-step meetings reported discussing the issue of disclosure of BMT in 12-step meetings (Suzuki & Dodds, 2016).

People report that the factors that help them sustain their recovery include employment, close relationships, involvement in recovery groups, and increased feelings of self-confidence and self-worth (Best, Gow, Taylor, Knox, & White, 2011). The purpose of AIM 2 is to inform stakeholders how participants progress while in treatment for OUD and the key factors influencing recovery outcomes, which include substance use, mental health, physical health, treatment engagement, and socioeconomic status factors.

AIM 2, Part 1: High-risk Participants' Progress after Entering Treatment

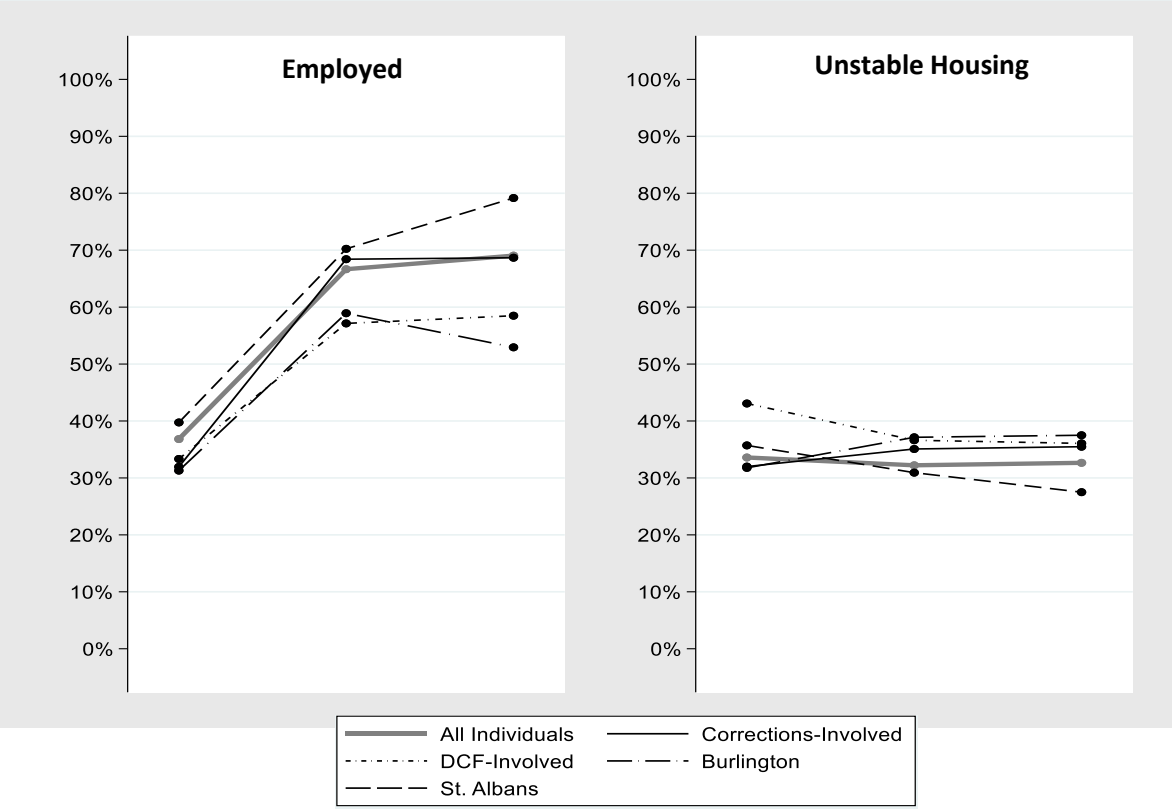
Each results page in AIM 2, Part 1 follows a similar outline:

1) Visually display unadjusted change from baseline to six- and twelve-months post treatment-entry using line graphs. Note that baseline % includes all participants whether or not they were lost to follow-up at later timepoints.
2) Present bullet points that describe the %s and note sub-group differences.
3) Using paired tests, present bullet points that indicate whether there is a significant difference from baseline to month 6 and then baseline to month 12. Note that paired tests use pairs of observations, so participants lost to follow-up at each timepoint are excluded.

See page 96. for descriptive tables with %s at each timepoint and page 112. for pre-post paired tests tables.

Goal: Improve Socioeconomic Status

Employment & Unstable Housing, % at Baseline, 6-Months and 12-Months



Employment

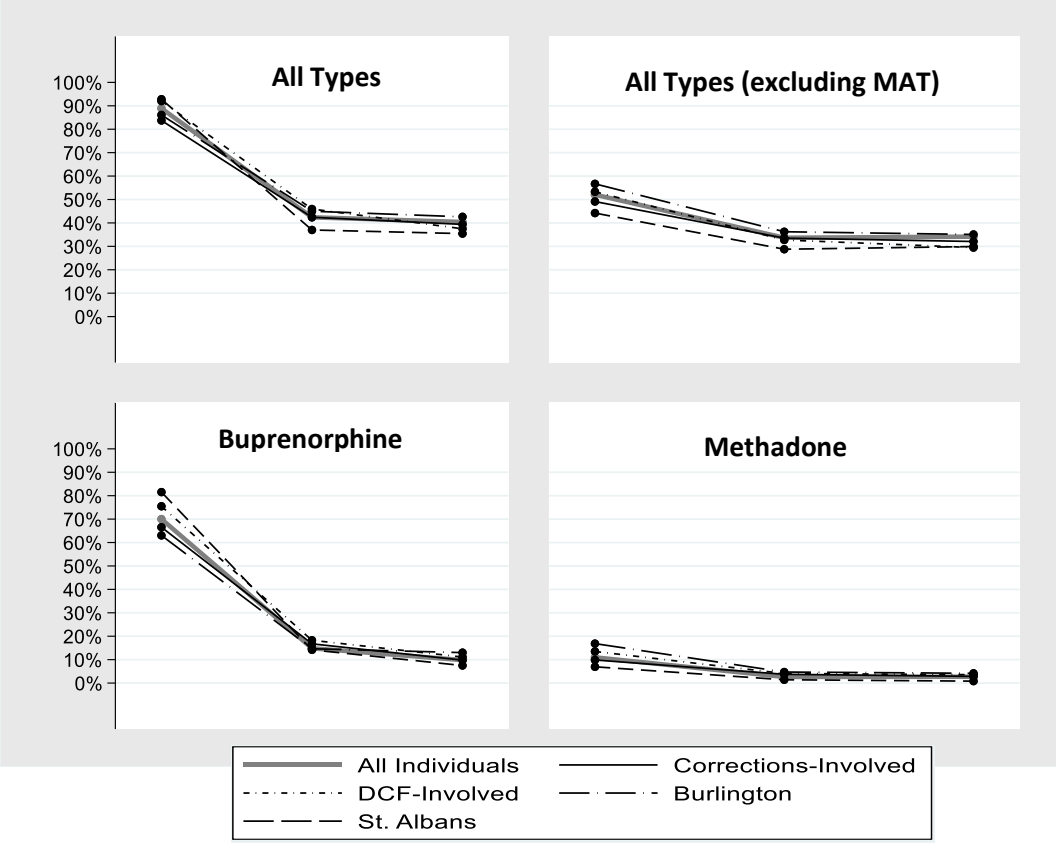
- The % of participants employed increased from 37% at baseline to 67% at month 6 and to 69% at 12-months.
- Corrections-involved and St. Albans saw the largest uptick; from baseline to month 12, the % of corrections-involved employment increased to 69% and in St. Albans to 79%.
- DCF-involved and Burlington participants have the lowest % employed at baseline at 32% and 31% which increased to 58% and 53% at 12-months.
- Paired comparison tests ($p<0.05$) show significant changes from baseline to month 6 and baseline to month 12 for all participants and across all subgroups.

Unstable Housing

- The % of participants in unstable housing decreased from 34% at baseline to 32% at month 6 and to 33% at month 12.
- DCF-involved and St. Albans saw slight decreases while Burlington and corrections-involved increased slightly.
- Paired comparison tests ($p<0.05$) show no significant changes from baseline to month 6 or baseline to month 12, for all participants and across all subgroups.

Goal: Decrease Non-Prescribed Substance Use

Past 30-day non-prescribed opioid use by type, 0-1 Month, 4-7 Months, 8-12 Months



Non-Prescribed Opioids All Types

- The % of participants using non-prescribed opioids decreased from 89% at month 0-1 to 42% during months 4-7 and to 40% at 8-12 months. St. Albans decreased the most from 94% at baseline to 35% at month 12.

Non-Prescribed Opioids (excluding non-prescribed MAT)

- The % of participants using non-prescribed opioids (excluding MAT) decreased from 52% at month 0-1 to 34% during months 4-7 and stayed at 34% at 8-12 months. DCF-involved had the largest drop from 53% at baseline to 29% at 8-12 months.

Non-Prescribed Buprenorphine

- The % of participants using non-prescribed buprenorphine decreased from 70% at month 0-1 to 15% during months 4-7 and to 10% at 8-12 months.

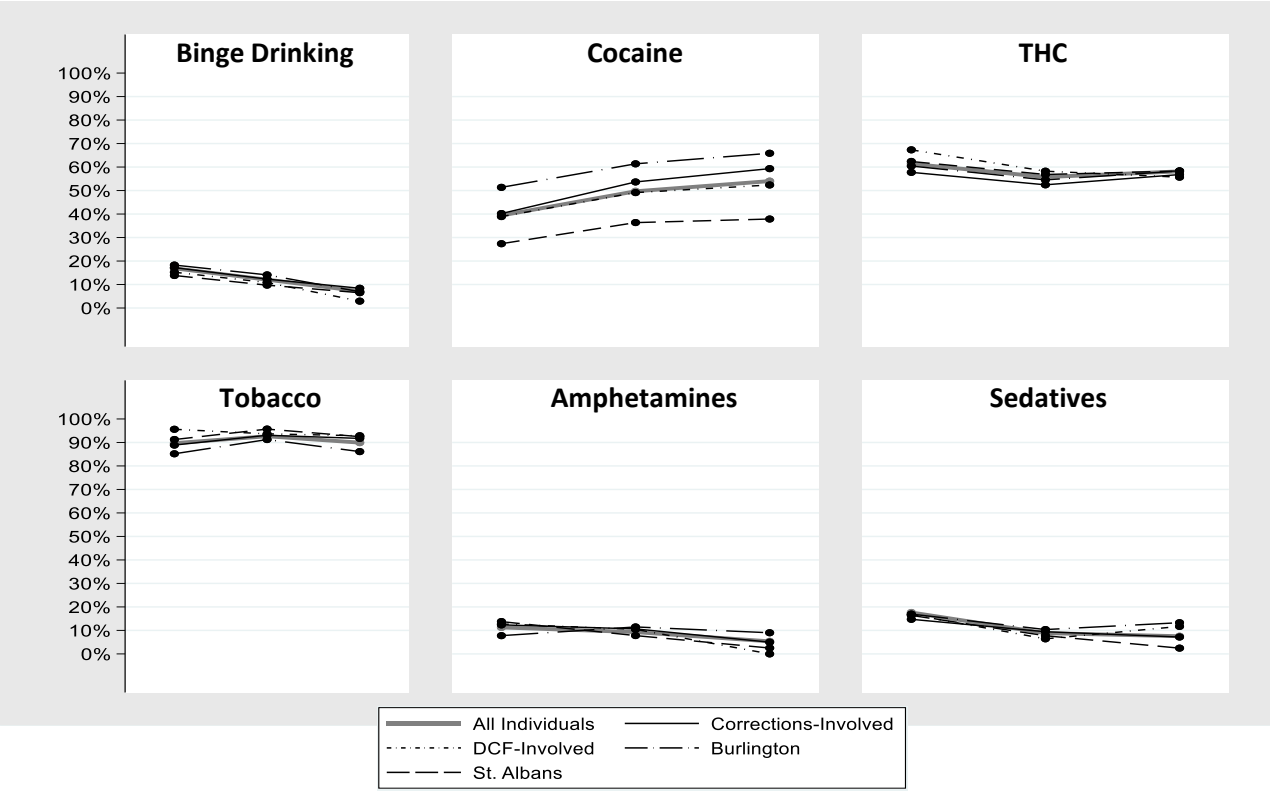
Non-Prescribed Methadone

- The % of participants using non-prescribed methadone decreased from 11% at month 0-1 to 3% during months 4-7 and stayed at 3% at 8-12 months. Most non-prescribed methadone use in the study is happening in Burlington.

Paired comparison tests ($p<0.05$) show significant change from baseline to month 6 and baseline to month 12 for all four non-prescribed opioid metrics, for all participants and across all subgroups. St. Albans and DCF-involved non-prescribed methadone use had numbers too small to test.

Goal: Decrease Non-Prescribed Substance Use

Past 30-day: % binge drinking, % using cocaine, % THC use, % tobacco use: 0-1 Month, 4-7 Months, 8-12 Months



Binge Drinking

- The % of participants binge drinking decreased from 17% at baseline to 12% at 6-months and to 7% at 12-months.
- Paired comparison tests ($p<0.05$) were mixed with no significant change from baseline to month 6 overall and by sub-group. Significant change occurred from baseline to month 12 for all participants, DCF-involved and St. Albans. No significant change occurred from baseline to month 12 for Corrections-involved and Burlington.

Cocaine

- The % of participants using cocaine increased from 39% at baseline to 50% at months 4-7 and to 54% at months 8-12. Burlington has a higher % of participants using cocaine than other sub-groups.
- Paired comparison tests ($p<0.05$) were mixed with significant change from baseline to months 4-7 overall and for Corrections-involved and St. Albans. No Significant change occurred from baseline to months 4-7 for DCF-involved and Burlington. Significant change occurred from baseline to month 12 for all participants and for all groups except St. Albans.

THC

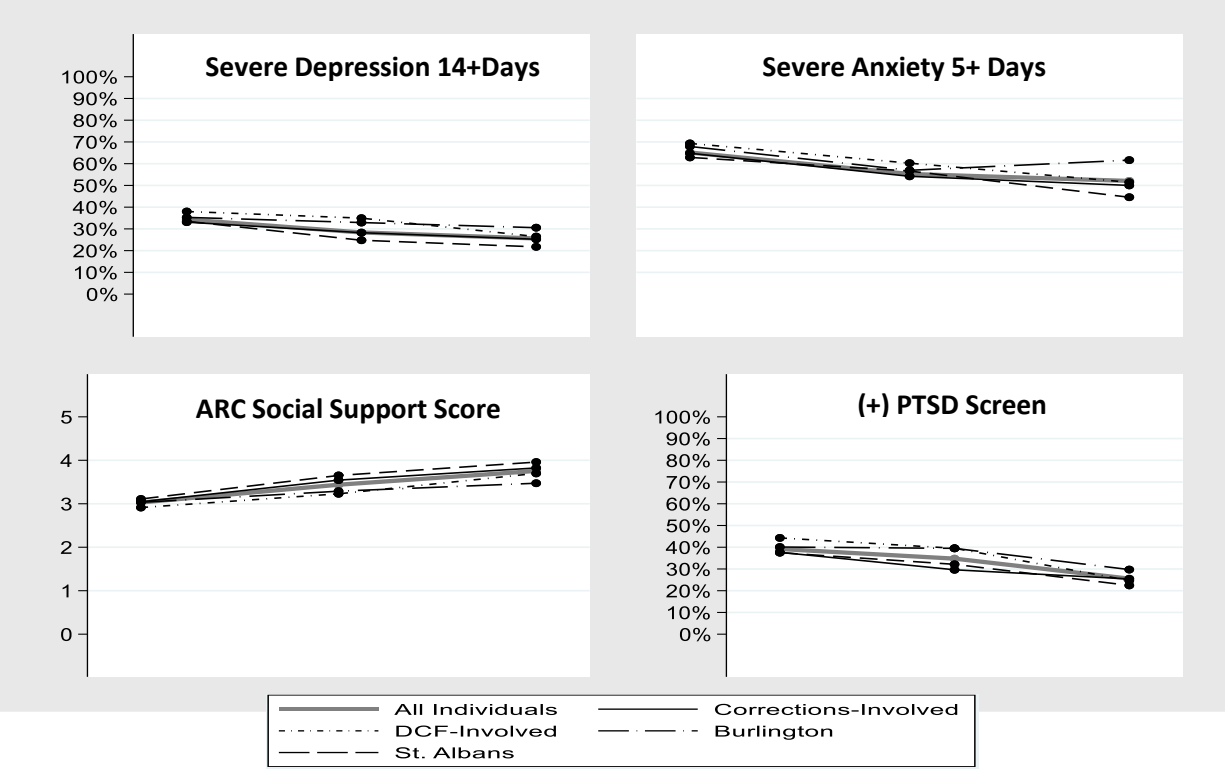
- The % of participants using THC decreased from 61% at baseline to 56% at months 4-7 and then to 58% at 8-12.
- Paired comparison tests ($p<0.05$) show no significant changes from baseline to month 6 or baseline to month 12, for all participants and across all subgroups.

Tobacco

- The % of participants using tobacco increased from 90% at baseline to 93% at 6-months and back to 90% at 12- months.
- Paired comparison tests ($p<0.05$) show no significant changes from baseline to month 6 or baseline to month 12, for all participants and across all subgroups.

Goal: Improve Mental/Behavioral Health

% severely depressed 14+ days, % severely anxious 5+ days, mean ARC social support domain score, % with elevated PTSD scores on the PCL-5, past 30-day baseline, 6-Months and 12-Months



Severe Depression

- The % of participants with severe depression decreased slightly from 34% at baseline to 28% at 6-months and to 26% at 12- months.
- Paired comparison tests ($p<0.05$) were mixed with no significant change in DCF-involved or Burlington (for both comparisons), and baseline to 12-months for corrections. Significant change occurred for all participants and St. Albans (for both comparisons) and baseline to month 6 for corrections-involved participants.

Severe Anxiety

- The % of participants with severe anxiety decreased slightly from 65% at baseline to 55% at 6-months and to 52% at 12- months.
- Paired comparison tests ($p<0.05$) were mixed with no significant change in DCF-involved or Burlington (for both comparisons), or baseline to month 6 in St. Albans. Significant change occurred for all participants and corrections-involved (for both comparisons) and baseline to month 12 in St. Albans.

PTSD

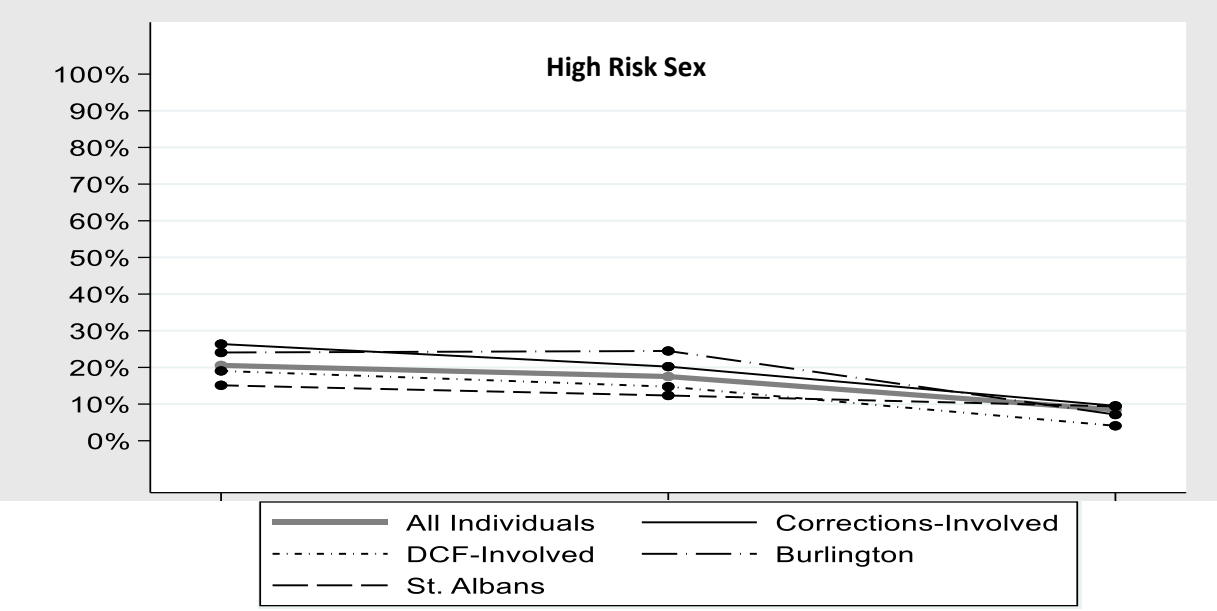
- The % of participants who screened positive for PTSD decreased from 39% at baseline to 35% at month 6 and then to 26% at month 12. DCF had the highest PTSD (+) screens at baseline.
- Paired comparison tests ($p<0.05$) were mixed with no significant changes from baseline to month 6 for all groups except corrections. Significant change occurred from baseline to 12-months for all participants and DCF-involved, no significant change occurred in other groups from baseline to 12-months.

ARC Social Support Score

- The mean social support score increased from 3.03 at baseline to 3.44 at month 6 and up to 3.76 at month 12.
- Paired comparison tests ($p<0.05$) were mixed with significant changes from baseline to month 6 and to month 12 for all groups except Burlington. No significant change occurred from baseline to 6 or 12-months for Burlington.

Goal: Improve Physical Health

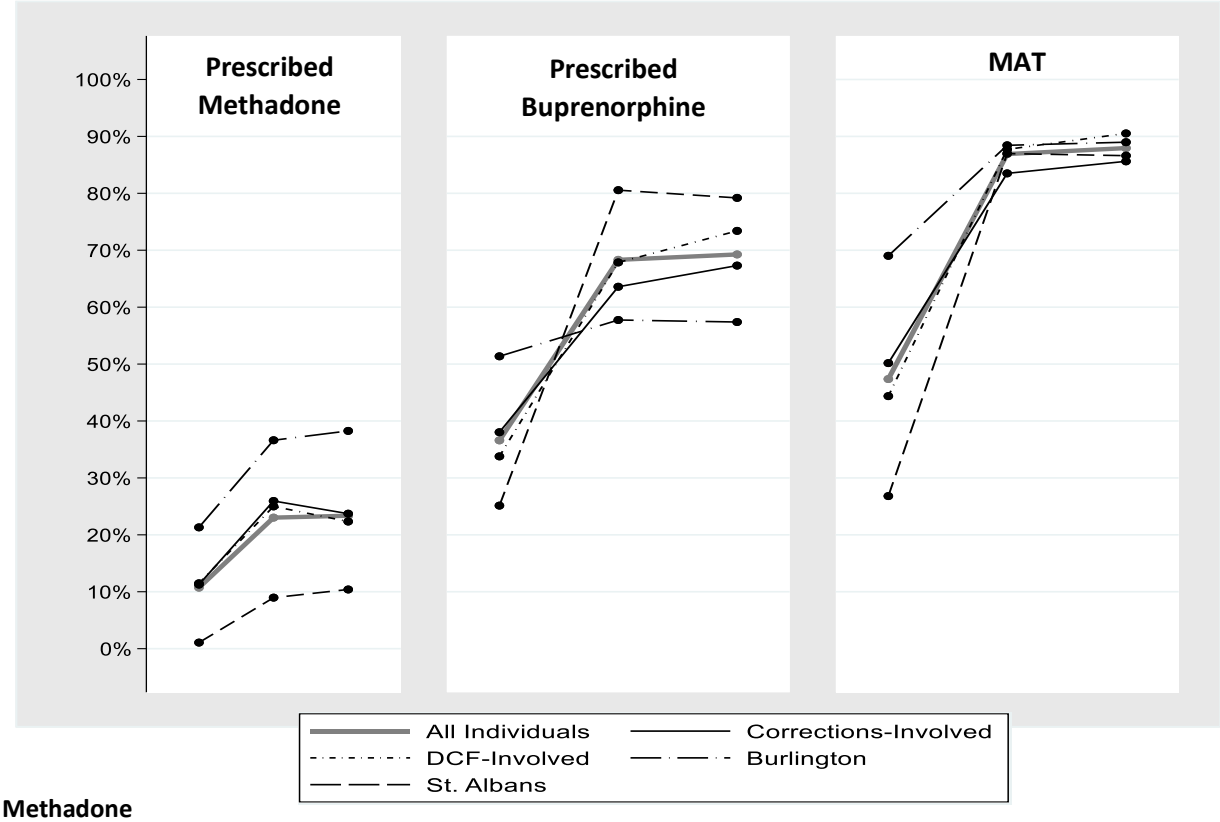
% having high risk sex past 30-day at baseline, 6-Months and 12-Months



- The % of participants having high-risk sex decreased from 21% at baseline to 18% at 6-months and to 8% at 12-months.
- Paired comparison tests ($p<0.05$) show no significant changes from baseline to month 6 or baseline to month 12, for all participants and across all subgroups.

Goal: Increase Treatment Engagement

% receiving MAT, 0-1 Month, 4-7 Months, 8-12 Months (note: no participants received >15 days of MAT in the 6-months prior to baseline, thus all participants start at zero and months 0-1 reflect receiving a MAT prescription early in treatment)



Methadone

- The % of participants prescribed methadone increased from 11% at months 0-1 to 23% at months 4-7 and stayed at 23% at months 8-12.
- Paired comparison tests (p<0.05) show significant changes from baseline to month 6 or baseline and to month 12, for all participants and across all subgroups.

Buprenorphine

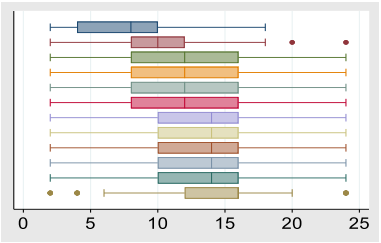
- The % of participants prescribed buprenorphine increased from 37% at months 0-1 to 68% at months 4-7 and to 69% at 8-12 months. The number receiving MAT increased dramatically from timepoint 1 to timepoint 2.
- Paired comparison tests (p<0.05) show significant changes from baseline to month 6 or baseline and to month 12, for all participants and across all subgroups except no significant changes in Burlington (both comparisons).

MAT Combined

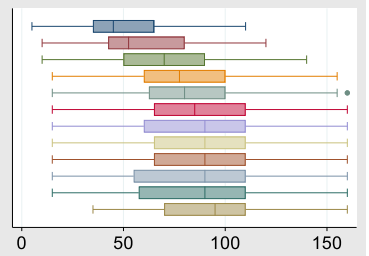
- The % of participants prescribed MAT increased from 47% at months 0-1 to 87% at months 4-7 and to 88% at 8-12 months.
- Paired comparison tests (p<0.05) show significant changes from baseline to month 6 or baseline and to month 12, for all participants and across all subgroups.

MAT Dosing Month 1-12 (top to bottom)

Buprenorphine

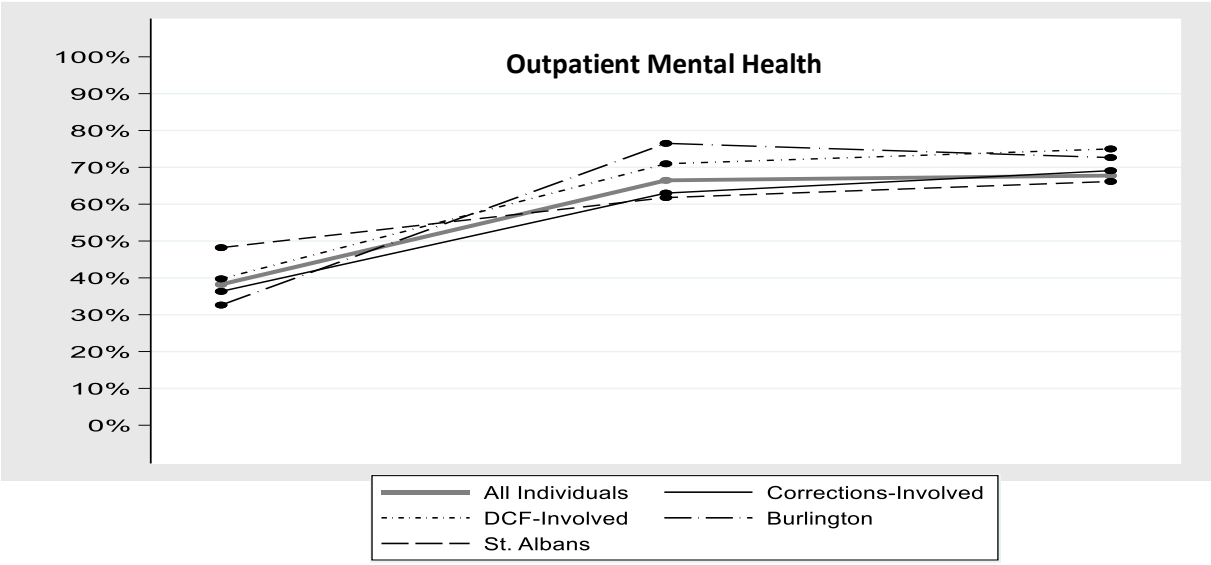


Methadone



Goal: Increase Treatment Engagement

% in outpatient mental health treatment, 0-1 Month, 4-7 Months, 8-12 Months

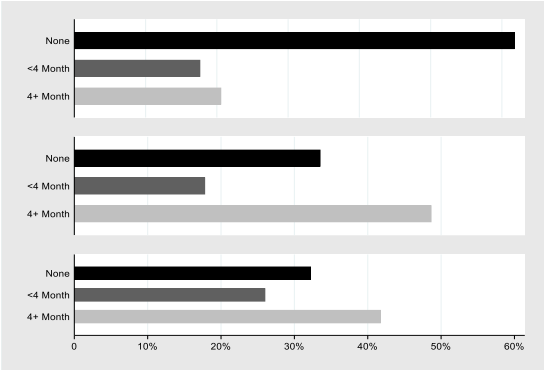


- The % of participants in outpatient mental health treatment increased from 36% at baseline to 63% at months 4-7 and to 68% at 8-12 months. Burlington had the largest increase from 33% at baseline to 73% in months 8-12.

- Paired comparison tests ($p<0.05$) show significant changes from baseline to month 6 or baseline and to month 12, for all participants and across all subgroups.

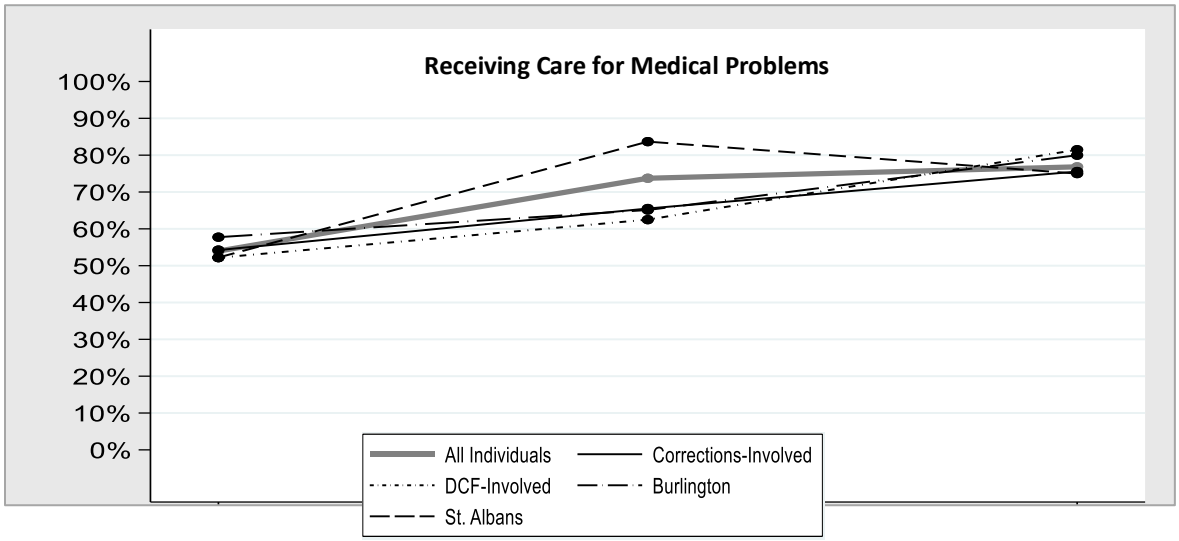
- Participants utilizing outpatient mental health at least 4 times in a single month increased from 21% at baseline to 49% at months 4-7 and a slightly decrease to 42% at months 8-12.

Outpatient Mental Health Frequency of Visits: None Any Month, <4 All Months, 4+ Any Month, Months 0, 4-7, 8-12 (top to bottom)



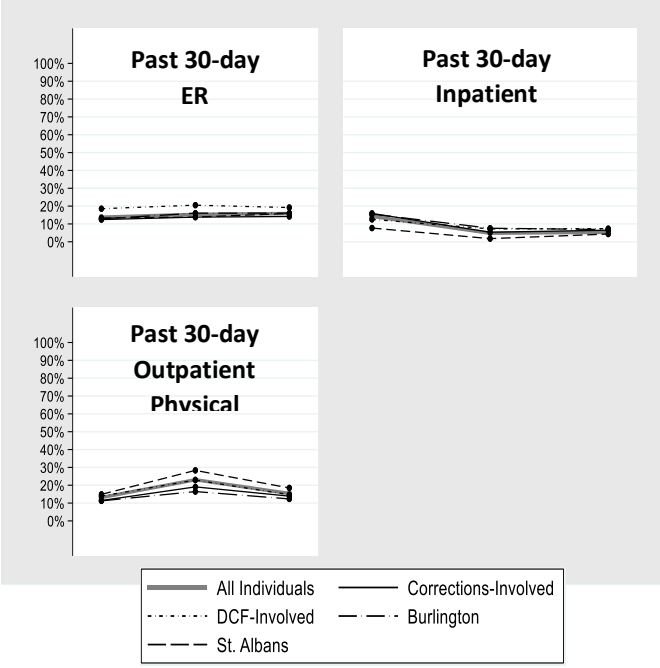
Goal: Increase Treatment Engagement

% receiving care for medical problems at baseline, 6-Months and 12-Months



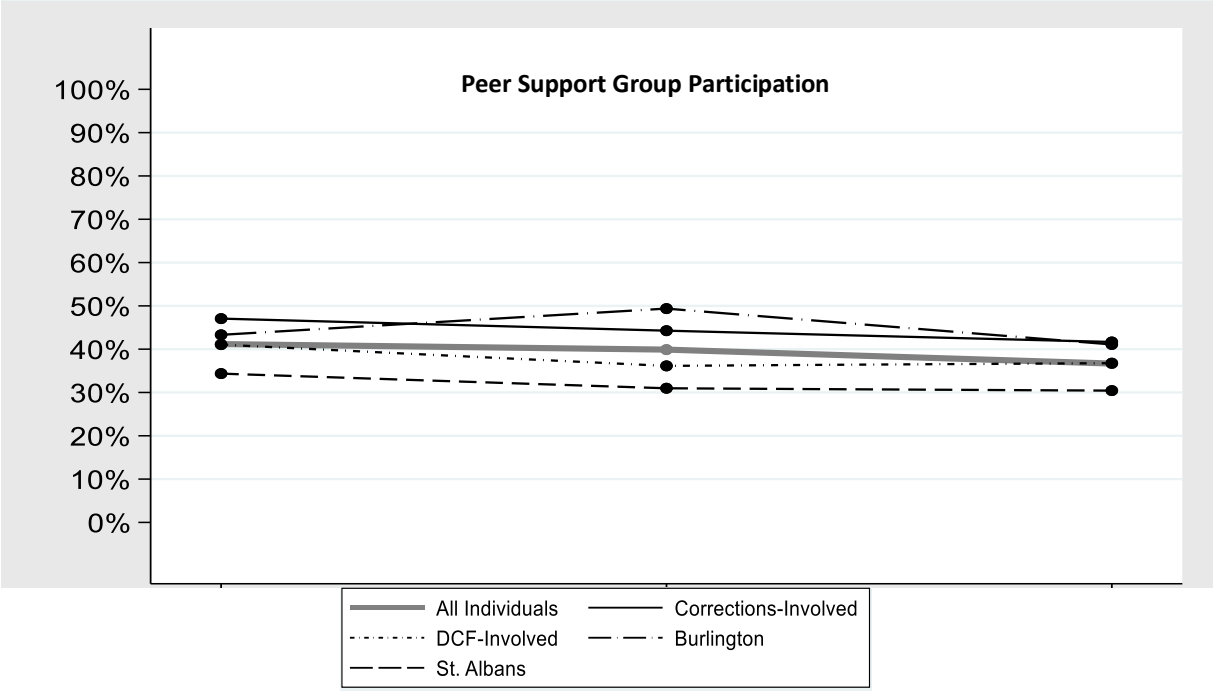
- The % of participants receiving care for existing medical problems increased from 54% at baseline to 74% at month 6 and to 77% at month 12. St. Albans had the largest jump from 52% at baseline to 84% at month 6. DCF-involved had the highest at month 12 at 81%.
- Paired comparison tests ($p<0.05$) were mixed. Significant changes for all participants at both comparisons and St. Albans from baseline to month 6. No significant change occurred for corrections-involved, DCF-involved, in Burlington and from baseline to 12-months in St. Albans.

- ER use remained fairly consistent across timepoints from 14% at baseline to 15% at month 6 and 16% at month 12. DCF-involved used the ER most.
- Outpatient physical increased from 13% at baseline to 23% at month 6 and decreased slightly to 15% at month 12.
- Inpatient use decreased from 14% at baseline to 5% at month 6 and stayed at 5% at month 12.



Goal: Increase Treatment Engagement

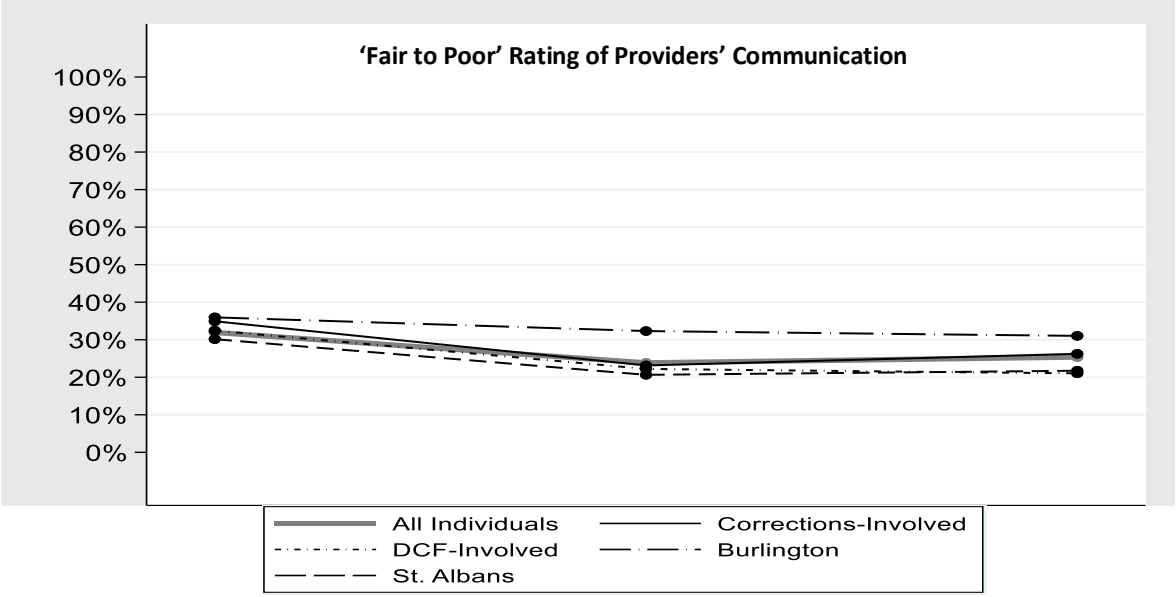
% past 30-day participated in peer support or other 12-step groups at baseline, 6-Months and 12-Months



- The % of participants participating in peer groups decreased slightly from 41% at baseline to 40% at month 6 and to 37% at month 12. St. Albans had the largest jump from 52% at baseline to 84% at month 6.
- Paired comparison tests ($p<0.05$) show no significant change from baseline to month 6 or baseline and to month 12, for all participants and across all subgroups, except St. Albans which significantly decreases from 46% of those not lost to follow-up for month 12 at baseline to 30% at month 12.

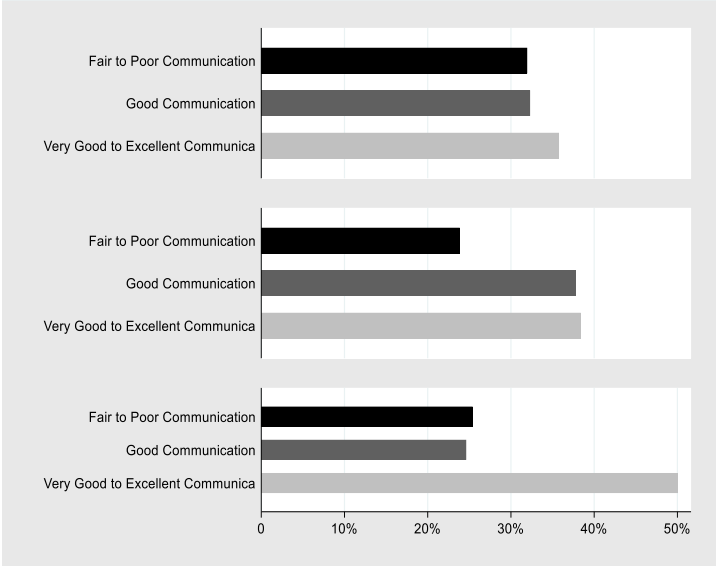
Goal: Increase Treatment Engagement

% of rating of communication between providers as 'Fair to Poor', baseline, 6-Months and 12-Months



- The % of participants rating communication between providers as 'Fair to Poor' decreased slightly from 32% at baseline to 24% at month 6 and to 25% at month 12. DCF-involved had the largest decrease from 32% down to 21% at month 12.
- Paired comparison tests ($p<0.05$) show <u>no significant</u> change from baseline to month 6 or baseline and to month 12, for all participants and across all subgroups.
- A rating of 'Very Good to Excellent' communication increased from 36% at baseline to 38% at month 6 and up to 50% at month 12.

Rating of Communication Between Providers
Baseline, 6 Months, 12 Months
(top to bottom)



AIM 2, Part 2: Identify Factors that Predict Non-Prescribed Opioid Use vs. Abstinence

AIM 2, part 2 uses logistic regression to identify the strongest predictors of non-prescribed opioid use vs. abstinence months 4-7 after entering treatment. For more information on methodology, please see page 76. in the Methods section. For results tables and ROC curves, see page 117.

Four non-prescribed opioid use measures were modeled: non-prescribed opioid use (all types) at month 4-7 (42% of all participants), non-prescribed opioid use (excluding MAT) at months 4-7 (34% of all participants), non-prescribed buprenorphine at baseline (70% of all participants) and non-prescribed methadone at baseline (11% of all participants). Following are some opioid specific descriptors of participants who are positive for each of the measures (characteristics at the same timepoint):

Non-Prescribed Opioid All Types Months 4-7

- 80% use non-prescribed opioids (excluding MAT) and 38% use non-prescribed MAT
- 40% use Darvon or Oxy
- 29% self-report using heroin
- 52% are prescribed Buprenorphine and 35% prescribed methadone

Non-Prescribed Opioid (excluding MAT) Months 4-7

- 20% use non-prescribed MAT
- 52% use Darvon or Oxy
- 41% self-report using heroin
- 51% are prescribed Buprenorphine and 45% prescribed methadone

Non-Prescribed Buprenorphine at Baseline

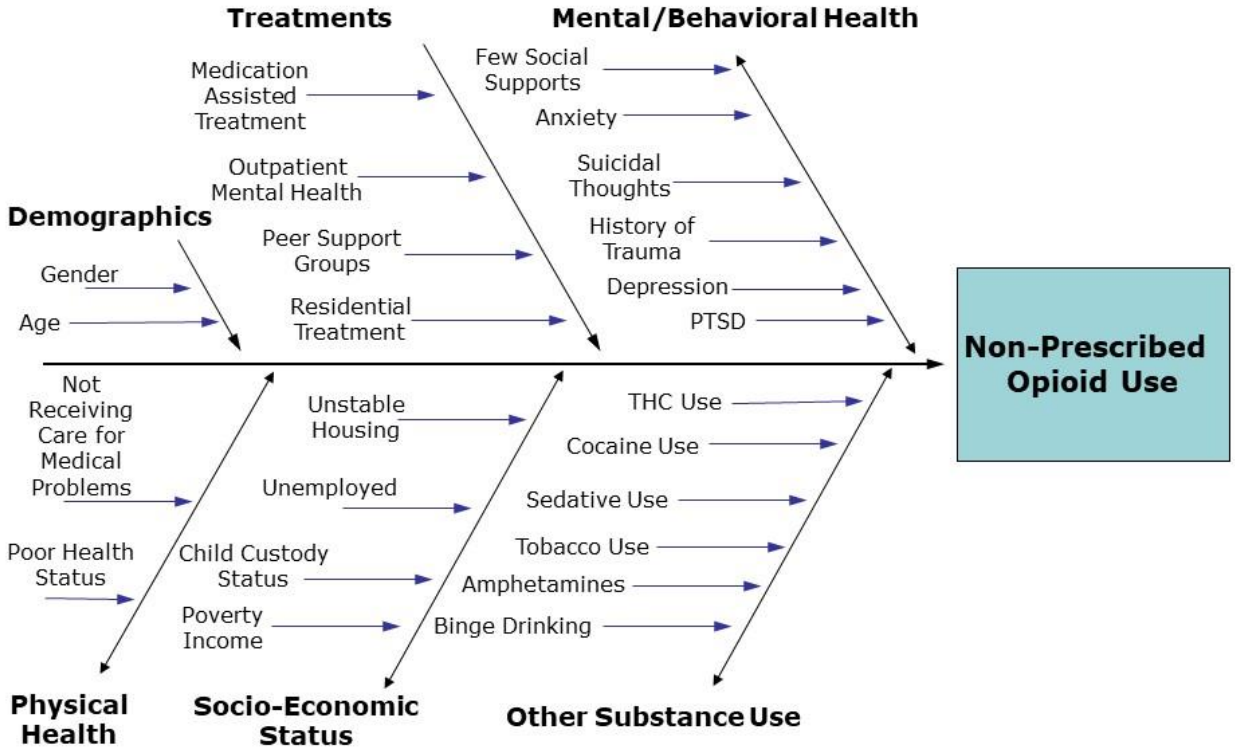
- 46% use non-prescribed opioids (excluding MAT)
- 8% use Darvon or Oxy
- 31% self-report using heroin

Non-Prescribed Methadone at Baseline

- 81% use non-prescribed opioids (excluding MAT)
- 15% use Darvon or Oxy
- 63% self-report using heroin

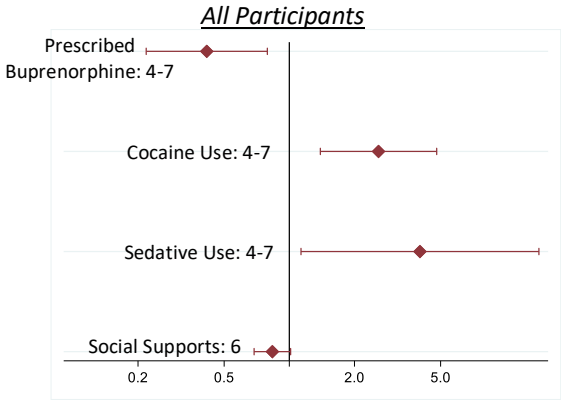
The following chart includes the literature-identified factors that were considered for inclusion in the logistic regression models, organized by category.

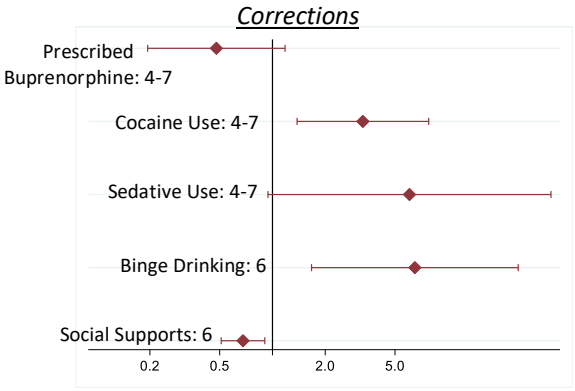
Factors with a Relationship to Non-Prescribed Opioid Use in the Literature
Tracked by the MAT-I Study & Considered as Potential Factors in AIM 2, Part 2

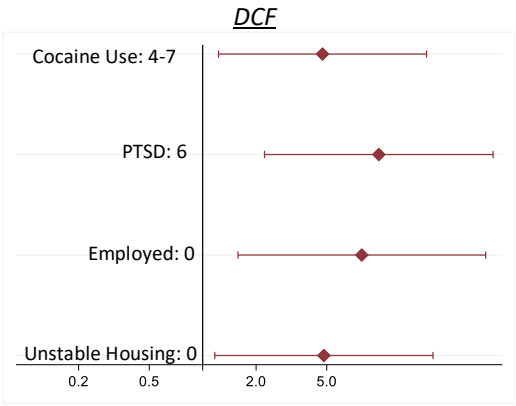


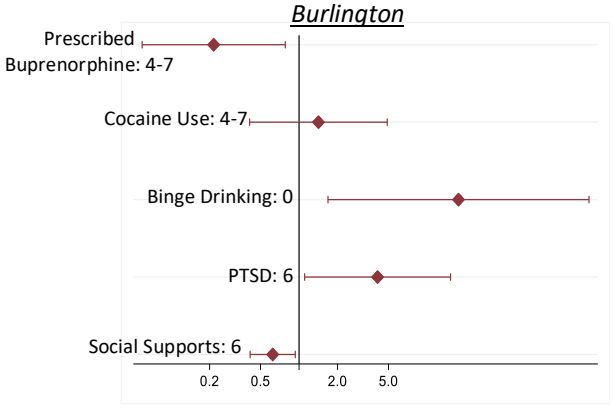
Predictors of Non-Prescribed Opioid Use during Months 4-7, All Participants and by Sub-Group

Note that all models presented are significant (p<0.001) with the vertical black line representing no difference, odds ratios to the right of the line representing a higher likelihood and odds ratios to the left of the line a lower likelihood, with the range the 95% confidence interval. The number following the factor is the timepoint for that factor.



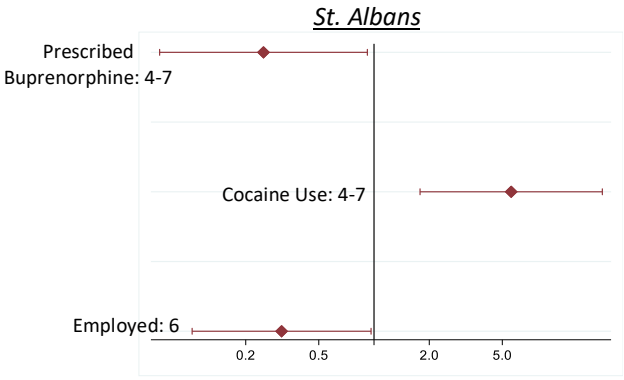






Predictors include:

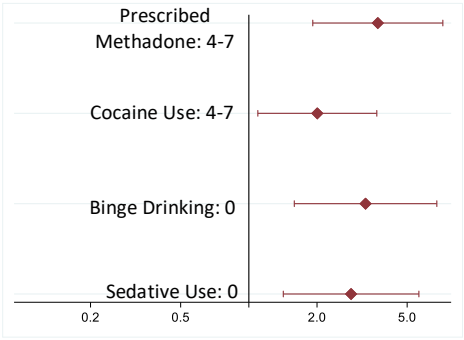
- *More likely*: Cocaine use, binge drinking, and sedative use during months 4-7
- *More likely*: PTSD at month 6
- *Less likely*: Prescribed buprenorphine at months 4-7
- *Less Likely*: Having social supports at months 6
- *More likely*: Unstable housing at baseline for DCF-Involved
- *Less likely*: Employment at month 6 in St. Albans
- *More likely*: Employment at baseline for DCF-involved



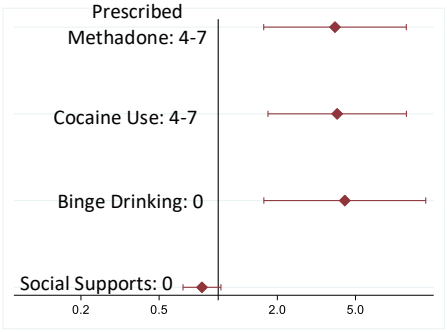
Predictors of Non-Prescribed Opioid Use (Excluding MAT) during Months 4-7, All Participants and by Sub-Group

Note that all models presented are significant (p<0.001) with the vertical black line representing no difference, odds ratios to the right of the line representing a higher likelihood and odds ratios to the left of the line a lower likelihood, with the range the 95% confidence interval. The number following the factor is the timepoint for that factor.

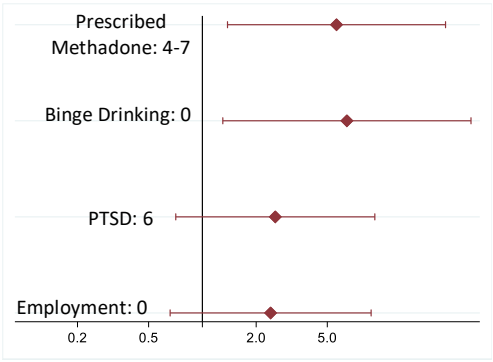
All Participants



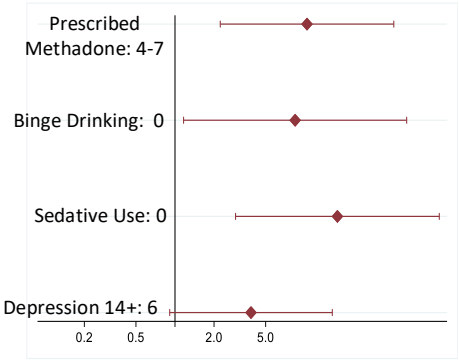
Corrections



DCF



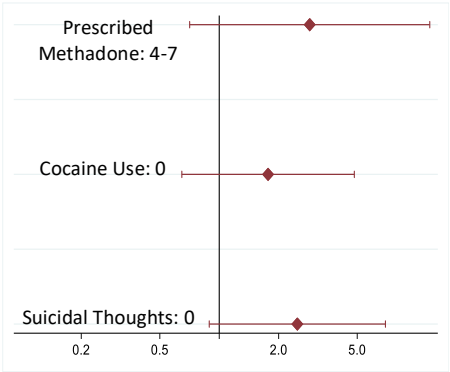
Burlington



Predictors include:

- *More likely*: Prescribed methadone, binge drinking, cocaine use, sedative use
- *More likely*: Depression, PTSD, suicidal thoughts
- *More likely:* Employment at baseline for DCF-involved

St. Albans



Predictors of Non-Prescribed Buprenorphine Use, All Participants and by Sub-Group

Note that all models presented are significant (p<0.05) with the vertical black line representing no difference, odds ratios to the right of the line representing a higher likelihood and odds ratios to the left of the line a lower likelihood, with the range the 95% confidence interval. All factors are at baseline to month 1.

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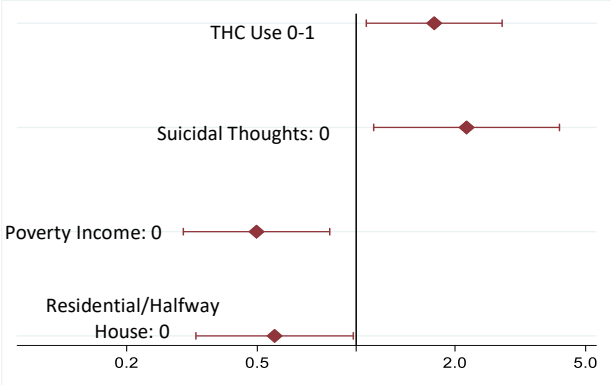
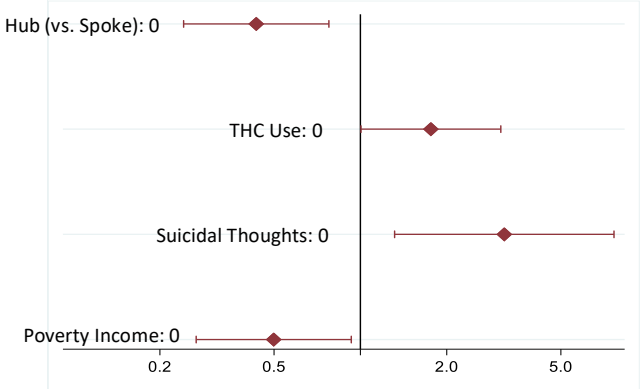
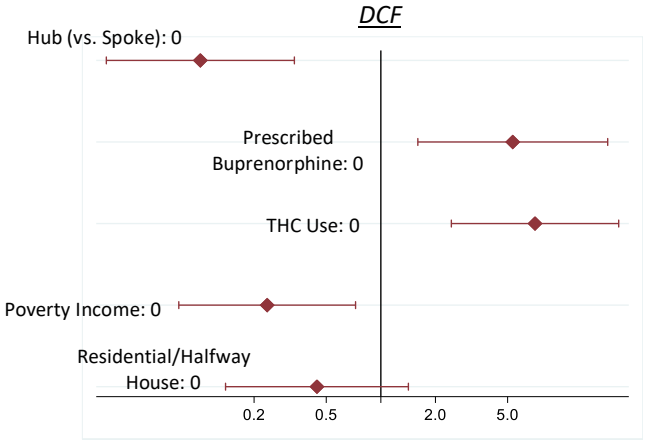
All Participants



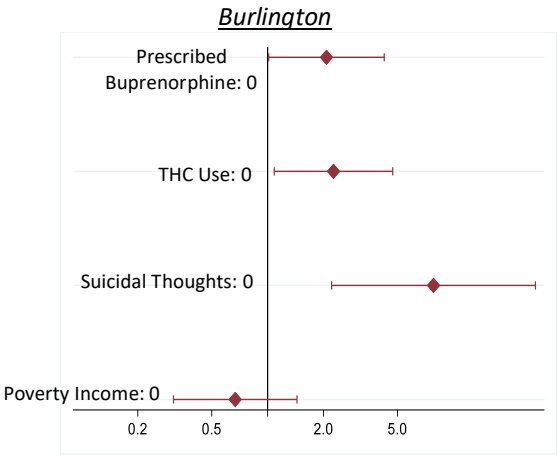
Corrections



DCF



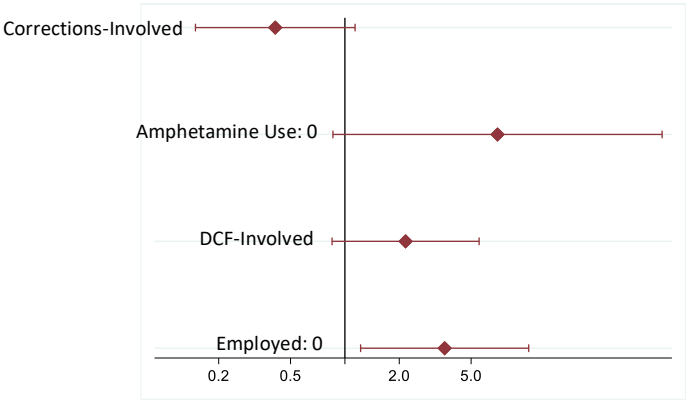
Burlington



Predictors include:

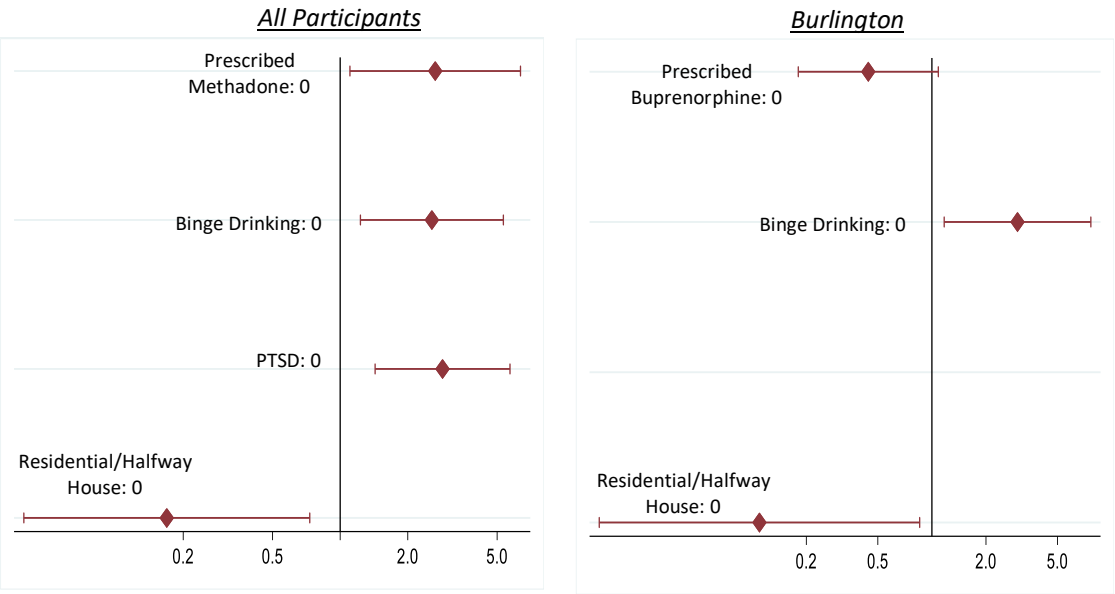
- *More likely*: THC use
- *More likely*: Suicidal thoughts
- *More likely*: Prescribed buprenorphine
- *Less likely*: Hub
- *Less likely*: Poverty income
- *Less likely*: Residential treatment/halfway house
- *More likely*: Involved with DCF, employed, amphetamine use in St. Albans
- *Less likely:* Corrections-involved in St. Albans

St. Albans



Predictors of Non-Prescribed Methadone Use, All Participants and by Sub-Group

Note that all models presented are significant (p<0.001) with the vertical black line representing no difference, odds ratios to the right of the line representing a higher likelihood and odds ratios to the left of the line a lower likelihood, with the range the 95% confidence intervals. All factors are at baseline to month 1.



Predictors include:

- *More likely*: Prescribed methadone or buprenorphine
- *More likely*: Binge drinking
- *More likely*: PTSD
- *Less likely*: Residential/Halfway House

AIM 2 Summary

Similar to previous studies, our results show that opioid use, including non-prescribed use of buprenorphine, significantly decreased over time for all subgroups. As well, employment significantly increased, with the largest increase for corrections-involved and St. Albans sample. Unfortunately, participants continue to face high rates of unstable housing, with no significant decrease over time. Literature on recovery outcomes suggest that this leaves them vulnerable to relapse (Shah, Galai, Celentano, Vlahov, & Strathdee, 2006). While binge drinking did not significantly decrease from baseline to 6 months, a significant decrease from baseline to 12 months was observed for the overall sample and some subgroups. This suggests that binge drinking may be more resistant to change or may take longer to change. Cocaine use significantly increased over time, with Burlington participants having the highest rates of cocaine use. Past research has shown a strong link between cocaine use and opioid recovery (Heidebrecht, MacLeod, & Dawkins, 2018;

Schottenfeld et al., 2005; Eastwood, Strang, & Marsden, 2019). Rates of tobacco and marijuana use were steady over time, with high rates of use. While severe depression did significantly decrease for the overall sample, this was not true for the DCF-involved and Burlington sample. A similar pattern was observed for anxiety. Results for PTSD scores were mixed, with only the Corrections-involved group showing a significant decrease from baseline to month 6. However, the overall sample and DCF-involved groups showed a significant decrease from baseline to month 12, suggesting that change in PTSD symptoms may occur later in treatment. Social support is a key factor in recovery and all groups except Burlington showed increased scores on a measure of social support. There were no significant changes in high-risk sex.

Receiving prescribed MAT significantly increased over time, including buprenorphine and methadone, across all groups. Significantly increased mental health treatment engagement over time was seen in all groups and was most striking in the Burlington sample. In addition, increased engagement in medical care was observed and ER visits remained steady, with the DCF group using ER services the most frequently. With the exception of a decrease from baseline to month 12 in the St. Albans sample, engagement in peer support remained steady over time. There is some evidence to suggest that peer support groups such as 12-step meetings influence recovery outcomes (Monico, et al., 2015). Research in this area is lacking due to the closed group nature of the 12-step program.

Predictors

Consistent with past studies of OUD, predictors of opioid use at follow-up include cocaine use, binge drinking, sedative use, screening positive for PTSD at month 6, and unstable housing (DCF group). Participants prescribed buprenorphine and those with adequate social support at month 6 were less likely to use opioids. Being employed at baseline predicted an increased likelihood of non-prescribed opioid use at follow-up for DCF-involved participants. When excluding use of non-prescribed MAT from the non-prescribed opioid use outcome, participants are more likely to use opioids if they are prescribed methadone, binge drinking, using cocaine, using sedatives, experiencing depression, PTSD positive, and experiencing suicidal thoughts.

Predictors of non-prescribed buprenorphine use include marijuana use, suicidal thoughts, prescribed buprenorphine, and amphetamine use in St. Albans. In the St. Albans sample, corrections involvement predicted less likely to use non-prescribed buprenorphine and DCF-involvement predicted increased likelihood to use non-prescribed buprenorphine. Participants in residential treatment/halfway houses were less likely to use non-prescribed buprenorphine. Baseline poverty also predicted a decreased likelihood of non-prescribed buprenorphine use at baseline. For DCF and corrections-involved participants, hub level of care decreased likelihood of non-prescribed buprenorphine use. Predictors of non-prescribed methadone use included prescribed methadone (at baseline), binge drinking, and PTSD. Participants in residential treatment/halfway houses were less likely to use non-prescribed methadone. In addition, prescribed buprenorphine predicted a decreased likelihood of non-prescribed methadone use in the Burlington sample.

Research does not support the notion that people age out of substance use disorders and many, if not most, can face decades of substance use problems, suggesting that chronicity also does not have an expiration date (Scherbaum & Specka, 2008). In a UVM study of MAT participants in VT (Rawson, 2017), participants reported an average of 14 years of opioid use. While abstinence at one time period does

tend to be associated with later abstinence, the wealth of research shows that OUD is a chronic disorder, accompanied by frequent relapses (Scherbaum & Specka, 2008). Research into the role of willpower on recovery has not supported the notion of substance use being a problem with willpower and this view supports the stigmatizing of people with SUD. It is hoped that our findings highlight the challenges people in OUD treatment face and the need to treat the whole person, not just the presenting disorder.

Our AIM 2 results support the following <u>actionable items</u> for consideration:

1. These findings continue to support rapid, low barrier access to buprenorphine treatment

2. Binge drinking and PTSD show some changes over time, but these changes take longer to appear than changes in opioid use. Clinicians may consider addressing binge drinking and PTSD earlier in psychotherapy, using evidence-based treatments.

3. Cocaine use continues at a high rate in study participants which increase from baseline. Future studies may further explore the reasons why participants continue to use. Clinic clients may benefit from enhanced psychoeducation on cocaine's activation of the reward pathway and how this may leave them vulnerable to relapse. Treatment models that meet clients where they are and help them identify their own personal values and how their choices align with their goals and values may be warranted (ex: Motivational Interviewing, Acceptance and Commitment Therapy)

4. Use of tobacco is very high and remains steady for study participants. Smoking cessation options should be explored with all participants. Nicotine replacement therapy has been shown to have some benefits for people with SUD, including decreased risk for relapse on alcohol and other substances (Prochaska, Delucchi, & Hall, 2004).

5. Depression and anxiety continue to be a problem for participants in the DCF and Burlington subgroups, suggesting that these groups may need additional help in these areas.

6. Social support seems to be a positive influence on recovery outcomes; however, the Burlington subgroup did not show increases in social support. Therapy efforts to bolster social support in this group may be especially warranted, as they may not be fully optimizing the benefits of adequate social supports.

7. Clinicians may consider talking with participants about potential barriers to attending peer support groups, including discussing ways to address potential stigma related to OST.

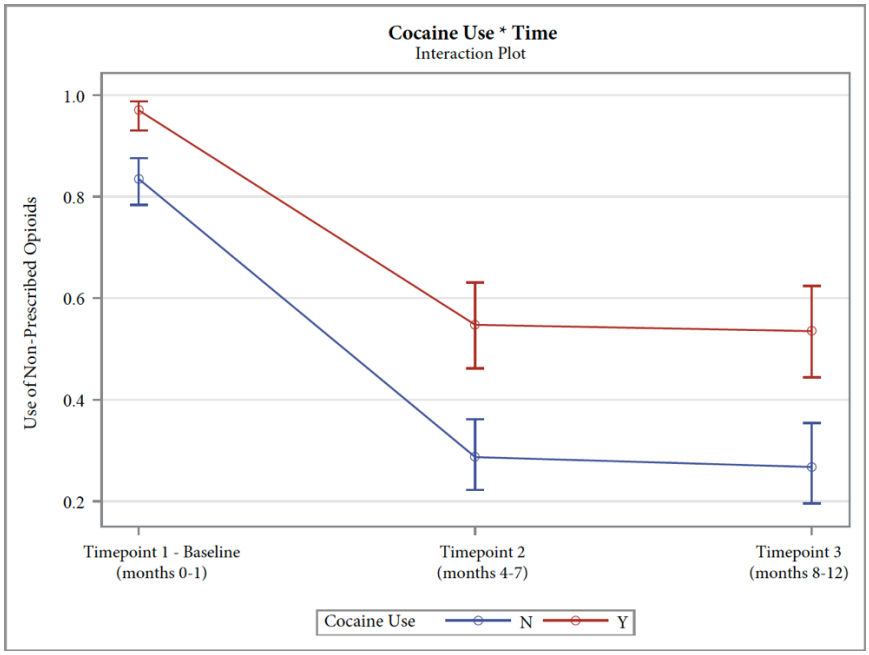
C. Evaluation AIM 3: Longitudinal Relationship between Select Factors and Non-Prescribed Opioid Use

AIM 3 uses mixed effects modeling to conduct a more in-depth examination of the longitudinal relationship between key factors identified in AIM 2 and opioid use, using modeling that accounts for missing data and assesses for co-variates that may influence the relationship between the key factors and opioid use outcomes. Potential co-variates were selected independently for each key factor, based on previous findings of a potential relationship between both the key factor and the outcome variables (AIM 2), a review of the literature and robust methods to analyze relationships between possible covariates and predictor and outcome variables. Covariates were included when a baseline relationship existed with the both the key factor and outcome variable.

In this section, the variables "prescribed buprenorphine" and "prescribed methadone" are the combination of medical record urine screen data, self-reported data using the Recent Services Survey, chart reviews of prescriptions administered and urine screens administered by research assistants. Participants have been prescribed either buprenorphine or methadone for a maximum of 15 days prior to baseline interview.

AIM 3A: What is the relationship between cocaine use and use of non-prescribed opioids?

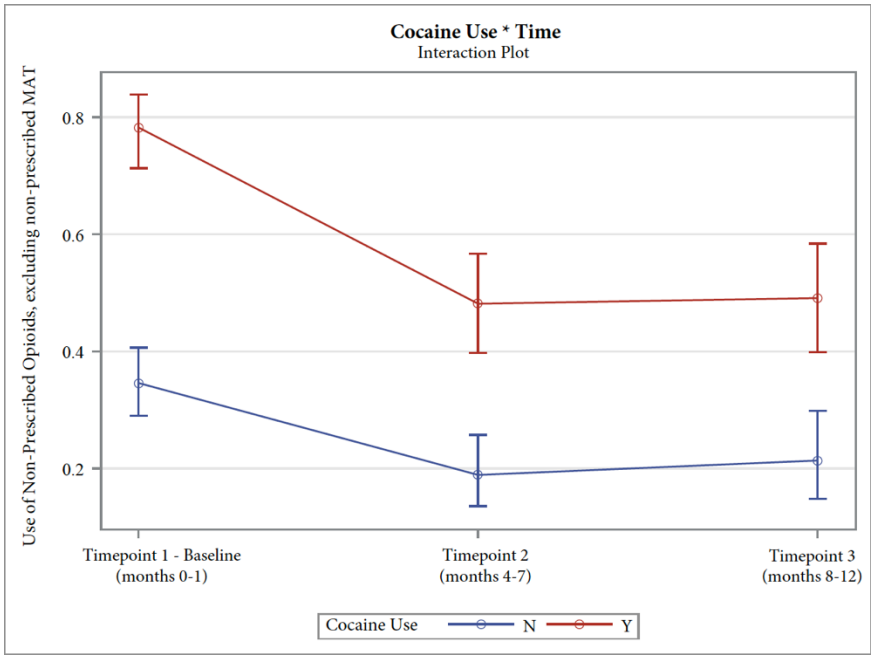
There is a significant relationship between cocaine use and non-prescribed opioid use ($p<.001$), indicating that the cocaine positive and cocaine negative groups are not equally likely to be using non-prescribed opioids. Both the cocaine positive and cocaine negative groups decrease in probability of opioid use over time ($p<.0001$).



- At the baseline time point, the odds of using non-prescribed opioids are .16 times lower for those who do not use cocaine than for those who use cocaine, which is a statistically significant difference.
- At time point 2 (months 4-7), the odds of using non-prescribed opioids are .33 times lower for those who do not use cocaine than for those who cocaine and, again, this difference is significant.
- At time point 3 (months 8-12), the odds of using non-prescribed opioids are .32 times lower for those who do not use cocaine than for those who use cocaine, which is also a statistically significant finding.

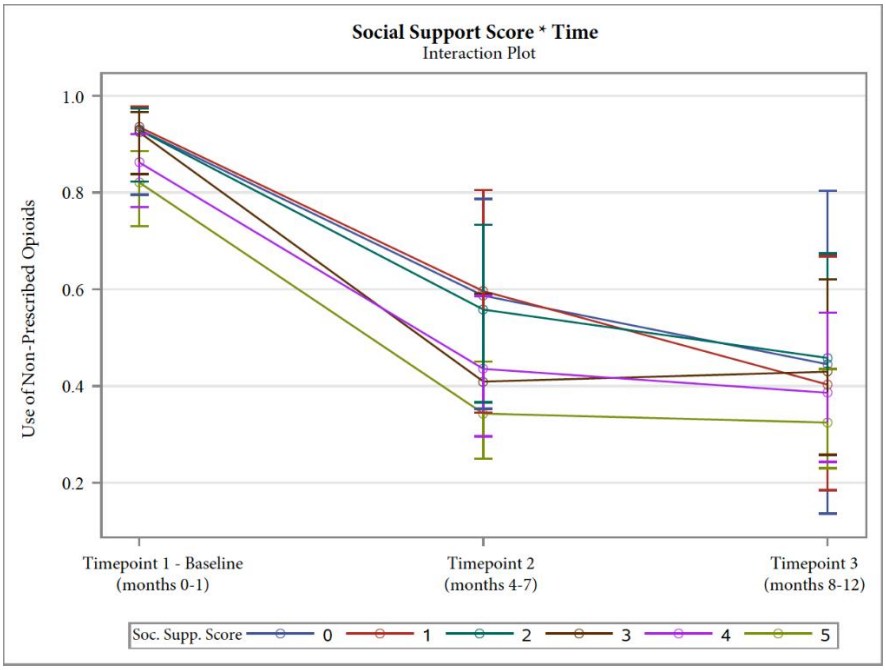
These findings on the relationship between cocaine use and opioid use remain true when adjusting for the following co-variates: location of care (Hub vs. Spoke), marijuana use, tobacco use, suicidal ideation, unstable housing, and poverty level income, confirming that cocaine use is an important factor in OUD recovery.

Results remain the same when examining opioid use outcomes, excluding use of non-prescribed MAT, as well as when adjusting for the following covariates in the relationship between cocaine use and opioid use (excluding non-prescribed MAT): location of care (Hub vs. Spoke), prescribed methadone, binge drinking, sedative use, amphetamine use, and suicidal ideation. Covariates were chosen for inclusion based on previous findings of a relationship with both variables examined (cocaine, opioid use).



AIM 3B: What is the relationship between social support and use of non-prescribed opioids?

Social support was measured using the social support domain of the Assessment Recovery Capital (ARC) tool, which measures social support on a 6-point scale from 0 (lowest) to 5 (highest). There is a significant relationship between social support (p = .0335) and non-prescribed opioid use. The relationship between social support and non-prescribed opioid use significantly changes over time (p<.0001).



In post hoc comparison, the differences between groups (i.e.: score on social support from 0-5) are not significant though several are trending towards significance:

- Participants with baseline social support scores of 1 were 3.158 times more likely to be using non-prescribed opioids than those with a social support score of 5 (p=.07).
- Participants with a social support score of 2 at baseline were 2.854 times more likely to be using non-prescribed opioids than those with a social support score of 5 (p=.07).
- At time point 2 (months 4-7), trends show that those with a social support score of 0 were 2.72 times more likely to be using non-prescribed opioids than those with a social support score of 5 (p=.06).
- At time point 2, trends show that those with a score of 1 were 2.829 times more likely to be using non-prescribed opioids than those with a social support score of 5 (p=.06).

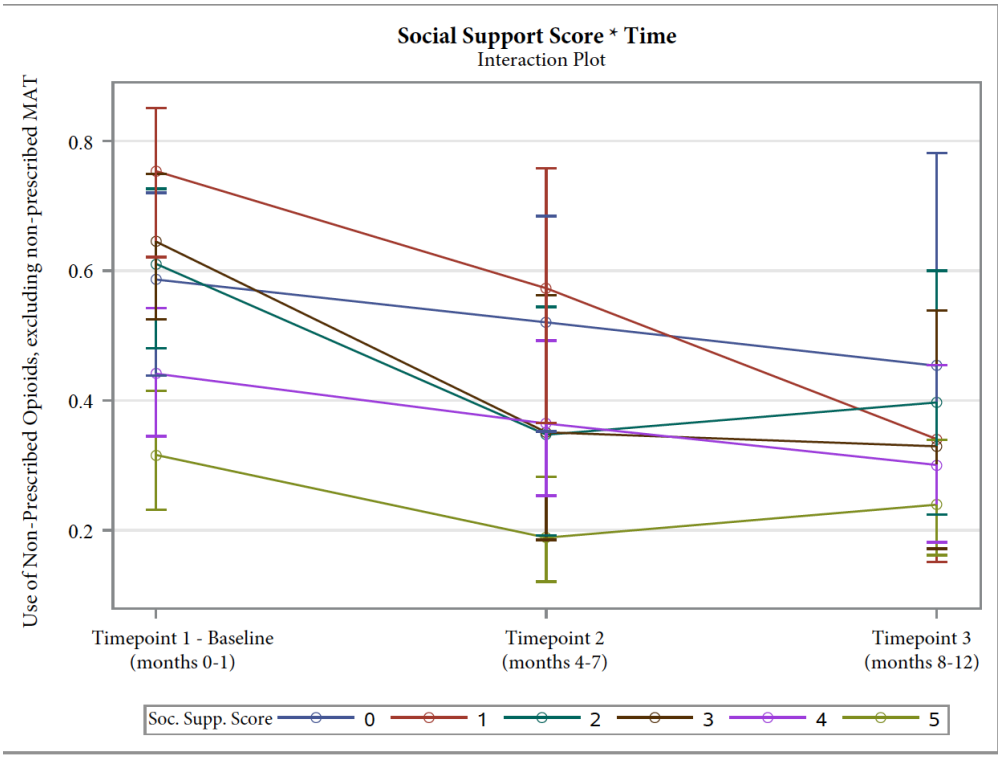
- At time point 2, trends show that those with a social support score of 2 were 2.419 times more likely to be using non-prescribed opioids than those with a social support score of 5 (p=-.054).

The interaction of time and social support is not significant (*p* = .98), reflecting that social support scores are changing over time in similar ways. *All* social support groups (scores of 0-5) at baseline show a significant effect of time (i.e.: there is statistically significant evidence of a time difference).

The relationship between social support and non-prescribed opioid use remains significant when adjusting for the following co-variates in the statistical model: location of treatment (Hub vs. Spoke), sedative use, marijuana use, and severe depression. However, inclusion of suicidal ideation and peer support participation into the model does eliminate the significance of the relationship between social support and prescribed opioid use, suggesting that suicidal ideation and peer support may overlap with the relationship between social support and non-prescribed opioid use.

Social Support and Non-Prescribed Opioid Use (Excluding Non-Prescribed MAT Use)

There is a significant relationship between social support (*p<.001*) and non-prescribed opioid use (excluding non-prescribed MAT). The relationship between social support and non-prescribed opioid use also significantly changes over time (p<.001).



In post hoc comparison, the differences between groups (i.e.: score on social support from 0-5) are significant at baseline and time point 2 (months 4-7).

At baseline:

- Participants with a social support score of 0 were 3.07 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p =.003).
- Participants with a social support score of 1 were 3.87 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p =.003).
- Participants with a social support score of 1 were 6.62 times more likely than those with a score of 4 to be using non-prescribed opioids (excluding MAT) p<.0001.
- Participants with social support score of 2 were 1.99 (approximately twice as likely) more likely than those with a score of 4 to be using non-prescribed opioids (excluding MAT) (p=.04).
- Participants with a social support score of 2 were 3.4 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p =.0005).
- Participants with a social support score of 3 were 2.3 times more likely (approximately twice as likely) than those with a score of 4 to be using non-prescribed opioids (excluding MAT) (p=.0115).
- Participants with a social support score of 3 were 3.93 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p<.0001).

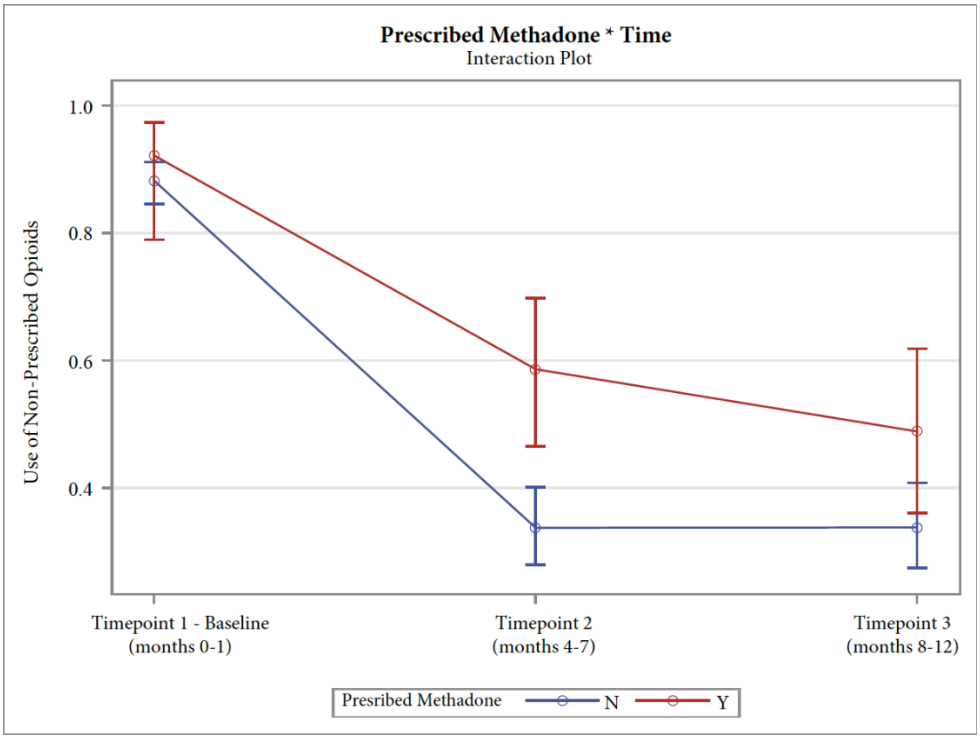
At time 1:

- Participants with a social support score of 0 were 4.67 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p =.0006).
- Participants with a social support score of 1 were 5.77 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p =.0007).
- Participants with a social support score of 4 were 2.47 times more likely than those with a score of 5 to be using non-prescribed opioids (excluding MAT) (p =.0177).

The relationship between social support and non-prescribed opioid use was no longer significant (p =.0570) when including all of the following covariates together, location of treatment (hub vs spoke), sedative use, marijuana use, severe depression, suicidal ideation, and peer support participation. In examining the each covariate separately and the effects of different combinations of covariates, it appears it is not any one covariate alone or any reduced combination of them eliminate the relationship between social support and non-prescribed opioid use, but rather significance is only washed out once they are all included.

AIM 3C: What is the relationship between prescribed methadone and use of non-prescribed opioids?

There is a significant relationship between prescribed methadone and use of non-prescribed opioids (*p*=.0083), with a significant difference between groups occurring at time point 2 (month 4-7, p=.0004) and 3 (months 8-12, P=.04). A significant time effect shows that both groups do change over time (p<.0001) and in a similar way.



- At baseline, those who were not prescribed methadone were .36 times less likely to be using non-prescribed opioids than those who were prescribed methadone.
- At time point 3 (months 8-12), those who were not prescribed methadone were .53 times less likely to be using non-prescribed opioids than those who were prescribed methadone. This is likely due to the effectiveness of buprenorphine and high rates of prescribed buprenorphine in the group not prescribed methadone in this comparison.

Significant effect of time:

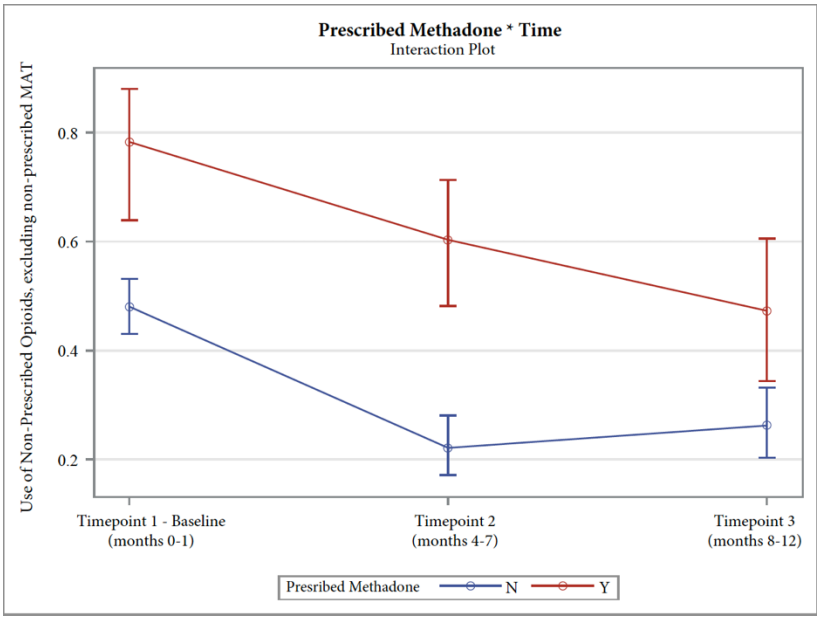
- Those who were prescribed methadone were 8.31 times more likely to be using non-prescribed opioids at baseline compared to time point 2 (months 8-12, *p*=.0007) and they were 12.33 times

more likely to be using non-prescribed opioids at baseline than at time point 3 (months 8-12, *p*<.0001).
- There was no significant difference between time point 2 and 3 for those who were prescribed methadone (*p*=.2085).

When adjusting for co-variates in the model, we found that location of treatment (hub vs. spoke) and prescribed buprenorphine do not impact the relationship between prescribed methadone and use of non-prescribed opioids. However, cocaine use does impact the relationship between prescribed methadone and use of non-prescribed opioids. This is not surprising, considering participants prescribed methadone are more likely to be using cocaine.

Prescribed Methadone and Non-Prescribed Opioid use (Excluding Non-Prescribed MAT Use)

When examining the relationship between prescribed methadone and use of non-prescribed opioids (excluding use of non-prescribed MAT), the results look similar. There is a significant relationship between prescribed methadone group and non-prescribed opioids, excluding MAT (*p*=.0001), with a significant difference between group at each time point (baseline, p<.0003; time point 2, p<.0001; time point 3, p=,04). A significant time effect shows that both groups do change over time (p<.0001) and in a similar way.



- At baseline, those who were not prescribed methadone were .26 times less likely to be using non-prescribed opioids (excluding non-prescribed MAT) than those who were prescribed methadone (*p*=.0003).

- At time point 2 (months 4-7), those who were not prescribed methadone were .19 times less likely to use non-prescribed opioids (excluding MAT) than those who were prescribed methadone (p<.0001).
- At time point 3 (8-12 months), those who were not prescribed methadone were .40 times less likely to be using non-prescribed opioids (excluding MAT) than those who were prescribed methadone (p=.0042).

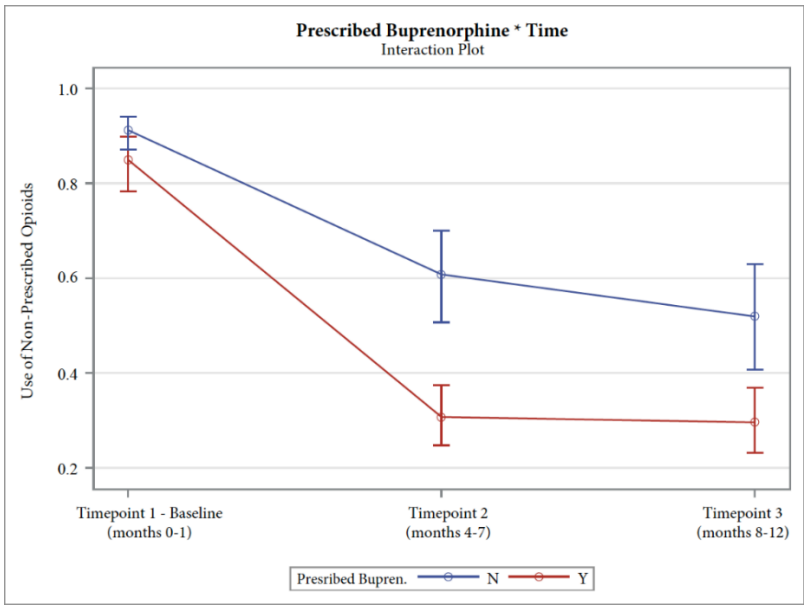
Significant effect of time:

- Those who were not prescribed methadone were 3.26 times more likely to be using non-prescribed opioids (excluding MAT) at baseline than at timepoint 2 (months 4-7, p<.0001), and they were 2.601 times more likely to be using non-prescribed opioids excluding MAT at baseline than at Timepoint 3 (months 8-12, p<.0001). There was no significant difference between timepoint 2 and timepoint 3 for those who were not prescribed methadone (p=.1803).
- Those who were prescribed methadone were 2.37 times more likely to be using non-prescribed opioids excluding MAT at baseline than at timepoint 2 (p=.0363) and they were 4.015 times more likely to be using non-prescribed opioids excluding MAT at baseline than at timepoint 3 (p=.0013).
- There was no significant difference between timepoint 2 and 3 for those who were prescribed methadone (p=.1053).

Adding co-variates to the model did not change the relationship between prescribed methadone and use of non-prescribed opioids (excluding MAT). Co-variates adjusted for included location of treatment (hub vs. spoke), cocaine use, suicidal ideation, health status, and engagement in peer support.

AIM 3D: What is the relationship between prescribed buprenorphine and non-prescribed opioid use?

There is a significant relationship between prescribed buprenorphine group (prescribed, not prescribed) on non-prescribed opioid use (p<.0001), indicating that the two groups are not equally likely to use non prescribed opioids. *At* time point 2 (p<.0001) and time point 3 (p=.0010), there is a significant difference between those prescribed buprenorphine and those not prescribed buprenorphine. A significant time effect shows that both groups do change over time (p<.0001) and in a similar way.



- At time point 2, those who were not prescribed buprenorphine were 3.49 times more likely to be using non prescribed opioids than those who were prescribed buprenorphine.
- At time point 3, those who were not prescribed buprenorphine were 2.57 times more likely to be using non-prescribed opioids than those who were not prescribed buprenorphine.
- No significant difference between the two groups was found at the baseline time point; however, this is trending towards significance (p=.0537).

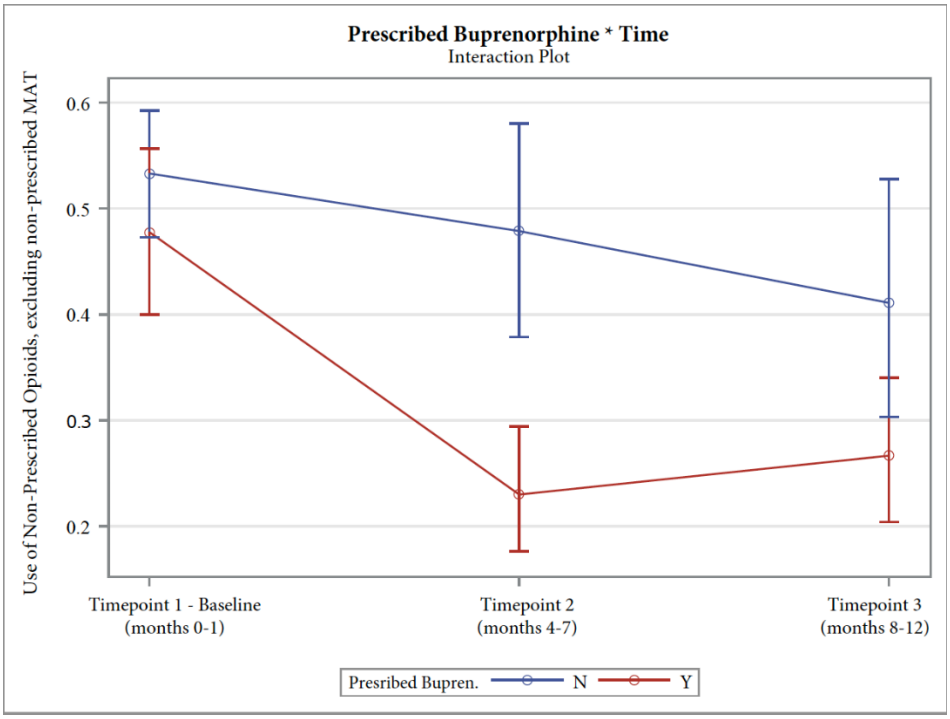
Significant effect of time:

- Those who were not prescribed buprenorphine were 6.69 times more likely to be using non-prescribed opioids at baseline than at time point 2 (months 4-7, p<.0001) and they were 9.60 times more likely to be using non-prescribed opioids at baseline than at time point 3 (p<.0001).
- There was no significant difference between time points 2 and 3 for those who were not prescribed buprenorphine (p=.16).
- Those who were prescribed buprenorphine were 12.71 times more likely to be using non-prescribed opioids at baseline than at time point 2 (months 4-7, p<.0001) and they were 13.41 times more likely to be using non-prescribed opioids at baseline than at time point 3 (p<.0001).
- There was no significant difference between time point 2 and 3 for those who were prescribed buprenorphine (p=.7652).

Adding co-variates to the model did not change the relationship between prescribed buprenorphine and use of non-prescribed opioids. Co-variates adjusted for included location of treatment (hub vs. spoke), marijuana use, unstable housing, residing in a halfway house, and engagement in peer support.

Interaction between Prescribed Buprenorphine and Non-Prescribed Opioid Use (Excluding Non-Prescribed MAT)

There is a significant relationship between prescribed buprenorphine (prescribed buprenorphine, not prescribed buprenorphine) and non-prescribed opioid use (excluding non-prescribed MAT) (p<.0003), indicating that the two groups are not equally likely to use non prescribed opioids. *At* time point 2 (p<.0001) and time point 3 (p=.0297), there is a significant difference between those prescribed buprenorphine and those not prescribed buprenorphine. A significant effect of time shows that both groups change over time (p=.0093).



- At the baseline time point, those who were not prescribed buprenorphine were 3.08 times more likely to be using non-prescribed opioids (excluding MAT) than those who were prescribed buprenorphine (p<.0001).
- At time point 3, those who were not prescribed buprenorphine were 1.07 times more likely to be using non-prescribed opioids (excluding MAT) than those who were prescribed buprenorphine.
- No significant difference between the two groups was found at baseline (p=.2741).

Significant effect of time:

- Those prescribed buprenorphine were 3.06 times more likely to be using non-prescribed opioids (excluding MAT) at baseline than at time point 2 (p<.0001), and they were 2.52 times more likely to be using non-prescribed opioids (excluding MAT) at baseline than at time point 3 (p<.0001).
- There was no significant difference between time points 2 and 3 (p=.2821).

- There are no significant differences between time points for those who were not prescribed buprenorphine.

The prescribed buprenorphine relationship with non-prescribed opioid use remained significant in the model (p=.0007) when adjusting for location of treatment (hub vs spoke) indicating that including the covariate hub_vs_spoke in the model did not eliminate the relationship between prescribed buprenorphine and the outcome measure. The same is true for the main effect of time, p<.0001.

Adjusting for other co-variates in the model did not change the relationship between prescribed buprenorphine and use of non-prescribed opioids (excluding MAT). Co-variates adjusted for included prescribed methadone, gender, marijuana use, and engagement in peer support.

AIM 3 Summary

Aim 3 analyses further confirm that cocaine use has a significant relationship with use of non-prescribed opioids, with those who are not using cocaine at each time point to be significantly less likely to be using non-prescribed opioids when controlling for missing data and adjusting for co-variates. Social support was also found to have a significant relationship with non-prescribed opioid use, with participants with the lowest social support scores doing less well than those with the highest social support score at baseline and at time point 2. Even just a one-point gain in social support score seems to decrease the likelihood of opioid use. Suicidal ideation and peer support participation impact the relationship between social support scores and opioid use outcomes, suggesting that these factors are also important when working with people with low social support. When adjusting for co-variates of non-prescribed opioid use, excluding use of non-prescribed MAT, severe depression, sedative use, and location of treatment also seem to be playing some role in the relationship between social support and opioid use, suggesting that these factors should also be considered closely when treating someone with low social support.

Participants who were prescribed methadone were more likely to be using non-prescribed opioids than those who were not prescribed methadone, when controlling for missing data and adjusting for co-variates. This is likely due to the increasing rates of prescribed buprenorphine in the not prescribed methadone. At baseline, 11% were prescribed methadone and 37% were prescribed buprenorphine. At time point 2, 23% were prescribed methadone and 68% were prescribed buprenorphine. At time point 3, 23% per prescribed methadone and 69% were prescribed buprenorphine. Participants who are prescribed methadone have similar opioid outcomes at both follow up time points, showing that reductions in opioid use for those receiving methadone treatment hold steady. When adjusting for co-variates, cocaine use was shown to impact the relationship between prescribed methadone and opioid use, likely due to the high rates of cocaine use in those that are prescribed methadone.

- 72% of participants prescribed methadone at Months 0-1 are using cocaine at Months 0-1
- 81% of participants prescribed methadone at Months 4-7 are using cocaine at Months 4-7
- 79% of participants prescribed methadone at Months 8-12 are using cocaine at Months 8-12

Of interest, when examining the effect of prescribed methadone on non-prescribed opioid use and excluding non-prescribed MAT from the outcome variable, cocaine use is no longer a significant co-variate, suggesting that cocaine use may be different or may play a different role in those who are using non-prescribed MAT. Further analyses would be needed to explore this.

Analysis of differences between those prescribed and those not prescribed buprenorphine at each time point show the inverse of the methadone group analysis, where those prescribed buprenorphine show a much greater decrease in opioid use over time, compared to those not prescribed buprenorphine.

While there is not quite a significant difference between those prescribed buprenorphine and those not prescribed buprenorphine using non-prescribed opioids at baseline, this is likely due to the short duration of time on prescribed buprenorphine at the baseline time point (not greater than 15 days). The difference between those prescribed and those not prescribed buprenorphine becomes significant by time point 2 and continues to be significant at time point 3.

Similar to those prescribed methadone, participants who are prescribed buprenorphine have similar opioid outcomes at both follow up time points, showing that reductions in opioid use for those receiving buprenorphine treatment hold steady.

While rates of use of non-prescribed opioids decrease for all groups, this data suggests that buprenorphine may be outperforming methadone overall. However, participants were not randomly assigned to treatment conditions, with severity of substance use and recovery success being a key factor in the treatment selection. Self-reported heroin use is 70% among participants prescribed methadone during months 0-1 and 34% among participants prescribed buprenorphine in months 0-1. The ability to accurately compare buprenorphine and methadone influence on non-prescribed opioid use outcomes is not within the scope of what is possible with this dataset.

D. Qualitative Results

Participants were asked about their experiences with the services they received over the past 12 months. These services may include medication-assisted treatment, counseling, recovery coaching, coordination of care or any other service received at one of the three program evaluation sites or in other parts of the community (See *Appendix K: Data Collection Tools* for full battery of qualitative questions). Although there were a wide range service experiences, the following diagram highlights the most common responses captured amongst the 109 qualitative interviews conducted.

MAT Coordinators

One of the strategies implemented in the VT-MAT PDOA Model was to ensure the availability of MAT Coordinators at each of the three sites, which has been identified as valuable to high-risk participants seeking treatment for OUD. Not only were MAT Coordinators identified as resources for services, but they also served as an essential support system: "They were always here when you needed them. You call them, and they will call you right back. They help with transportation. They help set up appointments and send reminders. And they look out for your better interest."

Non-Prescribed Substance Use

Being prescribed medication-assisted treatment helped with cravings and kept participants from using non-prescribed opioids. One person stated: "Keeps me off the drug streets. Keeps me home safe and not having to go out and peddle heroin just to get my fix." And another stated: "Receiving my Suboxone keeps me off of opiates."

Behavioral & Mental Health

Services Most Helpful

1. Rapid access to treatment
2. MAT Coordinators
   - Supportive
   - Resourceful
   - Valuable
3. AA/NA
   - Helped maintain sobriety
   - "Reminder that there are people out there just like me"
4. Prescribed MAT
   - Stability
   - Decreased financial strain
   - Reduced cravings for opioids
5. Transportation Assistance
   - "Able to make appointments"
   - Gas cards
6. Counseling
   - "Process" and "cope with feelings"
   - "Someone to connect and talk with"

Services Least Helpful

1. Hub hours
   - Short dosing hours
2. Spoke waitlist
   - "When someone is ready and wants help, there is a small window"

What would have been helpful?

1. Improved transportation services
2. More support groups available
   - Groups available for people at different stages of recovery
3. Socio-economic help
   - Improved assistance in regards to employment, housing and food

Counseling allowed participants to have a safe place to talk with someone and was identified as a way to gain coping skills. One person stated: "I have depression, and PTSD and anxiety… but I never knew how to deal with them, so I would shut them down. And then if something really got me going I would explode, it was literally an explosion. And now they have been helping me figure out ways to make it easier to deal with it and not making it the explosion… I write everything in my notebook." Another stated: "It helped me a lot with my OCD habits."

Physical Health

Transportation assistance in the form of bus passes, cabs and gas cards allowed participants to make all necessary appointments (i.e. medical and MAT appointments).

Socio-Economic Status

It was reported that it would have been helpful if there was improvement in housing and employment services; for example, having more job coaches available and additional supports with completing the initial housing process.

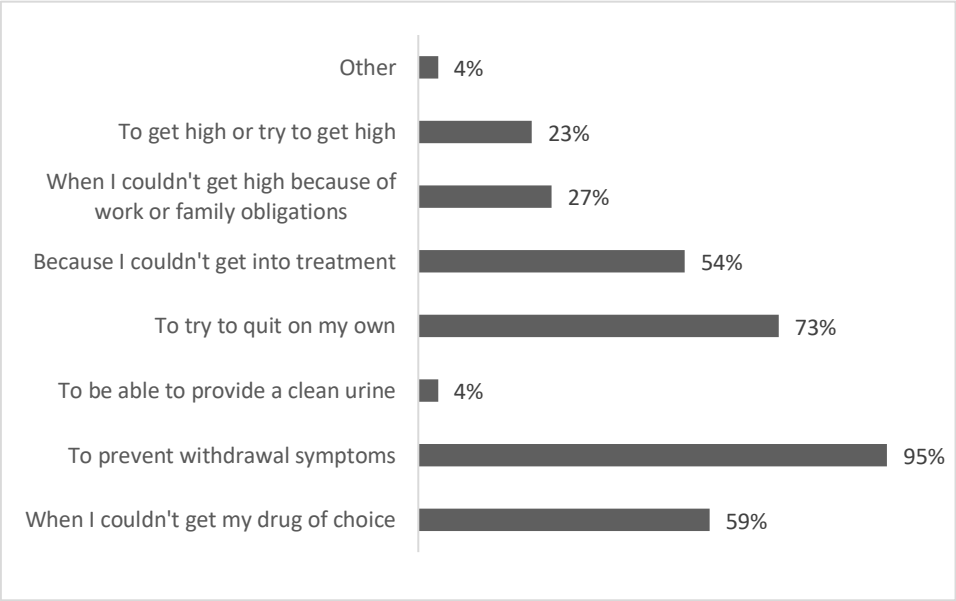
Treatment Engagement:

Peer support groups such as AA and NA were reported as places where one can talk to others in recovery and not feel alone, while also being described as a motivation for recovery: "I like to go to one meeting every 30 days; it reminds me why I'm here, where I am going and where I don't want to go again." But there was an interest in having more support groups available. The importance of support group availability is highlighted here: "When you are in drugs really deep, everyone around you is doing drugs, everybody you know does drugs. That is your whole life. If you are trying to get out of it, especially on your own, you have to eliminate yourself from all of your friends. It is hard to build a support group when you don't really know anybody that is in recovery. Initially building the support group was the challenging part for me."

Non-Prescribed Buprenorphine and Fentanyl

In October 2018, we revised our 12-month qualitative interview topics to include non-prescribed buprenorphine and fentanyl use (Refer to *Appendix K: Data Collection Tools* for the full battery of qualitative interview questions).

Among the 22 qualitative interviews conducted, the most common reasons for using non-prescribed buprenorphine was **to prevent withdrawal symptoms** and **to prevent the use of other opiates** such as heroin. When participants were asked to elaborate on other reasons why they used non-prescribed buprenorphine, 73% indicated non-prescribed use in order to try to quit



on their own and 59% indicated when they couldn't get their drug of choice. In addition, more than half (54%) indicated non-prescribed buprenorphine use because they couldn't get into treatment.

In response to Fentanyl, it was largely considered a dangerous drug and killing many, with more than half (55%) identifying either having something laced with Fentanyl or suspected it was laced.

E. Participant Stories

Fifty-two participants had the opportunity to tell us their story and were asked 3 questions:

1. **What was your life like before receiving treatment?**
2. **How did you get into treatment?**
3. **What is your life like now that you're in treatment?**

Each story was captured in writing and the most common responses were used to create the following word clouds:

Life before Treatment

How Did You Get Into Treatment?

Life Now in Treatment

F. Implementation Metric Results NMC-CPC

Northwestern Medical Center Comprehensive Pain Clinic (NMC-CPC) Implementation Metrics over the 36-Month Evaluation Period

1. Waitlist and Medication-Assisted Treatment Services

Over a 36-month period, NMC-CPC provided medication-assisted treatment to 162 participants and eliminated their MAT waitlist by the completion of the VT-MAT PDOA Program Evaluation (Figure II.G.1; Excluded Quarter 4 and Figure II.G.2; Excluded Quarter 1-4). In an attempt to reduce wait times, NMC-CPC created a triage system for qualified waitlisted participants interested in receiving Vivitrol. Over the evaluation period a total of 5 participants received a Vivitrol injection. (Table II.G.1). NMC-CPC also reported that the opening of the BAART Clinic, which provides Hub MAT services, reduced waitlist numbers and further increased access to medication-assisted treatment services. **Data highlighting month 6 – 12 (Quarter 2 – 4) Vivitrol activity were unavailable.*

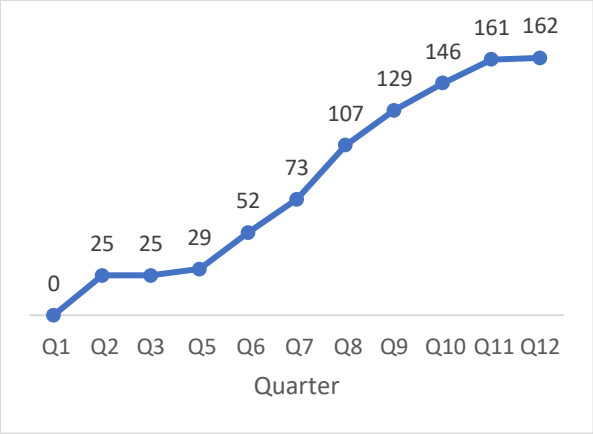


Figure II.G.1. *Number of NMC-CPC Participants on on MAT over 36-Month Evaluation Period*

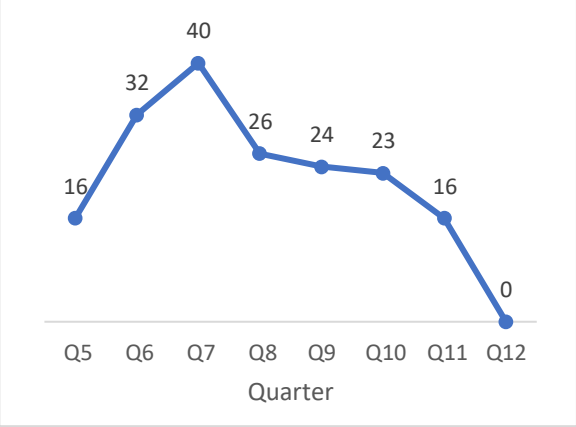


Figure II.G.2*. Number of NMC-CPC Participants a Waitlist over 36-Month Evaluation Period*

2. Peer Support and Making Recovery Easier (MRE)

The number of participants using peer supports increased over the course of 36 months, with a maximum of 116 participants utilizing 12-step or other peer support services (Figure II.G.3; Excluded Quarter 1-4). Participants attending MRE also increased beginning at month 18 (Quarter 6), but declined dramatically during the last 9 months (Quarter 10-12) of the program evaluation (Figure II.G.4; Excluded Quarter 1-4). The number of staff delivering MRE remained at 1 staff member during month 15 – month 36 (Quarter 5-12) (Table II.G.1). **Data highlighting month 6 –12 (Quarter 2 – 4) peer support and MRE activity were unavailable.*

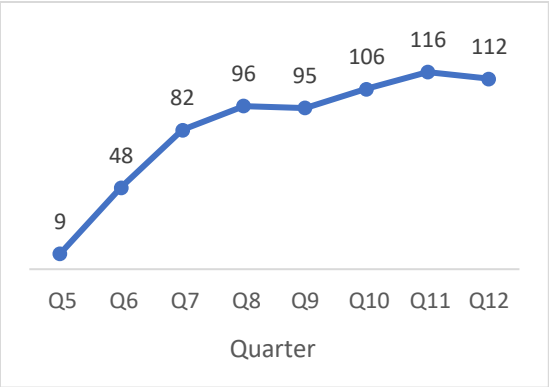


***Figure II.G.3**. Number of NMC-CPC Participants Using Peer Supports over 36-Month Evaluation Period*

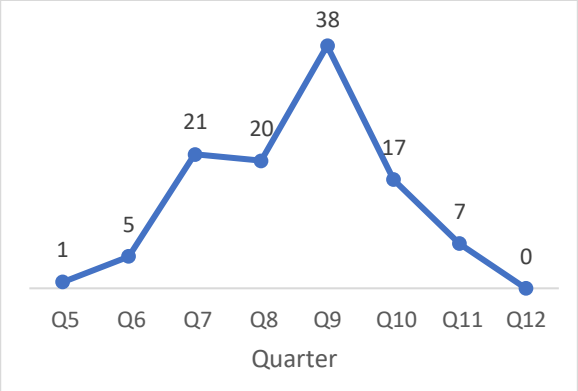


***Figure II.G.4.** Number of NMC-CPC Participants Attending MRE Group over 36-Month Evaluation Period*

3. Coordination to Outpatient Care and Treatment Services

The number of participants incarcerated or receiving inpatient treatment and transitioned to outpatient treatment began to dramatically increase by month 24 (Quarter 8) with a decrease during the last 6 months (Quarter 11-12) of the program evaluation (Figure II.G.5; Excluded Quarter 1-4). NMC-CPC also reported a decrease in participants receiving at least one service during the quarter, beginning at month 24 (Quarter 8) and continued over the remainder of the evaluation period (Figure II.G.6; Excluded Quarter 1-4). **Data highlighting month 6 -12 (Quarter 2 – 4) coordination to outpatient care and treatment services activity were unavailable*.

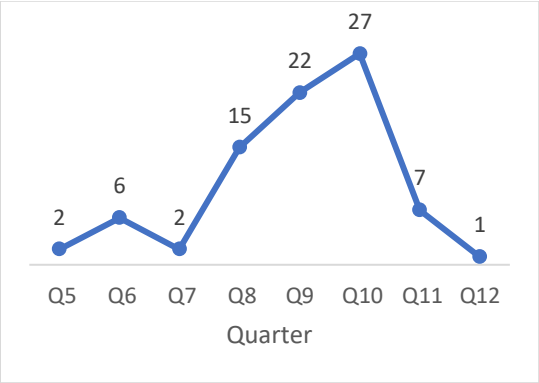


***Figure II.G.5.** Number of NMC-CPC Participants Incarcerated or Inpatient that Transitioned to Outpatient Treatment over 36-Month Evaluation Period*

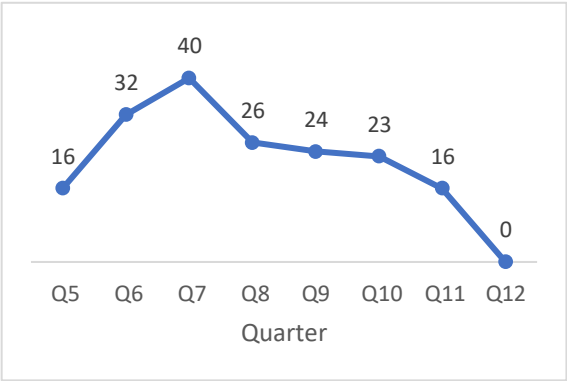


***Figure II.G.6**. Number of NMC-CPC Participants Who Received at Least One Service during the Quarter over 36-Month Evaluation Period*

4. Patient-Centered Medical Neighborhood (PCMH/N) Meetings

There were monthly PCMH/N meetings over the 36-month program evaluation (Table II.G.1). It was reported that these meetings allowed the coordination between practices to strengthen, thus promoting rapid access to treatment services. **Data highlighting month 6 – 12 (Quarter 2 – 4) PCMH/N meeting activity were unavailable.*

5. Interagency Agreements and Shared Care Plans Developed

The number of interagency agreements remained at 3 over the 36-month evaluation period (Table II.G.1). While the number of shared care plans developed began to dramatically increase by month 24 (Quarter 8), with a maximum of 16 by the end of the program evaluation (Figure II.G.7; Excluded Quarter 1-4). The low number of shared care plans over the evaluation period were due to these plans being abandoned early on due to privacy concerns. **Data highlighting month 6 – 12 (Quarter 2 – 4) interagency agreement and shared care plan activity were not available.*

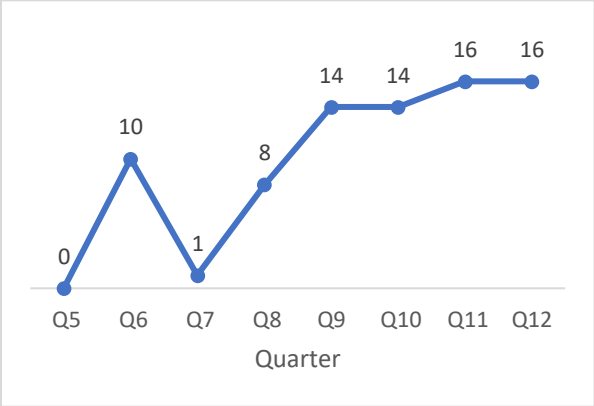


Figure II.G.7. *Number of NMC-CPC Shared Care Plans Developed over 36-Month Evaluation Period*

G. Implementation Metric Results Howard Center

Howard Center (HC) Implementation Metrics over 36-Month Evaluation Period

1. Waitlist and Medication-Assisted Treatment Services

Over a 33-month period, the Howard Center provided medication-assisted treatment to a maximum of 109 participants and eliminated their MAT waitlist by the completion of the VT-MAT PDOA Program Evaluation (Figure II.H.1 and Figure II.H.2). In an effort to keep participants engaged with the program while on the waitlist, MAT Coordinators connected waitlisted participants with community resources. It was also reported that the number of participants on MAT steadily decreased for the remainder of the 9-month reporting period (Quarter 9-11; Figure II.H.1). **Data highlighting the last 3-month (Quarter 12) waitlist and medication-assisted treatment services activity were unavailable.*

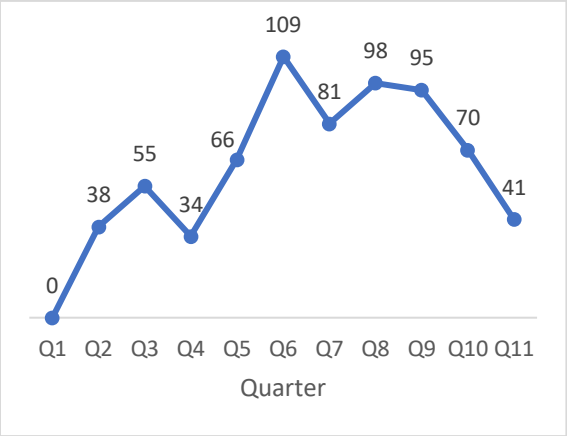


Figure II.H.1. *Number of HC Participants on MAT over 36-Month Evaluation Period*

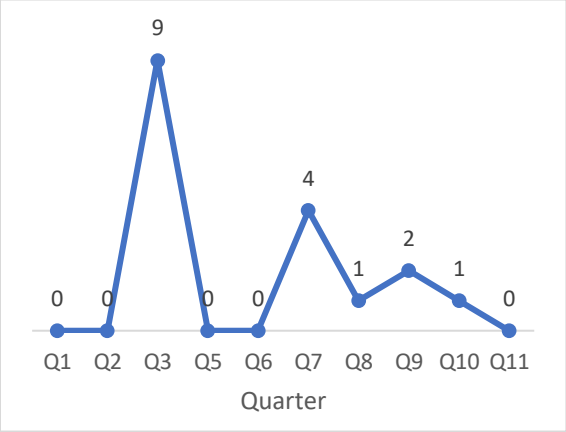


Figure II.H.2. *Number of HC Participants on a Waitlist over 36-Month Evaluation Period*

2. Peer Support and Making Recovery Easier (MRE)

The number of participants using peer supports increased over a 24-month period, but began to decrease by month 30 (Quarter 10). A maximum of 48 participants utilized 12-step or other peer support services (Figure II.H.3). Participants attending MRE also increased beginning at month 9 (Quarter 3), but declined dramatically by month 15 (Quarter 5) (Figure II.H.4; Excluded Quarter 6-11). The number of staff delivering MRE was on average 1 staff member during month 9 – month 24 (Quarter 3-8), with zero staff members delivering MRE by the end of the evaluation period (Table II.H.1). **Data highlighting the last 3-month peer support and MRE activity were unavailable.*

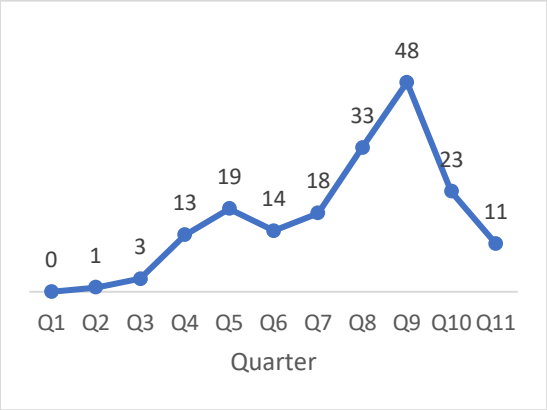


Figure II.H.3. *Number of HC Participants Using Peer Supports over 36-Month Evaluation Period*

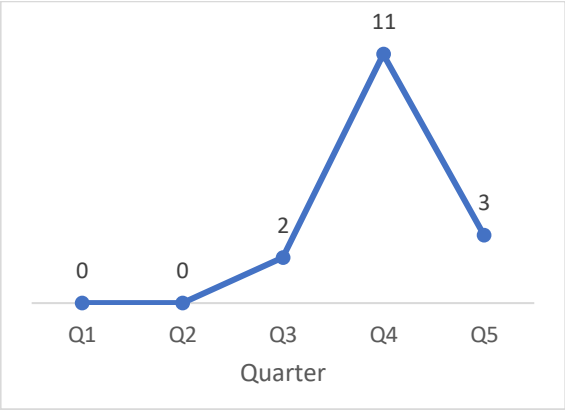


Figure II.H.4. *Number of HC Participants Attending MRE Group over 36-Month Evaluation Period*

3. Coordination to Outpatient Care and Treatment Services

The number of participants incarcerated or receiving inpatient treatment and transitioned to outpatient treatment dramatically increased by month 18 (Quarter 6), while fluctuating steadily over the remaining 15-month period (Figure II.H.5; Excluded Quarter 2, Quarter 3, Quarter 4). The Howard Center also reported a decrease in participants receiving at least one service during the quarter, beginning at month 12 (Quarter 4) and continued to decrease for the remainder of the evaluation period (Figure II.H.6; Excluded Quarter 5, Quarter 6, Quarter 11). **Data highlighting the last 3-month coordination to outpatient care and treatment service activity were unavailable.*

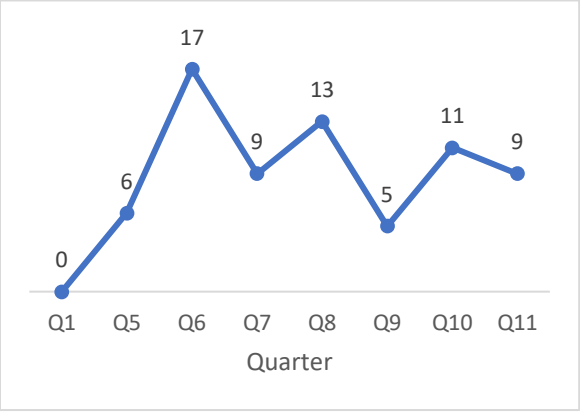


Figure II.H.5. *Number of HC Participants Incarcerated or Inpatient that Transitioned to Outpatient Treatment over 36-Month Evaluation Period*

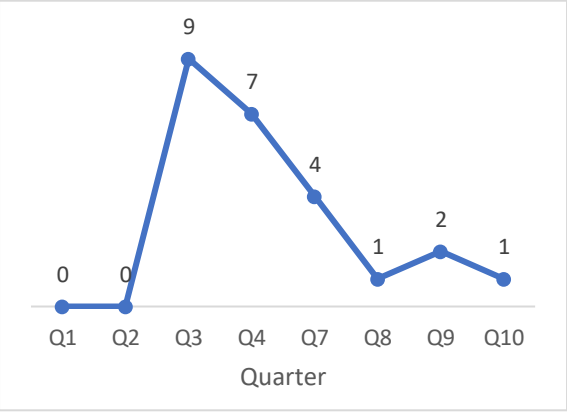


Figure II.H.6*. Number of HC Participants Who Received at Least One Service during the Quarter over 36-Month Evaluation Period*

4. Patient-Centered Medical Neighborhood (PCMH/N) Meetings

The number of PCMH/N meetings remained consistent over the 36-month program evaluation period (Table II.H.1). Similar to NMC-CPM, it was reported that these meetings allowed the coordination between practices to strengthen. **Data highlighting the last 3-month PCMH/N meeting activity were unavailable.*

5. Interagency Agreements and Shared Care Plans Developed

The number of interagency remained steady over a 21-month period, but reduced to zero for the remaining 9-month reporting period (Table II.H.1). While the number of shared care plans developed began to increase by month 18 (Quarter 6), they began to decrease by month 30 (Quarter 10) and for the remaining of the reporting period (Figure II.H.7). The low number of shared care plans over the evaluation period were due to these plans being abandoned early on due to privacy concerns. **Data highlighting the last 3-month interagency agreement and shared care plan activity were unavailable.*

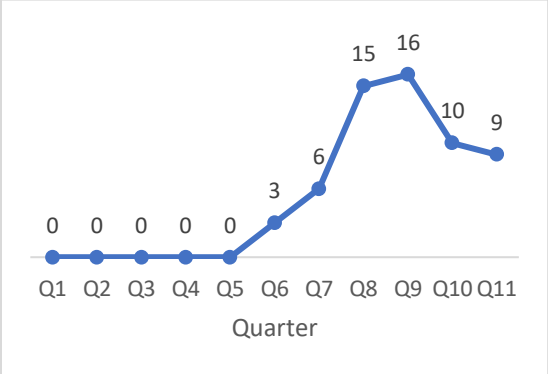


Figure II.H.7. *Number of HC Shared Care Plans Developed over 36-Month Evaluation Period*

H. Northwestern Medical Center Comprehensive Pain Clinic (NMC-CPC) Barriers & Facilitators

1. NMC-CPC Barriers

When NMC-CPC reached capacity and a waitlist was created, an assessment was made available to triage waitlist participants interested and qualifying for Vivitrol (Intramuscular naltrexone). These participants were given expedited appointments, but providers requested additional training regarding the appropriateness of prescribing Vivitrol. This additional training request along with an increased interest in Vivitrol led to an increased wait time of up to 2 weeks for an injection. NMC-CPC also reported that a lack of treatment providers and office space created a barrier for patients in need of treatment.

2. NMC-CPC Facilitators

NMC-CPC reported that participants leaving inpatient and residential programs were bridged with a MAT prescription upon discharge until their initial MAT appointment at NMC-CPC. Therefore a decrease in wait times for access to treatment once discharged from inpatient and residential treatment was observed. It was also reported that communication with the VT Department of Corrections regarding incarceration release dates was useful when coordinating intake appointments at NMC-CPC. This communication allowed for a decrease in wait times and increased access to MAT upon release. NMC-CPC also partnered with a local taxi service to create a pilot transportation program in order to address transportation issues. This allowed participants with transportation issues to attend clinic appointments and follow-up interviews.

I. Howard Center (HC) Barriers & Facilitators

1. HC Barriers

The Howard Center reported that without a waitlist, referrals to the program evaluation slowed considerably. The MAT Coordinators had to emphasize benefits such as case support and program incentives in order for recruit participants. It was also difficult for MAT Coordinators to refer to peer support workers due to participants refusing to sign a ROI for contact. Therefore MAT Coordinators utilized a “warm hand off” approach to address this barrier. It was also reported that cell phones and access to participants was a barrier throughout the evaluation, even with Q-Link as a resource used to connect participants with free cell phones. The Howard Center also reported that coordinating Vivitrol follow-up dosing was a barrier for the introduction of Vivitrol in the Chittenden County Department of Corrections and other treatment programs due to not having a referral system in place.

2. HC Facilitators

The use of travel vouchers was considered a vital resource for treatment retention because participants were able to comply with treatment requirements. The Howard Center also offered the Med-O Wheel for participants that traveled from afar, thus allowing for convenient access to MAT. The use of discretionary funds allowed for the Howard Center to hire a MAT Services Navigator, which increased the coordination of services such as: MAT treatment, housing, transportation and insurance. A MAT Integration Case Manager was also hired for additional assistance with housing and transportation services, medical management, care coordination and other basic needs.

III. Learning Collaboratives & Intervention Trainings

Learning collaboratives and empirically supported intervention trainings were offered to stakeholders at the three Vermont Patient Centered Medical Homes/Neighborhoods (PCMH/N's) regions: Burlington, Saint Albans and Rutland. The following are a list of the collaboratives and trainings offered:

A. Peer Recovery Support Services

Team-based learning among Medical Providers, Behavioral Health Clinicians, MAT Coordinators, Recovery Support Services, Law Enforcement, Policy Makers, VT Department of Children and Families, VT Department of Corrections and other stakeholders within the 3 Patient Centered Medical Homes/Neighborhood regions.

B. VT Women's Health Initiative and Opioid Use Disorder

Focused around the Vermont Women's Health Initiative and care coordination for comprehensive family planning in people seeking treatment for opioid use disorder.

C. Integrated Dual Disorder Treatment (IDDT) Training

A behavioral health training facilitated by Dr. Mary Brunette on Integrated Dual Disorder Treatment (IDDT). This training provided a general overview of IDDT and common psychiatric comorbidities. It also discussed the prevalence and consequences of tobacco use in people with substance use and/or mental illness. Lastly, the IDDT training explained the principles of motivational interviewing using several case studies.

D. Extended Release Naltrexone (Vivitrol) Training

This training provided an overview of extended release naltrexone, which included neurophysiology/pharmacology and efficacy information from Dr. Peter Friedmann from Bay State Health. Dr. Benjamin Nordstrom from the Phoenix House discussed clinical applications of extended release naltrexone and Dr. Katie Marvin from Stowe Family Practice shared how her team incorporated the medication into their practice. Lastly, Brandon Olson from ADAP discussed what the VT Department of Corrections is doing to facilitate extended release naltrexone injections upon release for those who qualify.

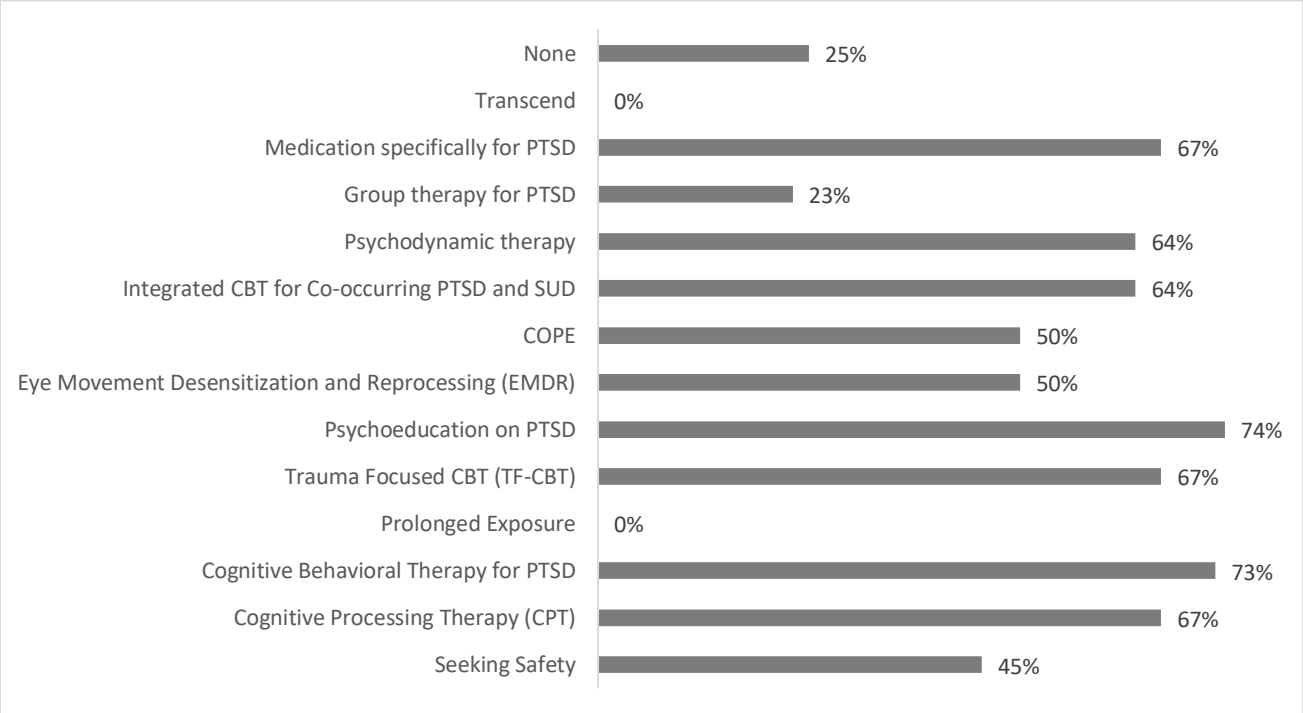
E. Cognitive Processing Therapy (CPT) Training:

Cognitive Processing Therapy (CPT) is a manualized therapy used by clinicians to help people recover from post-traumatic stress disorder (PTSD). CPT also has demonstrated efficacy for concurrent improvements in depressive symptoms. It draws from empirically-supported principles of Cognitive-Behavioral Therapy (CBT) with a focus on incorporating trauma-specific cognitive techniques to help people with PTSD more accurately appraise "stuck points" (erroneous conclusions about the traumatic event(s)) and progress towards recovery. This training presented by Dr. Sarah Craig is intended to give participants readily useable skills through a combination of presentation and hands-on learning. More specifically by providing skills such as applying cognitive theory to the development and maintenance of PTSD symptoms, Socratic questioning, enhancing clients' awareness of how beliefs contribute to/elicit emotional responding and helping clients challenge problematic patterns of thinking.

F. Seeking Safety, Cognitive Processing Therapy (CPT) and Cognitive Behavioral Therapy (CBT) Implementation

Thirty-one behavioral health therapists in Vermont MAT clinics were surveyed about current PTSD-specific interventions. Forty-five percent reported that they currently use Seeking Safety with MAT clients, while 67% currently use CPT and 64% currently use Integrated CBT for co-occurring PTSD and substance use disorder.

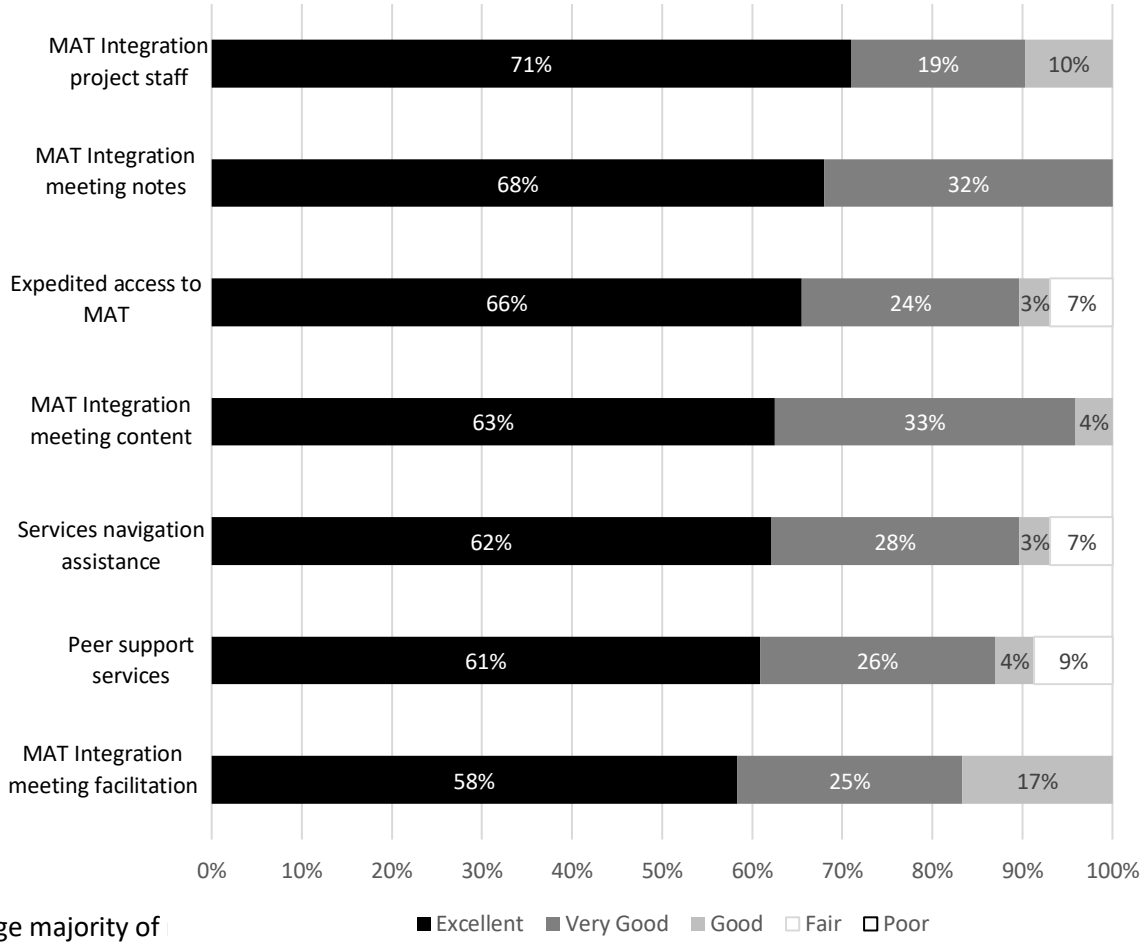
% VT MAT Behavioral Health Therapists by PTSD Specific Intervention



IV. Provider Survey Results

Provider surveys were distributed at Patient Centered Medical Neighborhood meetings in Burlington and St. Albans, and a web link was e-mailed out to meeting participants and community providers. This resulted in a convenience sample of 31 providers who answered questions about the impact of the MAT integration project. Survey respondent areas of work include: corrections, children and families, food security, housing, MAT services, peer support services, data analysis, psychotherapy, recovery coaching, employment, case management, outpatient OUD treatment and residential OUD treatment.

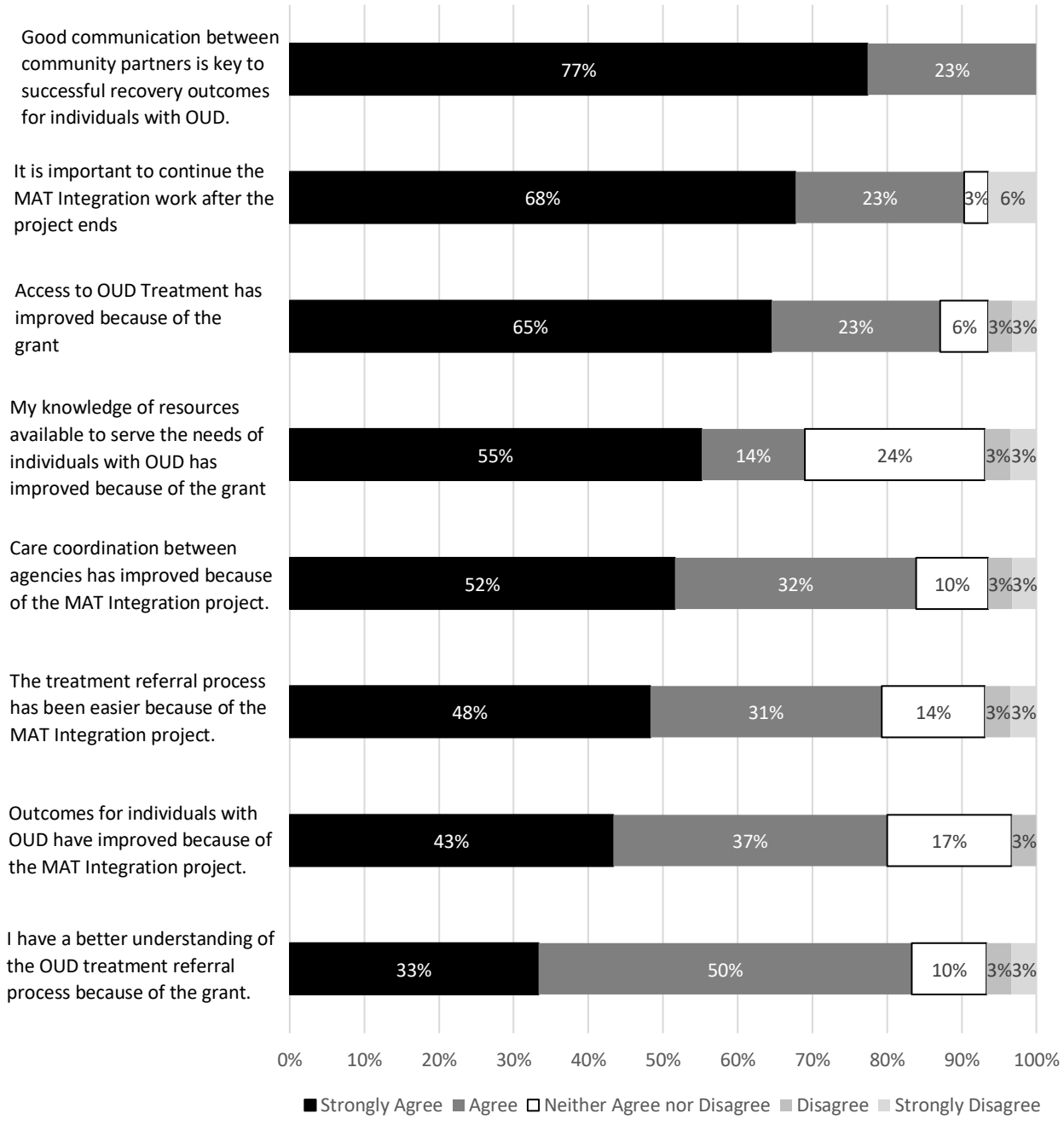
Provider Survey Respondent Ratings of Grant Staff & Activities….



A large majority of

responses to suggestions for improvement included: build supports for participants to taper off of MAT instead of staying on it for months/years, continuing the program past the end of the grant, more staff for outreach and more peer support.

Provider Survey Respondent Agreement with Statements on Access/Referral to Treatment, Communication between Community Providers and Opioid Use Disorder Treatment Outcomes….



Among providers that responded, a large majority strongly agreed or agreed with the statements, acknowledging positive grant impacts on access/referral to treatment, communication between community providers and treatment outcomes.

Providers were asked to name the top 3 most common barriers to recovery, and the following word cloud illustrates their responses. Larger words are used more frequently than smaller words in the cloud.

Providers were also asked about the 3 most common supports for recovery, and responses are displayed in the word cloud below.

Common responses across both questions include transportation and housing. Access to treatment was mentioned as an important barrier and adequate support as a common facilitator of recovery.

When asked open-ended questions about the impacts of the project, provider responses included having gained a greater awareness of *opioid addiction issues* and *community impacts*.

- "[I] understand the issues faced by people facing opioid addiction."
- "[I] have a greater appreciation for the breadth of impact opiate use has on a community."

Respondents also report a *greater knowledge of resources* and *acknowledged the benefits of the additional supports* funded by the grant.

- "I know who to contact for solutions or answers when different situations arise because of the Neighborhood Meetings. I know where to send people when they are looking to obtain MAT to help with their addiction."
- "I [now] know some of the extra supports that really make a difference to helping keep folks on track."
- "[I am] aware of many more resources and supports."
- "My knowledge of services has expanded exponentially."
- "I refer all my patients with opioid use disorder to the MAT Integration Project because they are great advocates for my clients."
- "I attribute much of the success we are having for people with OUDs in Chittenden County to the MAT Integration project. Each staff person is committed, and relentless for people with OUDs. Their selfless dedication is truly inspiring. They meet people where they are in supportive, caring and non-judgmental ways. We need more resources to adequately continue this important work in Vermont."
- "This project has been invaluable in assisting clients with particularly acute or complex needs to access long-term MAT services."
- "I think that it's a great program that has helped many people obtain recovery. The people who work on this project are caring passionate people who are great at their job. They have helped out the recovery community and those in recovery immensely. Not only by bringing people together through the Monthly Neighborhood Meetings, to help solve new and re-occurring issues, and make us all aware of each other's' programs, barriers, concerns, and needs. But also by being a non-judging, safe place for those inquiring about, and looking to recover from addiction. They are an inspiration for many."

One respondent griped, "More paperwork, thanks." and "cancel funding and redirect the money to something better."

Several respondents emphasized the *teamwork* that the project facilitated.

- "The skilled collaboration/participation of the MAT Integration Project Team has allowed VCCI to focus on other issues (in regards to time management) that likewise require support."
- "The wonderful staff at 45 Clarke Street have been a part of the collaborative effort that I have alluded to in this survey. We support one another and that makes the work so much easier."
- "I have found it helpful to put faces to names of other community providers. [MAT coordinators] have done an amazing job of coordinating meetings, keeping everyone in the loop and following

up after meetings with notes, contact info etc. It was great to have someone to coordinate with in terms of mutual clients."
- "I have a new appreciation for the level of contact that is needed for a team to be truly effective."

Work specifically for corrections-involved participants was noted when asked about day-to-day differences.

- "Ensure clients coming out of corrections have immediate access to MAT upon entrance into the community."
- "Communication resulting from the MAT Integration project has increased. DOC staff attend the Neighborhood Meetings regularly. This is no small feat because of DOC's workload, yet they find value in the information and meetings, as do many other local partners."
- "This project has helped many clients access treatment who would not otherwise, fantastic project."

In a separate survey administered online only, 27 MAT behavioral health therapists in VT anonymously completed a brief assessment of burnout, using 7 questions from the Maslach Burnout Inventory.

On questions of Emotional Exhaustion:

- 44% reported feeling emotionally drained by their work at least once per week
- 37% reported that at least once per week they feel fatigued when they wake up in the morning and have to face another day on the job
- 19% reported that at least once per week they feel that working with people all day is really a strain for them
- 37% reported feeling at least once per week that they are working too hard on the job

On a question measuring depersonalization:

- 4% (n=1) reported feeling that they treat some clients as if they were impersonal objects.

On questions measuring personal accomplishment:

- 93% reported feeling that they are positively influencing other peoples' lives through their work
- 85% reported feeling they have accomplished many worthwhile things in this job

V. Discussion

A total of 442 high-risk participants were enrolled in the VT-MAT PDOA Evaluation, including people involved with DCF, those involved with Corrections and those who were on the MAT waitlist. Over the course of the study, the wait list for MAT was eliminated in Hubs, a testament to the success of VT's Hub and Spoke system expanding access to MAT for people with OUD. Thus, the majority of the program evaluation participants were involved with DCF, Corrections or, in many cases, both DCF and Corrections. 78% of the participants were involved with at least one of these two state agencies. This program evaluation examined 20 metrics, clustered in 5 treatment goals: decrease substance use, improve behavioral health, improve physical health, improve socioeconomic status, and increase treatment engagement.

Case characteristics were presented, showing that 55% of participants were receiving care at a Hub and 45% were at a Spoke at baseline. As expected, most participants were using opioids within the past 30 days at baseline and there were high rates of other substance use, including marijuana, tobacco, and cocaine. Binge drinking, sedative use and amphetamine use was also not uncommon in those who were using opioids at baseline. Treatment needs for other conditions were also highly present. Rates of severe depression, severe anxiety, suicidal ideation and PTSD symptoms were alarmingly high. Many reported experiencing current medical problems and were not receiving care for those problems at baseline. About a third have Hepatitis C. The median income at baseline was $7,269 and 64% were living below the federal poverty line. Only a third were employed and many were unstably housed. Participants who were using at baseline and older participants had lower levels of social support, which was shown to have a significant relationship with recovery outcomes. About a third were in outpatient mental health treatment at baseline, 30-40% were prescribed buprenorphine early in treatment, and between 10-20% were prescribed methadone early in treatment.

Results show that non-prescribed opioid use, including use of non-prescribed MAT, significantly decreases for all study groups over time. Other positive findings include significant increases in employment and some decreases in binge drinking. Engagement in MAT, medical treatment and mental health treatment increased over time and engagement in peer support remained mostly steady. All groups except Burlington showed increased social support scores. Changes in mental health symptoms were variable, with DCF and the Burlington sample showing either no or less immediate improvements. Tobacco and marijuana rates remained high and the percent of people using cocaine significantly increased. There were no significant changes to the number in unstable housing, and housing continues to be problematic for participants.

Variables found to predict opioid use during months 4-7 included cocaine use, binge drinking, sedative use, screening positive for PTSD at month 6, depression, suicidal ideation, prescribed methadone and unstable housing. Participants who are less likely to be using non-prescribed opioids at follow-up are prescribed buprenorphine, have adequate social supports, and are employed at follow-up. Oddly, DCF participants who are employed at baseline are more likely to use at follow-up. Predictors of non-prescribed methadone at baseline include prescribed methadone or buprenorphine, binge drinking and PTSD. Predictors of non-prescribed buprenorphine at baseline include marijuana use, suicidal ideation, prescribed buprenorphine, and amphetamine use (St. Albans only). DCF involvement and being employed were also predictors of non-prescribed buprenorphine use. Some providers and participants

have suggested that people use non-prescribed buprenorphine to help them remain functional while attempting to hold their family life together and/or hold a job. Some have also speculated that people use non-prescribed buprenorphine when their dose is too low. In twenty-two qualitative interviews with questions specifically designed to understand non-prescribed MAT use, participants told us that the most common reason they use non-prescribed buprenorphine is to prevent withdrawal symptoms (95%), followed by to try to quit on their own (73%), when could not get drug of choice (59%), could not get into treatment (54%), and work/family obligations related (27%). Participants in Hubs were less likely to use non-prescribed buprenorphine, as well as those with poverty level incomes, and those involved with Corrections in St. Albans (Spoke). Participants in residential treatment/halfway houses were less likely to use non-prescribed buprenorphine and methadone.

Our data set included both research interview collected self-report data and urine screens, as well as data and urine screen results from participants' medical records. This data collection method allowed us to gather outcomes data on participants who did not complete follow-up interviews. Nonetheless, missing data is an inevitable part of research with human participants and so, mixed effects modeling was utilized to account for missing data and assess for co-variates (see methods section), and to examine the longitudinal relationship between key factors and opioid use outcomes. Co-variate analysis allowed us to examine whether other factors may influence the relationship between key factors and outcomes. Using these methods, we found that cocaine use does, in fact, have a significant relationship with the use of non-prescribed opioids. This is consistent with past literature and unfortunate, given the high rates of cocaine use in people with OUD. Social support was also confirmed as having a significant relationship with non-prescribed opioid use, suggesting that those with low social support may need special attention in treatment. Though our study did not do a side by side comparison between methadone treatment and buprenorphine, we did find that those receiving buprenorphine treatment had better opioid related outcomes than those not prescribed buprenorphine. Conversely, those prescribed methadone were more likely to be using non-prescribed opioids at follow-up than those not prescribed methadone. However, one should note that best practices result in patients with more severe substance use profiles being more likely to be prescribed methadone, further complicating a side by side comparison. Nonetheless, both treatment groups had significant reductions in non-prescribed opioid use, consistent with literature showing MAT to be the most efficacious treatment for OUD.

Qualitative interviews showed that participants were highly satisfied with the services and support of the MAT coordinators, as well as grateful for the stability of life made possible by the medication-assisted treatment. Of importance in the fight to reduce and eliminate deaths by overdose, over half of twenty-two participants asked specifically reported believing that they had been exposed to substances laced with Fentanyl. Difficulties with finding stable housing and transportation challenges were identified repeatedly through this evaluation.

In a survey of 27 VT MAT clinicians where we asked 7 questions from the Maslach Burnout Inventory, it seems that clinicians feel that that they are positively influencing the lives of people that they work with and feel good about their work accomplishments. However, many feel drained by their work and that they are working too hard. Collaborative team meetings, team decision making, supervision/leadership that encourages self-care and personal care practices of good sleep hygiene, meditation, yoga and exercise are some ways to address burnout in mental health clinicians. Other personal and administrative approaches are outlined in Burnout in Mental Health Services: A Review of the Problem and Its Remediation (Morse et al., 2012).

During the course of this program evaluation, we provided several learning collaboratives and trainings on empirically supported interventions for people with SUD. VT has many stakeholders invested in the prevention, treatment and recovery of people with OUD. We invite the reader to visit www.healthvermont.gov to learn more about the ongoing work that VT Department of Health Alcohol and Drug Abuse Programs is doing, as well as upcoming and past stakeholder meetings.

Summary of Actionable Items

1. These findings continue to support rapid, low barrier access to buprenorphine treatment.

2. Data supports integrated treatment approaches that target substance use disorders and mental illness simultaneously, with the same team of treatment providers. Programs can assess the level of training of their clinicians in providing integrated treatment and support their clinicians in treating the whole person by providing trainings that advance competencies in integrated dual disorder approaches.

3. Binge drinking and PTSD show some changes over time, but these changes take longer to appear than changes in opioid use. Clinicians may consider addressing binge drinking and PTSD earlier in psychotherapy, using evidence-based treatments.

4. People involved in DCF have unique challenges that may warrant special consideration, including higher levels of depression and anxiety. Participants in Burlington also continued to struggle with severe depression and anxiety. If not already doing so, clinics/clinicians may consider adding depression and anxiety screening instruments to standard practices.

5. Cocaine use continues at a high rate in study participants, and increased from baseline. Future studies may further explore the reasons why participants continue to use. Clinic clients may benefit from enhanced psychoeducation on cocaine's activation of the reward pathway and how this may leave them vulnerable to relapse. Treatment models that meet clients where they are and help them identify their own personal values and how their choices align with their goals and values may be warranted (ex: Motivational Interviewing, Acceptance and Commitment Therapy).

6. We recommend that all clinics treating people with OUD should screen or assess for PTSD. The PCL-5 is a quick and easy screening tool to administer for PTSD.

7. Heroin is a commonly used opioid that leaves people vulnerable to overdose. Our data supports the continued efforts to make rescue medications widely available.

8. There is some evidence suggesting that physical health needs of people with OUD may not be adequately addressed, though data does show some improvements in this area. Efforts to continue and increase collaboration between MAT clinicians and primary care clinicians are recommended. People with SUD can often be difficult to reach for follow-up care and so, primary care clinicians should give special consideration to those challenges when

recommending follow-up care (such as after someone tests positive for Hepatitis C). One recommendation may be to ask patients for permission to call a collateral contact for follow-up scheduling purposes, in the event that the patient can not be reached.

9. Rates of unprotected, high-risk sex supports the need for continuing efforts to educate and provide free or low-cost barrier methods of protection against infectious disease.

10. Use of tobacco remains steady for study participants. Smoking cessation options should be explored with all participants. Nicotine replacement therapy has been shown to have some benefits for people with SUD, including decreased risk for relapse on alcohol and other substances (Prochaska, Delucchi & Hall, 2004).

11. Our data supports that improving access to affordable housing for people in MAT programs should be a high priority in VT. Investment in employment services should continue.

12. Our data also suggests that services that enhance social support and therapy that builds upon social support can be highly beneficial for people in recovery.

13. Clinicians may consider talking with participants about potential barriers to attending peer support groups, including discussing ways to address potential stigma related to Opioid Substitution Treatment.

14. While this report focused on treatment needs and outcomes for people with OUD, we would also like to stress the importance of prevention of SUD in the fight against the opioid epidemic.

VI. Methods

A. Evaluation Design & AIMS

The Vermont Medication-Assisted Treatment (MAT) Prescription Drug & Opioid Addiction (PDOA) Program Evaluation is a prospective observational cohort evaluation of high-risk participants with Opioid Use Disorder (OUD), with no comparison group, that was specifically designed for Vermont policy makers and OUD treatment providers. Our first evaluation aim was to identify participant needs of people struggling with OUD to help treatment providers align their program to address these needs at treatment entry. Our second evaluation aim was to assess progress once people enter treatment and identify strong predictors of treatment outcomes, which will allow for treatment programs to identify what is working well and what may need more attention. It will also allow for treatment programs to identify areas of focus when working with clients on a specific treatment outcome. Our third evaluation aim was to assess the longitudinal relationship between select outcomes identified in AIM 2 and continued non-prescribed opioid use versus abstinence. More specifically focusing on how select factors effect non-prescribed opioid use amongst high-risk people with OUD in Vermont. In addition to our 3 evaluation aims, the VT- MAT PDOA Program Evaluation presented 5 goals: decrease non-prescribed substance use, improve behavioral and mental health, physical health and socio-economic status and increase treatment engagement amongst high-risk participants with OUD in Vermont.

5 Goals	20 Evaluation Metrics
Decrease Substance Use	• Non-Prescribed Opioid Use • Non-Prescribed Non-MAT Opioid Use • Non-Prescribed Buprenorphine Use • Non-Prescribed Methadone Use • Cocaine Use • THC Use • Tobacco Use • Binge Drinking
Improve Behavioral/Mental Health	• PTSD • Severe Depression • Severe Anxiety • ARC Social Support Score
Improve Physical Health	• High-Risk Sex
Improve Socio-Economic Status (SES)	• Unstable Housing • Employment
Increase Treatment Engagement	• Rating of Communication between Providers • Receiving Care for Existing Medical Problems • Prescribed MAT • Use of Outpatient Treatment for Mental Health • Use of Peer Supports

B. Setting

The VT-MAT PDOA Program Evaluation gathered data from 2 Hubs and 1 Spoke within 3 Vermont communities: Burlington, Saint Albans and Rutland regions. The 2 Hubs included in the program evaluation were the Howard Center Chittenden Clinic within the Burlington region and Rutland Regional's West Ridge Center within the Rutland region. The Northwestern Medical Center Comprehensive Pain Clinic within the Saint Albans region was the Spoke included in the evaluation. It is important to note that spokes throughout Vermont are by design locally-tailored to meet needs specific of each community hosting the Spoke. Thus, the Spoke model in St. Albans may differ considerably from other Spokes. From February 2016 - July 2018, 846 people were screened for program eligibility amongst three high-risk Vermont populations with OUD. These populations included those involved with the Department of Corrections, the Department of Children and Families (DCF) and people on a clinic waitlist for medication-assisted treatment. Those eligible for participation were those 18 years or older, have a history of Opioid Use Disorder (OUD) and have not received medication-assisted treatment for a maximum of 15 days prior to program evaluation intake.

C. Participant Sample & Follow-Up Procedures

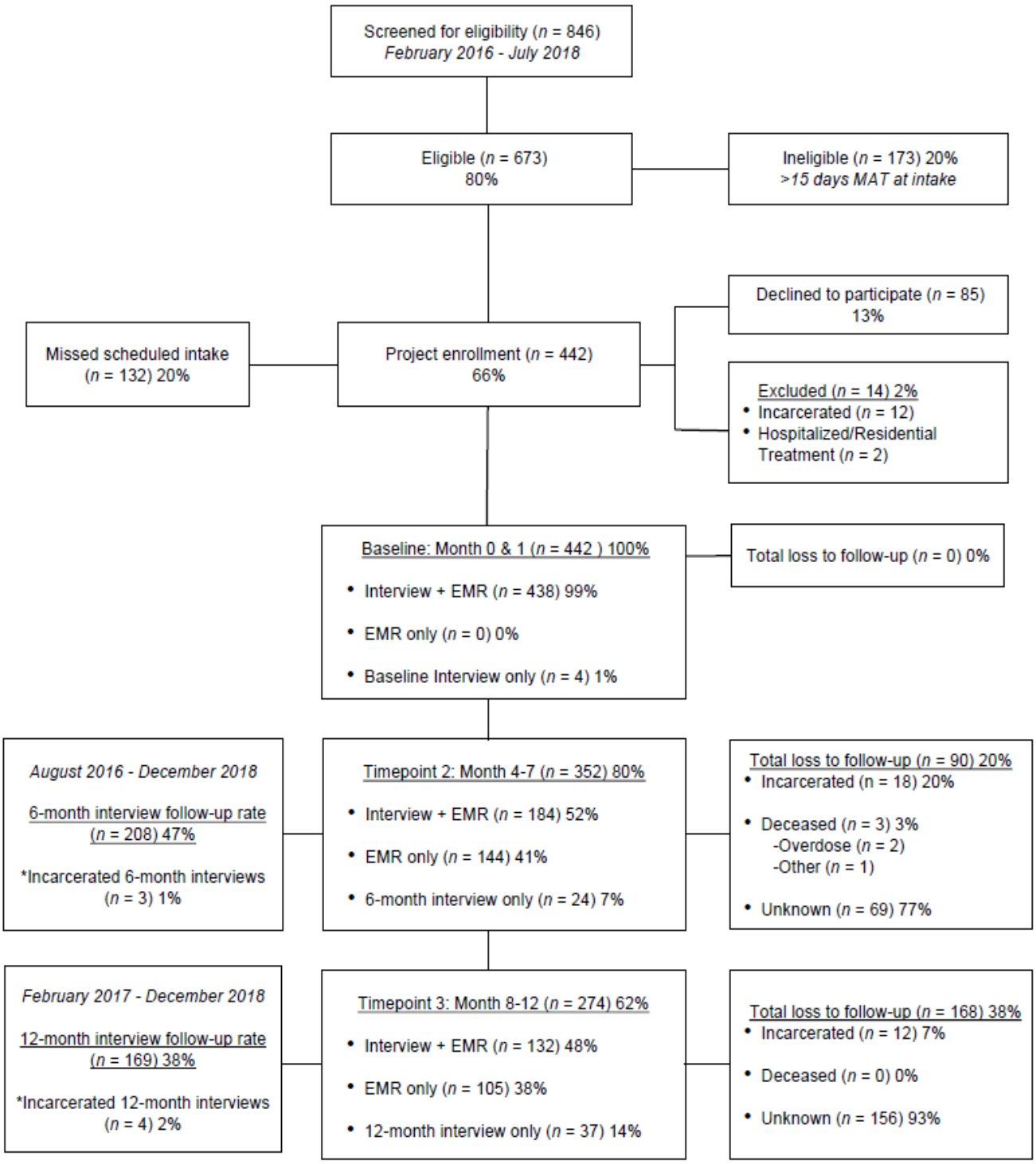
Of the 846 people screened, 673 (80%) were eligible and 442 participants (66%) were enrolled (Figure VI.1). Participants were referred by the VT Department of Corrections and VT Department of Children and Families for screening. In addition, people interested in medication-assisted treatment and placed on a waitlist were also referred for screening. Each participant completed an informed consent and a structured intake interview with a trained interviewer. Our structured interviews using evidence-based screening tools were designed to collect information such as demographic characteristics, alcohol and/or drug use history, lifestyle, medical and mental health and satisfaction with treatment. Participants were asked to return to complete a structured follow-up interview at 6 and 12-months post-intake with a similar battery of questionnaires that were used at intake (See Appendix K: *Data Collection Tools*). A follow-up window was set for each participant in order to provide flexibility in scheduling: 33 days before and 33 days after the official 6 and 12-month follow-up date. From August 2016 - December 2018, 208 participants (47%) completed a 6-month interview and from February 2017 - December 2018, 169 (38%) participants completed a 12-month interview (Figure VI.1). Twenty participants were excluded from our follow-up outcome due to interview completion outside of the designated follow-up window. Each participant was requested to complete a breathalyzer test and provide a urine sample after the completion of the intake and follow-up interviews. Urine samples were analyzed using a 13-panel CLIA waived rapid test and recorded. Participants were compensated for each follow-up completed by receiving $20 at month 6 and $30 at month 12.

D. Electronic Health Record Follow-Up Procedures

Monthly electronic health record data were also collected over the course of a 12-month post-intake period for each participant and categorized into 3 timepoints -*baseline:* month 0 & 1, *timepoint 2:* months 4-7 and *timepoint 3*: months 8-12. Electronic health record data was collected on 438 participants (99%) at *baseline*, 328 participants (74%) at *timepoint 2* and 237 participants (54%) at *timepoint 3* (Figure VI.1). Monthly electronic health record data included medication-assisted treatment services, behavioral health services and urine analyses. Loss to follow-up electronic health record data was a result of participants either receiving treatment services outside of our provider network or were considered lost to contact by our treatment providers.

Total follow-up data, which includes structured interview data and electronic health record data, was collected on 442 participants (100%) at *baseline*, 352 participants (80%) at *timepoint 2* and 274 participants (62%) at *timepoint 3* (Figure VI.1).

Figure VI.1. Overview of Participant Sample & Follow-up



E. Outcome Measures

Goal 1: Decrease Substance Abuse

Non-prescribed substance use is measured using a combination of EMR urine screen data, self-reported data using the SAMHSA CSAT GPRA survey tool, ASSIST tool and Research Assistant administered urine screens given at intake, 6-month and 12-month follow-up. We separated opioid use into 4 categories: Non-prescribed opioid use, non-prescribed opioid use (excluding MAT), non-prescribed buprenorphine use and non-prescribed methadone use. Opioid, cocaine and THC use measures include 3 time points: timepoint 1 (30 days prior to intake to 30 days after intake), timepoint 2 (months 4-7) and timepoint 3 (months 8-13). Tobacco use and binge drinking are self-reported only and measured at baseline, 6-month and 12-month interviews.

Non-Prescribed Opioid Use

Non-prescribed opioid use is a dichotomous (Yes/No) measure of whether participants used any opioids, which include: buprenorphine, methadone, oxycodone, hydrocodone, morphine, propoxyphene (Darvon), codeine, Tylenol 2,3,4, Dilaudid (hydromorphone), Demerol, heroin and fentanyl. A negative result is derived from EMR and urine screen negatives, while positives are derived from those sources plus self-reports of non-prescribed use.

Non-Prescribed Opioid Use (excluding MAT)

Non-prescribed non-MAT opioid use is a dichotomous (Yes/No) measure of whether participants used non-MAT opioids, which include: oxycodone, hydrocodone, morphine, propoxyphene (Darvon), codeine, Tylenol 2,3,4, Dilaudid (hydromorphone), Demerol, heroin and fentanyl. A negative result is derived from EMR and urine screen negatives, while positives are derived from those sources plus self-reports of non-prescribed use.

Non-Prescribed Buprenorphine Use

Non-prescribed buprenorphine use is a dichotomous (Yes/No) measure of whether participants used buprenorphine without a prescription. A negative result is derived from EMR and urine screen negatives, while positives are derived from those sources plus self-reports of non-prescribed use.

Non-Prescribed Methadone Use

Non-prescribed methadone use is a dichotomous (Yes/No) measure of whether participants used methadone without a prescription. A negative result is derived from EMR and urine screen negatives, while positives are derived from those sources plus self-reports of non-prescribed use.

Cocaine and THC Use

Cocaine and THC use are both dichotomous (Yes/No) measures of whether participants used either cocaine or THC. A negative result is derived from EMR and urine screen negatives, while positives are derived from those sources plus self-reports of non-prescribed use.

Tobacco Use

Tobacco use is a dichotomous (Yes/No) measure of prior 90-day tobacco use which includes 3 times points: 1) baseline 2) 6 months and 3) 12 months. It is self-reported only for both negatives and positives.

Binge Drinking

Binge drinking is a dichotomous (Yes/No) measure of whether participants participated in binge drinking in the past 30 days using the self-report SAMHSA CSAT GPRA survey tool and includes 3 times points: 1) baseline 2) 6 months and 3) 12 months. Binge drinking was defined as 5 or more drinks in one sitting for men and 4 or more drinks and felt intoxicated or 5 drinks in one sitting for women. It is self-reported only for both negatives and positives.

Goal 2: Improve Behavioral and Mental Health

Post-Traumatic Stress Disorder (PTSD)

PTSD is a dichotomous (Yes/No) measure of whether participants screened positive for PTSD in the past 30 days using the 20-item self-report PCL-5 measurement tool and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months. A threshold of 33 or above was considered a positive screen for PTSD.

Severe Depression

Severe depression measures the continuous number of days of whether participants experienced severe depression in the past 30 days using the self-report SAMHSA CSAT GPRA tool and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months.

Severe Anxiety

Severe anxiety measures the continuous number of days of whether participants experienced severe anxiety in the past 30 days using the self-report SAMHSA CSAT GPRA tool and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months.

ARC Social Support Score

The ARC social support score measure is an ordinal score (0-5) derived from the social support domain of the self-report Assessment of Recovery Capital Tool and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months. One point is added to the ARC social support score for every "yes" response and is constructed upon the following:

1. "I am happy with my personal life"
2. "I am satisfied with my involvement with my family"
3. "I get lots of support from friends"
4. "I get the emotional help and support I need from my family"
5. "I have a special person that I can share my joys and sorrows with"

Goal 3: Improve Physical Health

Engaging in High-Risk Sex

Engaging in high-risk sex is a dichotomous (Yes/No) measure of whether participants have participated in high-risk sex during the past 30 days using the self-report HIV Risk Tool and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months. High-risk sex was defined as either having unprotected sex with a casual partner, an IV drug user participating in unprotected sex or having unprotected sex with main partner while suspecting main partner is having sex with someone else.

Goal 4: Improve Socio-Economic Status

Unstable Housing

Unstable housing is a dichotomous (Yes/No) measure of whether participants had stable housing in the past 30 days using the self-report SAMHSA CSAT GPRA tool and includes three time points: 1) baseline 2) 6 months and 3) 12 months. Unstable housing was defined as living in a shelter, on the street/outdoors or living in someone else's apartment, room or house for most of the time during the past 30 days. We excluded participants who were 18-24 years old due to the likelihood that living with someone else may be their parents and not represent unstable housing. Stable housing is defined as owning or renting an apartment, room or house or residing within an institution, halfway-house or residential treatment setting in the past 30 days.

Employment (Part-Time or Full-Time)

Employment is a dichotomous (Yes/No) measure of whether participants were employed in the past 30 days using the self-report SAMHSA CSAT GPRA tool and includes three time points: 1) baseline 2) 6 months and 3) 12 months. Unemployment was defined as looking for work, not looking for work or participating in volunteer work. Employment was defined as either being employed full-time (35+ hours per week) or part-time. Participants either disabled or retired were excluded.

Goal 5: Increase Treatment Engagement

Rating of Communication between Providers

Rating of communication between providers is a self-reported measure of how well participants felt their current providers have communicated with each other about their care in the past 30 days using the self-report Recent Services Survey and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months. This measure categorized the 5-point Likert scale responses into three categories:

- Excellent to Very Good Communication
- Good Communication
- Fair to Poor Communication

Receiving Care for Existing Medical Problems

Receiving care for existing medical problems is a dichotomous (Yes/No) measure of whether participants have received care for current medical problems using the self-report Dartmouth Recent Services Survey and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months. Participants who did not report current medical problems were excluded.

Prescribed Buprenorphine or Methadone

Prescribed buprenorphine or methadone a dichotomous (Yes/No) measure of whether Participants used prescribed buprenorphine or methadone in the past 30 days using the combination of EMR chart review data, EMR urine screen data, self-reported data using the Dartmouth Recent Services survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. The 3 time points include: 1) 30 days prior to intake date to 30 days after intake date, 2) months 4-7 and 3) months 8-13.

Use of Outpatient Treatment for Mental Health

Use of outpatient treatment for mental health is a categorical variable that includes ‘no visits’, visits but less than 4 in any single month in the time-period, and 4+ in any single month during the time-period. For pre-post comparisons, a dichotomous outpatient (Yes/No) measure was used. Sources for the measure are EMR chart review data and self-reported data using the SAMHSA CSAT GPRA tool and includes 3 time points: 1) 30 days prior to intake date 2) months 4-7 and 3) months 8-12.

Use of Peer Supports

Use of peer supports is a dichotomous (Yes/No) measure of whether participants utilized peer support in the past 30 days using the self-report SAMHSA CSAT GPRA and includes 3 time points: 1) baseline 2) 6 months and 3) 12 months.

F. Data Quality Assessment & Mitigation

1. Efforts to Minimize Missing Data

Missing data reports were run for each data collection tool used throughout the evaluation in order to monitor missing data activity. These reports allowed us to minimize missing data due to data entry errors. Each data collection tool was paper sourced, therefore data recorded on paper was used as a resource for missing data highlighted from these reports.

2. Outcome Logic Model and Cross-Reference

An outcome logic model was created to identify any inconsistencies within our analytic file. The logic model was structured using interview questions from our data collection tools that cross-reference one another (Table VI.F.1). If responses were not similar in nature amongst cross-referencing interview questions they were flagged for further investigation. For example if numerical outcomes differed amongst cross-referencing questions (i.e. number of days or number of times) the largest numerical outcome was chosen. Similarly, if cross-referencing interview questions differed amongst yes/no responses, these would be corrected using the cross-reference response outcome logic model (Table VI.F.2).

3. SAMHSA's Performance Accountability and Reporting System (SPARS) vs. REDCap Reports

Data collected using the SAMHSA CSAT GPRA survey tool was entered twice, and stored in two separate systems: the SAMHSA's Performance Accountability and Reporting System (SPARS) and REDCap. In order to monitor data quality, regular reports comparing the two systems were run flagging data discrepancies. Outcome data collected using the SAMHSA CSAT GPRA survey tool were recorded on paper and therefore used to cross-reference and correct any flagged data discrepancies between SPARS and REDCap.

4. Categorization of Open-Ended Responses

Open-ended text responses were categorized in order to be accurately captured in our data analyses. This method also allowed us to narrow the wide array of responses pertaining to supports, medications and providers. More specifically, we categorized medications and providers by drug class and treatment type respectively.

5. Range Checks

Range checks were conducted on numerical responses, which was a crucial effort in emphasizing values that were not within a 30-day period (i.e. 31+ days). It also increased the accuracy of our numerical responses by highlighted any data entry errors

G. Statistical Methods

Evaluation AIM 1

Descriptive statistics are used to describe participant characteristics at baseline and include counts, proportions (displayed as percents), means and medians, for all participants and where differences exist by participant sub-groups. The types of visuals used in AIM 1 and throughout the paper include line plots, vertical and horizontal bar graphs, tree-maps, pie charts, word clouds and a scatter plot.

Evaluation AIM 2, Part 1

Participants' unadjusted progress towards evaluation outcomes is assessed in two ways. First, study outcome proportions (displayed as %s) are displayed in line graphs at three sequential timepoints for all participants and subgroups. Baseline timepoints in these visuals include all participants regardless of participation in follow-up timepoints. Percents for all participants and notable subgroups differences are then narratively summarized.

The second is performing paired tests comparing baseline to month 6 and baseline to month 12, and including solely participants who are not lost to follow-up for that timepoint. Two types of paired tests are used, one for dichotomous measures and one for continuous. The test used for binary (yes/no) pre and post timepoint measure comparisons is McNemar's chi-square test, which uses 2x2 tables to assess if marginal proportions differ significantly, to determine if there is a significant change with 95% confidence. The second test is the paired t-test which measures whether the difference in the means/averages of two timepoints can be explained by random variation or is significantly different with 95% confidence.

Evaluation AIM 2, Part 2

Logistic regression models used to identify predictors of continued non-prescribed opioid use vs. abstinence were built using a series of 10 steps as follows:

- STEP 1: Create a list of factors that have a relationship to non-prescribed opioid use in prior peer-reviewed studies. Determine which factors are tracked by the MAT-I study and order the factors by the strength of the evidence of the relationship in the literature.

For all participants in the study cohort, and then for each sub-group:

- STEP 2: Perform bivariate tests of each literature-identified factor at timepoint 1 and timepoint 2 to the four dichotomous non-prescribed opioid use outcomes:

    - non-prescribed opioid use all types during months 4-7
    - non-prescribed opioid use (excluding MAT) during months 4-7
    - non-prescribed buprenorphine during months 0-1
    - non-prescribed methadone during months 0-1

  Bivariate tests include Pearson's chi-squared test, Wilcoxon rank-sun and ANOVA. Eliminate factors from the list with $p>0.15$ relationship.
- STEP 3: With the culled list, review correlations between baseline predictors for collinearity, and in cases of collinearity, remove all except for the factor with the strongest bivariate relationship to the outcome. To facilitate simplicity of interpretation, dichotomize ordinal variables based on the strongest bivariate relationship to the outcome.
- STEP 4: Using a strength of evidence driven hierarchical order, run nested likelihood ratio tests for baseline predictors, removing factors with $p>.10$.
- STEP 5: Repeat STEP 3 and 4 for 6-month predictors.
- STEP 6: Merge baseline and 6-month models, and review collinearity again, removing variables based on strength of bivariate association to the outcome.
- STEP 7: Using a strength of evidence hierarchical order, run final nested likelihood ratio tests to determine which factors to remove.
- STEP 8: Identify the final most parsimonious model.
- STEP 9: Create an Area Under the Receiver Operating Characteristics curve (ROC) curve.
- STEP 10: Run post-hoc tests including Hosmer-Lemeshow goodness-of-fit tests and collinearity tests (VIF, Eigenval and Condition Index).

Models were run if the number of "events" or the smaller side of the proportion was at least 30 people. It is important to note that the models do not include non-prescribed opioid factors, as these factors have nearly shared meaning with the outcomes, such as heroin use at baseline or 6 months to opioid use (excluding MAT), or opioid use at timepoint 1 as a predictor of non-prescribed opioid use at timepoint 2. This is intentional to uncover factors other than non-prescribed opioid factors that influence continued non-prescribed opioid use vs. abstinence.

Evaluation AIM 3

Main and Interaction Effects of Mixed Modeling with a Binomial Distribution

Each of our models tested the main effects of a predictor and time and the interaction between them on non-prescribed opioid use outcomes. General Linear mixed model – accessing the GLIMMIX feature in SAS – was used to analyze all AIM 3 binomial distribution models. Mixed modeling allowed for the visualization of fixed and random effects in our models, accounting for the repeated timepoint measures clustered within subjects.

Because of the binomial nature of the data, we included logit link in our code in order to retrieve LS-Means – rather than normal means – as LS-means are constructed on the linked scale, such that the least square means are predicted population margins of the logits. Interaction plots were then requested using LS-means for each of the models in order to visual the odds between groups at each time and between times for each group.

Requesting Simple Comparisons (post-hoc)

Since we were interested in the interaction of our predictor with time in each of the models, we used the SLICEDIFF option in GLIMMIX in order to request simple comparisons of predictor*time sliced by time (odds differences between the groups at each timepoint) and, separately, sliced by the predictor (odds differences between timepoints for each group). Due to the increased familywise error rate inherent in multiple comparison procedures, we adjusted for the increased Type-I error using Bonferroni. Bonferroni was chosen for its conservative adjustment and its improved power over the conservative Sidak adjustment when there are not an overwhelming number of comparisons to be calculated.

Including Covariates

We ran each model three times, the first an unadjusted model with no covariates, the second adjusting for level of care at baseline (hub vs. spoke) and the third adjusting for all covariates with a theoretical basis in the literature and a relationship with the predictor and outcome variables.

The second model included only hub_vs_spoke in order to assess for of the influence of hub_vs_spoke on the relationship between the predictor and outcome variables. Originally we considered clustering individuals within hub or spoke based on recruitment site, but it is advisable to include such variables as covariates rather than levels when only two options (e.g, hub vs. spoke) are available. This is because of the estimation issues in error variance.

The final model included adjusting for all possible covariates and hub_vs_spoke. Where covariates influenced or changed main or interaction effects, each covariate was parsed out separately and the model was re-run with one covariate at a time to assess for individual effects on the relationship between predictors and model outcomes. When it was unclear which covariates were influencing the

relationship between a predictor and outcome, the model was rerun several times, adjusting with multiple variations of covariates to assess covariate effects.

Covariate Selection

Theoretically-driven statistical techniques were used to make conservative decisions about covariate inclusion. Because of the messy nature inherent in naturalistic studies, it is not uncommon for numerous baseline variables to be related to the predictor and outcome variables. However, parsimony is equally essential in making balanced decisions around covariate selection. Hence, multiple techniques were used for covariate selection using SAS, STATA and SPSS. The process included the following:

- Review of previous literature on the relationship between predictors and outcomes;
- Pearson correlations in STATA;
- Fisher's Exact test in SPSS;
- Robust analyses to account for outcomes beyond our one sample, including Monte Carlo and Bootstrapping approaches in SAS and SPSS.

VII. Limitations

The evaluation uses a prospective observational cohort design with no randomization or comparison group. Thus, its conclusions on program impact are limited in inference beyond future clients at the settings and agencies under study. The results should be considered hypotheses-generating with the goal of making actionable recommendations to local policy-makers and program managers. Some potential sources of systematic error impacting generalizability:

- Type 1 error due to the number of tests run
- Selection bias due to differences between people choosing or refusing participation in the study
- Attrition bias due to differences in people who are lost to follow-up versus those that continue (see page 156. for a chart comparing baseline differences for those who are lost to follow-up)
- Information bias due to data entry errors (see data quality section on page 83. for steps taken to mitigate) or variable transformation errors due to the large number of metrics (over 5,000 metrics were culled and combined to
- Confounding due to the possibility of unmeasured factors existing that may influence study outcomes (for example historical length of time using non-prescribed opioids was not measured)
- Participant recall bias for past 30-day events at baseline or follow-up interviews

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Appendix A: Evaluation AIM 1: Descriptive Tables of VT-MAT PDOA Program Evaluation Cohorts at Baseline, Month 6 and Month 12[5]

Table 1. Demographic and Socioeconomic Characteristics of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Burlington: Howard Center	St. Albans: NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Female (vs. male)	31%	47%	36%	38%	36%
Age Group					
18-24	13%	14%	9%	14%	12%
25-34	52%	54%	50%	51%	49%
35-44	27%	28%	27%	27%	27%
45+	8%	5%	14%	8%	11%
Has Children	75%	99%	76%	81%	77%
White	96%	97%	95%	97%	97%
Native American	22%	21%	21%	29%	24%
Family/Someone Close in Military	35%	41%	34%	45%	38%
Level of Education					
Less than 12th Grade	30%	33%	28%	36%	31%
High School Diploma	52%	51%	49%	48%	49%
Some College	14%	12%	15%	12%	14%
BA/BS or Higher	4%	4%	8%	5%	7%
Poverty Income <=$12,140					
Baseline	67%	62%	66%	61%	64%
Month 6	51%	54%	58%	46%	50%
Month 12	51%	55%	59%	46%	51%
Receiving $ Public Assistance					
Baseline	33%	42%	34%	42%	38%
Month 6	44%	58%	45%	49%	46%
Month 12	42%	42%	51%	33%	41%
Receiving $ Disability					
Baseline	11%	11%	16%	14%	15%
Month 6	17%	13%	22%	17%	19%
Month 12	14%	15%	22%	17%	19%
Employed					
Baseline	32%	33%	31%	40%	37%
Month 6	68%	57%	59%	70%	67%
Month 12	69%	58%	53%	79%	69%
Study Exit	67%	58%	53%	76%	67%
Unstable Housing					
Baseline	32%	43%	32%	36%	34%
Month 6	35%	37%	37%	31%	32%
Month 12	35%	36%	38%	28%	33%
Study Exit	34%	35%	35%	31%	32%
Involved with Corrections	100%	64%	69%	58%	65%
Involved with DCF	34%	100%	33%	37%	34%
Burlington	45%	41%	100%	0%	42%
St. Albans	39%	48%	0%	100%	44%
Rutland	16%	11%	0%	0%	14%
Federal Fiscal Year Enrolled					
2016	22%	25%	22%	15%	21%
2017	57%	58%	56%	52%	55%
2018	20%	18%	22%	33%	24%
1+ Non-Prescribed Opioid Follow-Up Time Point Post-Baseline	80%	83%	87%	85%	80%

[5] Metrics with a yellow highlight indicate a characteristic that is designated as one of the 20 key VT MAT-PDOA Program Evaluation metrics. Note that baseline and different time points are often not the same groups of participants due to loss to follow-up. Study exit is last post baseline time point collected.

Table 2. Non-Prescribed Opioid Substance Use of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Past 30-Day Non-Prescribed Opioid Use All					
Month 0-1	84%	92%	86%	93%	89%
Months 4-7	42%	46%	45%	37%	42%
Months 8-12	39%	38%	43%	35%	40%
Study Exit	29%	31%	33%	24%	29%
Past 30-Day Non-Prescribed Opioid Use (excluding MAT)					
Month 0-1	49%	53%	57%	44%	52%
Months 4-7	34%	33%	36%	29%	34%
Months 8-12	32%	29%	35%	30%	34%
Study Exit	24%	23%	25%	21%	24%
Past 30-Day Non-Prescribed Buprenorphine Use					
Month 0-1	67%	75%	63%	82%	70%
Months 4-7	16%	18%	15%	14%	15%
Months 8-12	10%	11%	13%	8%	10%
Past 30-day Non-Prescribed Methadone Use					
Month 0-1	10%	14%	17%	7%	11%
Months 4-7	4%	4%	5%	1%	3%
Months 8-12	3%	4%	4%	1%	3%
Past 30-Day Non-Prescribed MAT					
Month 0-1	68%	78%	69%	82%	73%
Months 4-7	18%	19%	15%	15%	15%
Months 8-12	10%	13%	13%	8%	11%
Past 30-Day Non-Prescribed Prescription Opioids (Oxy and Darvon)					
Month 0-1	9%	11%	7%	18%	12%
Months 4-7	16%	16%	13%	19%	18%
Months 8-12	14%	15%	12%	20%	18%
Past 30-Day Heroin Use					
Baseline	37%	38%	46%	22%	37%
Month 6	15%	12%	15%	9%	13%
Month 12	12%	9%	16%	5%	11%
Study Exit	13%	10%	14%	7%	11%

Table 3. Substance Use of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Past 30-Day Binge Drinking[6]					
Baseline	17%	15%	18%	14%	17%
Month 6	12%	11%	14%	10%	12%
Month 12	8%	3%	7%	7%	7%
Study Exit	9%	4%	8%	7%	8%
Past 30-Day THC					
Month 0-1	58%	67%	60%	62%	61%
Months 4-7	52%	58%	55%	57%	56%
Months 8-12	57%	56%	58%	58%	58%
Study Exit	51%	53%	55%	54%	54%
Past 30-Day Tobacco					
Baseline	89%	96%	85%	91%	90%
Month 6	93%	94%	91%	96%	93%
Month 12	92%	93%	86%	92%	90%
Study Exit	91%	92%	88%	94%	90%
Past 30-Day Cocaine					
Month 0-1	40%	39%	51%	27%	39%
Months 4-7	54%	49%	61%	36%	50%
Months 8-12	59%	52%	66%	38%	54%
Study Exit	46%	45%	51%	31%	42%
Past 30-Day Sedatives					
Month 0-1	15%	17%	17%	16%	18%
Months 4-7	9%	6%	10%	8%	9%
Months 8-12	7%	12%	13%	2%	8%
Study Exit	4%	6%	7%	2%	4%
Past 30-Day Amphetamines					
Month 0-1	12%	13%	8%	14%	11%
Months 4-7	11%	10%	11%	8%	9%
Months 8-12	5%	0%	9%	3%	5%
Study Exit	6%	2%	10%	3%	6%
Past 30-Day Injected Drugs					
Baseline	32%	30%	45%	14%	31%
Month 6	16%	19%	21%	7%	14%
Month 12	13%	10%	19%	7%	13%
Study Exit	14%	14%	20%	6%	12%

[6] Binge drinking is defined as 4+ drinks in a sitting and felt high or 5+ drinks in a sitting for women, and 5+ drinks in a sitting for men.

Table 4. Mental/Behavioral Health Characteristics of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Past 30-Day Level of Severe Depression 14+ Days					
Baseline	33%	38%	35%	34%	34%
Month 6	28%	35%	33%	25%	28%
Month 12	25%	26%	31%	22%	26%
Study Exit	26%	32%	30%	22%	26%
Past 30-Day Suicidal Thoughts					
Baseline	19%	25%	21%	19%	20%
Month 6	15%	22%	21%	12%	17%
Month 12	5%	10%	10%	6%	7%
Study Exit	10%	18%	16%	8%	13%
Past 30-Day Level of Severe Anxiety 5+Days					
Baseline	65%	69%	68%	63%	65%
Month 6	54%	60%	57%	57%	55%
Month 12	50%	51%	62%	45%	52%
Study Exit	49%	59%	59%	48%	52%
PCL-5 Score Indicates PTSD					
Baseline	38%	44%	40%	38%	39%
Month 6	30%	40%	40%	32%	35%
Month 12	25%	25%	30%	22%	26%
Study Exit	30%	35%	38%	26%	32%
Lifetime Trauma					
Physical Assault	69%	70%	71%	63%	66%
Weapon Assault	43%	40%	45%	32%	39%
Sexual Assault	31%	39%	34%	31%	32%
Other Uncomfortable Sexual Experience	31%	39%	34%	31%	32%
Captivity	9%	12%	11%	6%	9%
Fire or Explosion	16%	21%	18%	16%	18%
Accident	66%	65%	65%	66%	64%
Past 30-Day Psychological/Emotional Symptoms					
Baseline	40%	44%	42%	42%	42%
Month 6	38%	40%	42%	38%	39%
Month 12	25%	26%	27%	28%	27%
Study Exit	29%	31%	32%	30%	31%
MMS Score: High Likelihood of Mental Illness					
Baseline	52%	63%	58%	50%	53%
Month 6	57%	58%	67%	51%	56%
Month 12	42%	41%	46%	38%	41%
Study Exit	48%	48%	54%	40%	46%
Past 30-Day Satisfaction Personal Relationships					
Baseline	75%	70%	71%	80%	77%
Month 6	91%	83%	86%	92%	90%
Month 12	83%	85%	81%	85%	83%
Study Exit	86%	85%	84%	88%	86%

Table 5. Recovery Capital Domain Scores of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Substance Use & Sobriety					
Baseline	2.5	2.4	2.3	2.6	2.4
Month 6	3.4	3.2	3.3	3.6	3.4
Month 12	3.5	3.7	3.3	3.9	3.6
Global Psychological Health					
Baseline	3.6	3.3	3.4	3.6	3.5
Month 6	3.9	3.6	3.8	4.0	3.9
Month 12	4.1	4.0	3.9	4.1	4.1
Global Physical Health					
Baseline	2.9	2.8	2.8	2.9	2.8
Month 6	3.5	3.0	3.0	3.4	3.3
Month 12	3.7	3.4	3.4	3.5	3.5
Citizenship & Community Involvement					
Baseline	2.9	2.7	2.8	2.8	2.8
Month 6	3.5	3.2	3.5	3.5	3.5
Month 12	3.7	3.4	3.6	3.4	3.5
Social Support					
Baseline	3.0	2.9	3.0	3.1	3.0
Month 6	3.5	3.2	3.3	3.7	3.4
Month 12	3.8	3.7	3.5	4.0	3.8
Meaningful Activities					
Baseline	2.9	2.7	2.8	2.8	2.8
Month 6	3.5	3.2	3.3	3.5	3.4
Month 12	3.7	3.7	3.5	3.6	3.5
Risk-Taking					
Baseline	3.2	3.2	3.0	3.4	3.2
Month 6	3.6	3.3	3.6	3.6	3.6
Month 12	3.7	3.7	3.5	3.7	3.6
Coping & Life Functioning					
Baseline	2.8	2.6	2.7	2.8	2.8
Month 6	3.5	3.2	3.3	3.6	3.5
Month 12	3.7	3.6	3.6	3.6	3.6
Recovery Experience					
Baseline	4.0	3.9	3.8	4.0	3.9
Month 6	4.3	4.2	4.1	4.5	4.3
Month 12	4.4	4.3	4.2	4.5	4.4

Table 6. Treatment Utilization: Non-Medication of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Past 30-Day Emergency Room Visit					
Baseline	12%	19%	13%	13%	14%
Month 6	14%	21%	16%	14%	15%
Month 12	14%	19%	16%	16%	16%
Study Exit	14%	19%	16%	16%	16%
Past 30-Day Inpatient Stay					
Baseline	16%	13%	16%	8%	14%
Month 6	5%	7%	8%	2%	5%
Month 12	6%	7%	7%	4%	5%
Study Exit	6%	7%	6%	4%	5%
Outpatient Mental 4+/Any Month					
Month 0-1	17%	23%	13%	29%	21%
Months 4-7	47%	52%	60%	39%	49%
Months 8-12	42%	42%	48%	37%	42%
Study Exit	21%	17%	18%	14%	18%
Past 30-Day Outpatient Physical Visit					
Baseline	11%	14%	11%	15%	13%
Month 6	19%	23%	16%	28%	23%
Month 12	14%	15%	12%	18%	15%
Study Exit	17%	19%	13%	24%	19%
Past 30-Day Care for Medical Problems					
Baseline	54%	52%	58%	52%	54%
Month 6	66%	63%	65%	84%	74%
Month 12	76%	81%	80%	75%	77%
Study Exit	75%	77%	81%	76%	77%
Past 30-Day Attended 12-Step/Other Peer Support Group					
Baseline	47%	41%	43%	34%	41%
Month 6	44%	36%	49%	31%	40%
Month 12	42%	37%	41%	30%	37%
Study Exit	42%	35%	46%	27%	38%
Past 30-Day Sober Living Facility or Residential Program					
Baseline	27%	17%	27%	14%	21%
Month 6	15%	10%	13%	9%	11%
Month 12	7%	6%	12%	2%	6%
Study Exit	12%	9%	14%	6%	9%
Past 30-Day Rating of Providers' Communication: 'Fair to Poor'					
Baseline	35%	32%	36%	30%	32%
Month 6	23%	22%	32%	21%	24%
Month 12	26%	21%	31%	22%	25%
Study Exit	25%	24%	32%	22%	25%
Client Satisfaction Score (CSQ-8)					
Month 12	29.0	29.0	29.1	28.8	29.0

Table 7. Treatment Utilization: Prescribed Meds of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Past 30-Day MAT					
Month 0-1	50%	44%	69%	27%	47%
Months 4-7	84%	88%	88%	87%	87%
Months 8-12	86%	91%	89%	87%	88%
Study Exit	78%	84%	82%	83%	82%
Past 30-Day Buprenorphine					
Month 0-1	38%	34%	51%	25%	37%
Months 4-7	64%	68%	58%	81%	68%
Months 8-12	67%	73%	57%	79%	69%
Study Exit	62%	65%	56%	77%	65%
Past 30-Day Methadone					
Month 0-1	11%	11%	21%	1%	11%
Months 4-7	26%	25%	37%	9%	23%
Months 8-12	24%	22%	38%	10%	23%
Study Exit	22%	22%	32%	8%	21%
Past 30-Day Non-MAT Opioids					
Month 0-1	0%	0%	0%	1%	0%
Months 4-7	0%	0%	0%	1%	0%
Months 8-12	0%	0%	0%	1%	0%
Study Exit	0%	0%	0%	1%	0%
Past 30-Day Sedatives					
Month 0-1	1%	1%	2%	3%	2%
Months 4-7	1%	2%	2%	2%	2%
Months 8-12	1%	1%	1%	2%	2%
Past 30-Day Amphetamines					
Month 0-1	1%	0%	2%	1%	1%
Months 4-7	8%	7%	4%	12%	7%
Months 8-12	9%	10%	3%	16%	9%
Past 30-Day Medication for Pain					
Baseline	16%	16%	18%	11%	15%
Month 6	17%	10%	22%	15%	17%
Month 12	15%	13%	16%	12%	15%
Study Exit	14%	11%	18%	13%	15%
Past 30-Day Psychological/Emotional					
Baseline	29%	28%	30%	27%	29%
Month 6	42%	41%	42%	48%	45%
Month 12	42%	40%	42%	45%	43%
Study Exit	42%	40%	40%	47%	43%
Past 30-Day Sleep					
Baseline	18%	20%	24%	15%	19%
Month 6	20%	25%	23%	26%	24%
Month 12	19%	21%	13%	22%	18%
Study Exit	20%	21%	17%	22%	20%

Table 8. Physical Health of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Hepatitis C Positive					
Baseline	34%	26%	42%	15%	30%
Month 6	37%	31%	51%	15%	32%
Month 12	43%	30%	48%	23%	36%
Hepatitis C Positive & Taken Medication					
Baseline	10%	9%	11%	21%	14%
Month 6	22%	17%	26%	20%	23%
Month 12	21%	32%	28%	32%	28%
Trouble Understanding, Concentrating or Remembering					
Baseline	50%	58%	49%	54%	51%
Month 6	42%	40%	51%	41%	43%
Month 12	38%	41%	44%	41%	42%
Health Status: Good to Excellent					
Baseline	58%	54%	60%	54%	58%
Month 6	68%	55%	53%	68%	63%
Month 12	60%	63%	55%	64%	60%
Study Exit	67%	60%	56%	67%	63%
Quality of Life: Good to Very Good					
Baseline	61%	62%	55%	68%	63%
Month 6	78%	70%	68%	80%	75%
Month 12	75%	69%	68%	86%	78%
Study Exit	74%	67%	67%	82%	76%
Able to Perform Daily Activities					
Baseline	66%	59%	64%	57%	60%
Month 6	76%	59%	67%	68%	68%
Month 12	74%	71%	70%	70%	69%
Study Exit	74%	65%	70%	70%	70%
Not Enough Energy for Everyday Life					
Baseline	23%	31%	24%	25%	25%
Month 6	16%	26%	26%	19%	22%
Month 12	12%	15%	24%	10%	17%
Study Exit	14%	18%	22%	13%	17%
Dissatisfied with Self					
Baseline	25%	33%	25%	27%	26%
Month 6	10%	21%	19%	15%	16%
Month 12	10%	13%	16%	9%	12%
Study Exit	11%	18%	20%	10%	14%
Sexually Active					
Baseline	65%	79%	68%	75%	69%
Month 6	71%	81%	63%	82%	73%
Month 12	66%	78%	64%	77%	70%
High Risk Sex					
Baseline	26%	19%	24%	15%	20%
Month 6	20%	15%	24%	12%	18%
Month 12	10%	4%	7%	9%	8%
Study Exit	15%	9%	16%	12%	14%

Table 9. Criminal Justice Characteristics of High-Risk Participants with OUD

	Corrections Involved	DCF Involved	Howard Center	NMC	All Study Cohorts
Number of Participants Enrolled	289	151	187	195	442
Past 30-Days Arrested					
Baseline	19%	17%	14%	10%	12%
Month 6	8%	6%	4%	5%	5%
Month 12	3%	1%	3%	1%	2%
Study Exit	4%	3%	3%	2%	3%
Past 30-Days Arrested for Drugs					
Baseline	8%	6%	5%	5%	5%
Month 6	2%	1%	0%	2%	1%
Month 12	0%	0%	0%	0%	0%
Past 30-Days Incarcerated					
Baseline	43%	20%	40%	17%	28%
Month 6	13%	6%	10%	5%	8%
Month 12	9%	3%	8%	4%	6%
Study Exit	13%	5%	11%	5%	8%
Past 30-Days on Probation or Parole					
Baseline	68%	36%	43%	40%	44%
Month 6	60%	30%	41%	36%	38%
Month 12	56%	34%	36%	37%	36%
Study Exit	60%	33%	39%	37%	38%
Past 30-Days on Awaiting Charges, Trial or Sentencing					
Baseline	31%	26%	22%	18%	20%
Month 6	24%	17%	11%	17%	15%
Month 12	19%	15%	18%	7%	12%
Study Exit	23%	15%	16%	11%	15%
Past 30-Days Met with Parole Officer					
Baseline	91%	81%	92%	87%	91%
Month 6	77%	77%	86%	68%	77%
Month 12	75%	71%	78%	73%	75%
Study Exit	73%	67%	79%	65%	73%
Past 30-Days Child in Custody Due to a Child Protection Order					
Baseline	23%	49%	24%	18%	21%
Month 6	23%	41%	27%	19%	22%
Month 12	24%	47%	37%	17%	25%
Study Exit	25%	45%	33%	16%	23%
Ever Lost Custody of a Child					
Baseline	23%	30%	21%	20%	21%
Month 6	27%	32%	29%	23%	23%
Month 12	25%	29%	24%	23%	22%
Study Exit	27%	32%	26%	22%	22%
Past 30-Days Met with DCF Worker					
Baseline	56%	63%	50%	69%	62%
Month 6	38%	51%	47%	53%	51%
Month 12	56%	69%	40%	88%	69%
Study Exit	50%	60%	43%	74%	60%

Appendix B: Evaluation AIM 1: PTSD and OUD

Dartmouth-Hitchcock

MAT Integration Data Brief

March 2019

Post Traumatic Stress Disorder in High Risk Participants entering Medication Assisted Treatment Programs in Vermont

by Keri Height, PsyD, Annie Paumgarten, MSW, MS
Nicholas Salvas, BS, and Karyn Gunnet-Shoval, PhD

Key Findings

* Non-prescribed use of opioids decreases over time for participants enrolled in study.

*Non-prescribed use of MAT decreases.

*38-44% of participants had clinically elevated PTSD scores. By month 12, scores decreased to about 25%

*Most participants have experienced physical assault and a third have experienced sexual assault. Those who experienced sexual assault are 5 times more likely to have elevated PTSD scores†.

*Participants with elevated PTSD scores are significantly more likely to be severely depressed, anxious, and suicidal.

*Social support seems to mediate the relationship between elevated PTSD scores and opioid use at month 6, with higher social support decreasing likelihood of elevated PTSD scores.

†when controlling for other predictive variables

The "opioid epidemic" and Medication Assisted Treatment

The "opioid epidemic" is a serious problem faced by our country, with New England having the highest rates of opioid caused overdoses in the nation. Vermont responded to the high rates of overdoses in the state by developing an innovative "hub and spoke" model of Medication Assisted Treatment (MAT). MAT includes FDA approved medications for Opioid Use Disorder (OUD), including full agonist (Methadone), partial agonist (buprenorphine/Suboxone), and antagonists (naltrexone, naloxone, Extended Release naltrexone). Within this model, people with OUD can receive MAT not only in intensive substance use disorder treatment facilities (Hubs) but also in a wide range of community care settings (Spokes). The development of this system of care has expanded the availability and accessibility of MAT, with 9 regional hubs and over 75 spokes spread out over the state. [1]

The MAT Integration Study

This 3 year study examined baseline demographic, behavioral and functional characteristics and monthly treatment progress of high risk individuals entering MAT programs in 3 communities in VT (St. Albans, Burlington, Rutland), across 12 months. For the purpose of this brief, high risk is defined as involvement with the Department of Corrections and Department of Children and Families (DCF).

Overall Opioid Use Progress Snapshot

Overall, the study enrolled 442 participants who were seeking treatment for OUD at a Hub or Spoke in VT. Of those enrolled, 289 were corrections-involved and 151 were DCF-involved (groups are not mutually exclusive). Across all groups, the study found significantly decreased use of non-prescribed opioids, including non-prescribed MAT.

Table 1. Rates of Non-Prescribed Opioid Use at Baseline, Time Point 2 and Time Point 3

	Corrections-Involved	DCF Involved	All
Past 30-day Non-Prescribed Opioid Use			
Baseline (Month 0-1)	84%	92%	89%
Time point 2 (Months 4-7)	39%	41%	36%
Time point 3 (Months 8-12)	33%	28%	31%
Past 30-day Non-Prescribed MAT			
Baseline (Month 0-1)	68%	78%	73%
Time point 2 (Months 4-7)	18%	19%	15%
Time point 3 (Months 8-12)	10%	13%	11%

1

Post Traumatic Stress Disorder

Post Traumatic Stress Disorder is a disorder that one may develop in response to experiencing a traumatic event or series of events in which one felt that their life was at risk. Symptoms can include intrusive memories or images of the events, nightmares, avoidance of reminders of the events, changes in cognition and mood, feeling detached from oneself or surroundings, heightened startle response, and hypervigilance. Studies estimate 26-53% of people with substance use disorders (SUD) meet lifetime PTSD criteria and 15-42% meet current criteria.[2-5]

Theories for why there are high rates of PTSD in people with Substance Use Disorders

There are many theories to explain the high co-morbidity between PTSD and SUD.

- Self-medication: Substance use can be conceptualized as serving the purpose of avoiding emotions
- Susceptibility: Substance use may limit the successful processing of trauma
- High risk: Substance use is associated with risky behaviors that increase risk for exposure to trauma
- Shared vulnerability: there may be shared risk factors and neurocircuitry to explain the high rates of co-occurrence of PTSD and SUD
- Mutual Maintenance: PTSD symptoms may promote substance use and substance use may maintain PTSD symptoms

Co-occurring PTSD and SUD

PTSD and SUD individually and collectively result in high costs to personal wellbeing, the health care system, and the criminal justice system.[6,7] People with co-occurring PTSD and SUD have a more severe clinical profile, lower general functioning, poorer physical health, higher unemployment, increased social impairments, increased mortality, and worse recovery outcomes.[8-11]

Our Findings

The MAT Integration study found that high-risk individuals entering MAT programs in VT had much higher rates of *currently* clinically elevated PTSD scores (PCL threshold>33) than the general population and on the higher end of the range reported by previous studies examining rates of PTSD in people with substance use disorders.

Spotlight on Women

* Women who were involved with DCF and women who were involved with corrections were significantly more likely than men to be unemployed ($p=0.01$, $p<0.01$ respectively).

* Women in high risk study groups were more likely than men to have clinically elevated PTSD scores (Corrections, $p=0.03$, DCF, $p=0.05$).

* In women, a cross sectional comparison at month 6 shows a significant correlation between baseline PTSD and opioid use; however, PTSD did not have a significant effect on change in opioid use across time.

Table 2. Rates of Elevated PTSD Scores and Rates of Types of Trauma

	Corrections Involved	DCF Involved	All
Elevated PTSD Scores (using PTSD Checklist)			
Baseline	38%	44%	39%
6-month follow up	30%	40%	35%
12-month follow up	25%	25%	26%
Types of Lifetime Trauma			
Physical Assault	69%	70%	66%
Weapon Assault	43%	40%	39%
Sexual Assault	31%	39%	32%
Other Uncomfortable Sexual Experience	31%	39%	32%
Captivity	9%	12%	9%
Fire or Explosion	16%	21%	18%
Accident	66%	65%	64%

Baseline Characteristics of participants with clinically elevated PTSD scores

At baseline, high risk participants with clinically elevated PTSD scores were significantly more likely to be:

- severely depressed ($p<0.01$)
- severely anxious ($p<0.001$)
- suicidal ($p<0.001$)
- experiencing trouble controlling violent behavior ($p<0.001$)
- accessing less social support ($p<0.001$)
- prescribed psychotropic medications (corrections $p<0.001$, DCF $p=0.03$)
- experiencing trouble understanding, concentrating and remembering ($p<0.001$)
- rate providers' communication as fair to poor ($p<0.001$)

High risk participants with and without clinically elevated PTSD scores at baseline were equally unstably housed (between 32% and 44% of high risk participants were unstably housed at baseline). While participants involved with corrections who have elevated PTSD scores were significantly more likely to be using sedatives at baseline ($p=0.01$), high risk participants with and without clinically elevated PTSD scores did not significantly differ in rates of past 30 days use of other substances nor rates of employment at baseline. Participants who are corrections-involved and have a history of lifetime sexual assault were significantly more likely to be unemployed at baseline than those without a history of lifetime sexual assault ($p<0.01$).

Relationship between PTSD and non-prescribed opioid use

Using logistic regression, there is a significant positive relationship between clinically elevated PCL scores at 6 months and opioid use at 6 months ($p=.04$). However, this association was no longer significant when controlling for social support scores. Adjusting for PCL score, there is a negative relationship between social support scores at 6 months and opioid use ($p<.01$). Namely as social support scores increase, the probability that an individual will use non-prescribed opioids decreases.

Using mixed effects modeling and adjusting for gender and social support, we found:

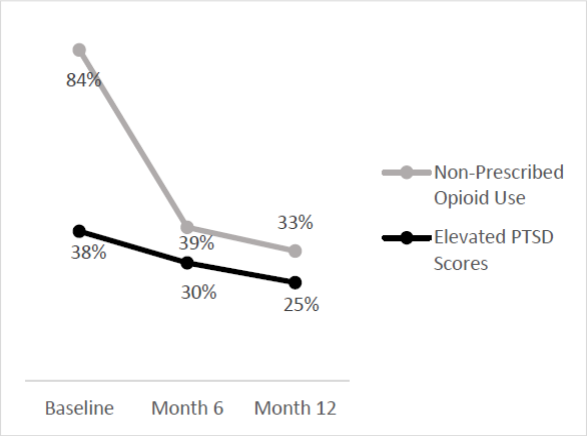
- There is no significant relationship between PTSD Checklist (PCL) scores and change over time in non-prescribed opioid use (excluding MAT) for both Corrections ($p=.98$) and DCF-involved ($p=.59$) individuals.

- There is no significant relationship between PCL scores and change over time in use of non-prescribed opioids (including MAT) for both corrections ($p=.19$) and DCF-involved ($p=.97$) individuals.

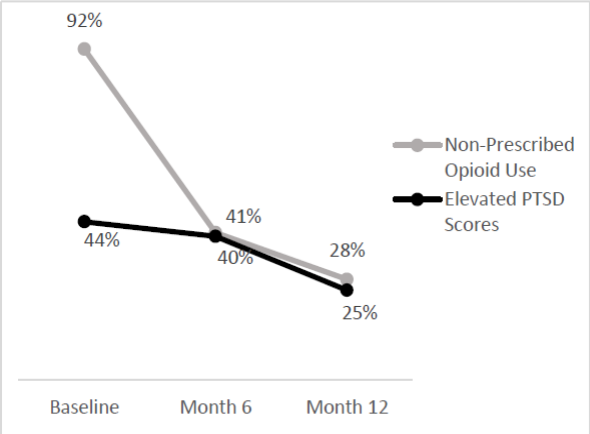
- There **is** a significant positive relationship between PCL score and change over time in non-prescribed prescription opiate use (oxy, Darvon) for both corrections ($p=.02$) DCF-involved individuals ($p=.03$).

- There is no significant relationship between PCL score and change over time in non-prescribed MAT use and for both corrections-involved individuals (.96) and DCF-involved ($p=.29$).

- There is no significant positive relationship between PCL score and change over time in opioid use for a woman only sample, though the overall change in non-prescribed MAT use for women only was nearing significance ($p=.0655$).



30-day Non-Prescribed Opioid Use and Elevated PTSD Scores among Corrections-Involved



30-day Non-Prescribed Opioid Use and Elevated PTSD Scores among DCF-Involved

PTSD scores over time

While there was a significant decrease in clinically elevated PTSD scores in the corrections-involved sample from baseline to 6 month follow up (p=0.03), the DCF-involved sample did not experience a significant decrease in clinically elevated PTSD scores from baseline to 6 month follow up (p=0.82)

What variables predict clinically elevated PTSD scores at 6 month follow up?

- Just over 1/3 of participants interviewed at month 6 reported having been sexually assaulted at some point in their lives and these individuals are 5 times more likely to have elevated PTSD scores.
- Past 30-day mental health symptoms predict a greater likelihood of elevated PTSD scores among individuals interviewed at month 6, including severe anxiety (7 times more likely to screen at the threshold for PTSD), severe depression (5 times more likely) and suicidal thoughts (7 times more likely).

Table 3. Logistic Regression: Predictors of PCL Score Meeting PTSD Threshold at Month 6†

	Odds Ratio	95% Confidence Interval
Lifetime Sexual Assault (for example rape, attempted rape, sex act via force or threat)	4.5	1.9-10.6
Past 30 Day 5+ Days of Severe Anxiety at Month 6	6.6	2.4-18.3
Past 30 Day 14+ Days of Severe Depression at Month 6	4.6	1.8-11.5
Past 30-Day Suicidal Thoughts at Month 6	7.3	2.2-23.9

† Pseudo R2 = 0.4121, p = <0.0001; H-L chi2 (6) = 4.46, p=0.6143; Area Under ROC Curve= 0.8960

Corrections-involved sample:

- 70% of corrections-involved interviewed at month 6 reported having been physically assaulted in their lives, and this group is 9 times more likely to have elevated PTSD scores.
- The amount of baseline social support an individual has is correlated with PTSD at month 6; each additional point in the ARC social support score (from 0-5) leads to a corresponding 32% reduction in the likelihood of PTSD.
- Individuals interviewed at month 6 who report severe depression (14+ days out of the past 30) are 18 times more likely to report elevated PTSD scores.

Table 4. Logistic Regression: Predictors of PCL Score Meeting PTSD Threshold at Month 6 among Corrections-Involved†

	Odds Ratio	95% Confidence Interval
Lifetime Physical Assault (attacked, hit, slapped, beaten up)	8.5	1.5-49.3
ARC Social Support Domain Score (0-5) at Baseline	.68	.49-.94
Past 30 Day 14+ Days of Severe Depression at Month 6	17.8	5.6-56.1
Past 30-Day Halfway House or Residential Treatment at Baseline	3.0	.93-9.93

† Pseudo R2 = 0.3924, p = <0.0001; H-L chi2 (8) = 8.43, p=0.3924; Area Under ROC Curve= 0.8900

DCF-involved sample:

- DCF-involved individuals reporting a lifetime sexual assault are 8 times more likely to have elevated PTSD scores than DCF-involved without the history of surviving sexual abuse.
- 45% of DCF-involved individuals who were interviewed at month 6 used non-prescribed opioids, and these individuals were 27 times more likely to screen at the threshold for PTSD.
- Reporting good to excellent health status is associated with a 88% reduction in the likelihood of having elevated PTSD scores.

Table 5. Logistic Regression: Predictors of PCL Score Meeting PTSD Threshold at Month 6 among DCF-Involved†

	Odds Ratio	95% Confidence Interval
Lifetime Sexual Assault (for example rape, attempted rape, sex act via force or threat)	8.2	1.5-43.6
Non-Prescribed Opioid Use, Months 4-7	27.3	3.9-190.8
Past 30-Day Suicidal Thoughts at Month 6	36.7	4.5-302.1
Past 30-Day Health Status, Good to Excellent at Baseline	.12	.03-.58

† Pseudo R2 = 0.5209, p = <0.0001; H-L chi2 (7) = 2.00, p=0.9596; Area Under ROC Curve= 0.9285

Treatment Models

- There are several psychological therapies for co-occurring PTSD and substance use disorder.[12]
- Trauma focused cognitive behavioral therapies (TF-CBT) combined with SUD specific interventions seem to be more effective in decreasing PTSD severity than non-trauma focused psychotherapies/treatment as usual.
- Examples of trauma-focused therapies include Prolonged Exposure, Cognitive Processing Therapy, and Eye Movement Desensitization and Reprocessing (EMDR).

Summary

According to the National Center for PTSD,[13] 50-60% of people will experience at least one traumatic event and 7-8% of the population will have PTSD at some point in their lives. Among the general population, women have higher PTSD prevalence rates than men do (10% vs. 4% respectively). Many prior studies have found a comorbidity between OUD/SUD and PTSD, with prevalence rates of PTSD much higher than national averages. While rates of clinically elevated scores on a measure of PTSD symptoms were much higher in our sample than compared to national averages, our results are consistent with national data showing higher rates of PTSD in women than men and consistent with previous substance use disorder research on prevalence of co-occurring PTSD and OUD. Our results are also consistent with literature showing that people with PTSD have a more severe clinical profile, including severe depression, severe anxiety, suicidal thoughts, self-reported trouble controlling violent behavior, less social support utilization, trouble with executive functioning, and higher rates of prescribed psychotropic medications. Consistent with previous studies,[14,15] we also found social support to be an important factor in understanding PTSD and our results suggest that increasing social support may be important in the treatment of PTSD. It is encouraging to see the success of MAT programs in VT in reducing the rates of non-prescribed use of opioids and decreases in PTSD scores for high risk participants. Nonetheless, approximately 25% of participants who completed 12 month follow up visits continued to have clinically elevated PTSD scores and PTSD data on participants who did not complete follow up interviews is not available. It is important that stakeholders in addressing prevention and treatment of OUD are informed of the characteristics of participants with co-occurring PTSD and OUD and that programming takes these characteristics into account.

Limitations of the study

- *Follow up rates*: Forty-seven percent of participants (n=208) completed 6-month follow-up interviews and 38% (n=169) completed 12 month follow up interviews. Medical records data (including urine screen results) was collected on 99% of participants at baseline, 74% at time point 2 and 54% at time point 3. Total loss to follow up is as follows: Baseline=0%, time point 2=20%, time point 3=38%. While it is possible that participants lost to drop out may be over represented by those achieving better or worse outcomes, we found no significant baseline differences between those for whom we have follow up data and those for whom we do not have follow up data.
- *PCL cut off scores:* This study uses the PTSD Checklist and the provisionally proposed cut off score of 33 to indicate clinically elevated scores. We did not examine individual clinically meaningful change scores.
- While substance use data that relies on *self-report* can be subject to the reliability of the participants' self-report, this study attempted to control for this by 1. Assuring participants of the confidentiality of their research data, including obtaining a Certificate of Confidentiality and 2. Corroborating self-reported substance use with both research urine screens and clinical urine screens.
- This study does not include a control group nor did we control for the amount of behavioral health sessions completed.

- There may be confounding variables that were not analyzed within the scope of this Data Brief.
- There is some increased risk of type 1 error due to the number of tests ran.

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Appendix C: Evaluation AIM 2, Part 1: Progress in Treatment, All Participants & by Sub-Group

Table 1. Progress from Baseline to 6 and 12 Months: All Participants

	Baseline to Month 6			Baseline to Month 12		
	Baseline	**Month 6**	**p-value***	**Baseline**	**Month 12**	**p-value***
Goal 1: Decrease Substance Use						
Past 30-day Non-Prescribed Opioids All	90%	42%	<0.001	90%	40%	<0.001
Past 30-day Non-Prescribed Opioids All Non-MAT	54%	34%	<0.001	58%	35%	<0.001
Past 30-day Non-Prescribed Buprenorphine	75%	15%	<0.001	72%	10%	<0.001
Past 30-day Non-Prescribed Methadone	12%	3%	<0.001	12%	3%	0.0002
Past 30-day Binge Drinking	16%	12%	0.31	14%	7%	0.02
Past 30-day THC	61%	56%	0.09	62%	59%	0.42
Past 30-day Cocaine	43%	50%	0.003	46%	55%	0.001
Past 30-day Tobacco	89%	93%	0.26	86%	90%	0.19
Goal 2: Improve Behavioral/Mental Health						
Past 30-day Severe Depression			0.04			0.03
No depression	38%	41%		38%	41%	
<14 days	25%	30%		26%	34%	
14+ days	28%	29%		37%	26%	
Past 30-day Severe Anxiety, %			<0.001			<0.001
No anxiety	20%	32%		17%	30%	
<5 days	16%	12%		14%	18%	
5+ days	64%	56%		69%	52%	
Past 30-day PTSD (+)	39%	35%	0.28	37%	26%	0.009
ARC Social Support Score, mean	3.0	3.4	<0.001	3.1	3.8	<0.001
Goal 3: Improve Physical Health						
Past 30-day High-Risk Sex	20%	14%	0.24	16%	9%	0.21
Goal 4: Improve Socio-Economic Status						
Past 30-day Employed (part time or full time)	34%	66%	<0.001	36%	70%	<0.001
Past 30-day Unstable Housing	32%	32%	1.0	32%	33%	1.0
Goal 5: Increase Treatment Engagement						
Past 30-day Outpatient Mental Health			<0.001			<0.001
None	57%	34%		54%	32%	
<4 Month	20%	18%		21%	26%	
4+ Month	23%	49%		25%	42%	
Past 30-day Receiving Care for Medical Problems	62%	80%	0.01	59%	80%	0.03
Past 30-day Peer Group Participation	41%	40%	0.89	42%	37%	0.25
Past 30-day Rating of Providers' Communication			0.22			0.048
Fair to Poor	34%	25%		32%	25%	
Good	33%	38%		27%	23%	
Good to Excellent	33%	36%		40%	52%	
Prescribed MAT	53%	87%	<0.001	53%	88%	<0.001

* Paired T-test, Signed Rank, McNemar's

Table 2. Progress from Baseline to 6 and 12 Months: Corrections-Involved Participants

	Baseline to Month 6			Baseline to Month 12		
	Baseline	**Month 6**	**p-value***	**Baseline**	**Month 12**	**p-value***
Goal 1: Decrease Substance Use						
Past 30-day Non-Prescribed Opioids All	84%	42%	<0.001	86%	39%	<0.001
Past 30-day Non-Prescribed Opioids All Non-MAT	53%	34%	<0.001	58%	32%	<0.001
Past 30-day Non-Prescribed Buprenorphine	68%	17%	<0.001	68%	10%	<0.001
Past 30-day Non-Prescribed Methadone	10%	4%	0.03	10%	3%	0.02
Past 30-day Binge Drinking	16%	12%	0.38	14%	8%	0.17
Past 30-day THC	58%	53%	0.28	60%	58%	0.72
Past 30-day Cocaine	45%	54%	0.006	47%	60%	0.001
Past 30-day Tobacco	88%	93%	0.21	86%	92%	0.21
Goal 2: Improve Behavioral/Mental Health						
Past 30-day Severe Depression			0.15			0.18
No depression	39%	41%		41%	41%	
<14 days	22%	31%		26%	34%	
14+ days	39%	28%		34%	26%	
Past 30-day Severe Anxiety, %			<0.001			<0.001
No anxiety	17%	33%		15%	34%	
<5 days	18%	12%		15%	16%	
5+ days	65%	55%		70%	51%	
Past 30-day PTSD (+)	41%	30%	0.03	36%	25%	0.06
ARC Social Support Score, mean	2.9	3.6	<0.001	3.1	3.8	<0.001
Goal 3: Improve Physical Health						
Past 30-day High-Risk Sex	29%	17%	0.12	22%	12%	0.23
Goal 4: Improve Socio-Economic Status						
Past 30-day Employed (Part-Time or Full-Time)	26%	68%	<0.001	26%	71%	<0.001
Past 30-day Unstable Housing	30%	35%	0.42	32%	35%	0.76
Goal 5: Increase Treatment Engagement						
Past 30-day Outpatient Mental Health			<0.001			<0.001
None	60%	37%		57%	31%	
<4 Month	21%	16%		24%	27%	
4+ Month	19%	48%		19%	42%	
Past 30-day Receiving Care for Medical Problems	59%	69%	0.39	59%	72%	0.34
Past 30-day Peer Group Participation	47%	44%	0.75	50%	42%	0.16
Past 30-day Rating of Providers' Communication			0.09			0.03
Fair to Poor	38%	26%		38%	26%	
Good	36%	38%		29%	26%	
Good to Excellent	26%	36%		33%	48%	
Prescribed MAT	55%	83%	<0.001	54%	86%	<0.001

* Paired Tests: T-test, Signed Rank, McNemar's

Table 3. Progress from Baseline to 6 and 12 Months: DCF-Involved Participants

	Baseline to Month 6			Baseline to Month 12		
	Baseline	**Month 6**	**p-value***	**Baseline**	**Month 12**	**p-value***
Goal 1: Decrease Substance Use						
Past 30-day Non-Prescribed Opioids All	93%	46%	<0.001	94%	38%	<0.001
Past 30-day Non-Prescribed Opioids All Non-MAT	55%	33%	<0.001	55%	30%	<0.001
Past 30-day Non-Prescribed Buprenorphine	79%	18%	<0.001	79%	11%	<0.001
Past 30-day Non-Prescribed Methadone	13%	4%	0.06	11%	4%	0.15
Past 30-day Binge Drinking	16%	11%	0.50	13%	3%	0.04
Past 30-day THC	67%	58%	0.10	62%	56%	0.50
Past 30-day Cocaine	41%	50%	0.05	45%	53%	0.04
Past 30-day Tobacco	95%	94%	1.0	94%	94%	1.0
Goal 2: Improve Behavioral/Mental Health						
Past 30-day Severe Depression			0.51			0.37
No depression	34%	35%		40%	40%	
<14 days	27%	30%		27%	34%	
14+ days	40%	35%		34%	27%	
Past 30-day Severe Anxiety, %			0.04			0.02
No anxiety	17%	29%		18%	29%	
<5 days	18%	11%		19%	19%	
5+ days	65%	60%		63%	52%	
Past 30-day PTSD (+)	42%	40%	0.82	37%	25%	0.049
ARC Social Support Score, mean	2.8	3.2	0.009	3.1	3.7	0.005
Goal 3: Improve Physical Health						
Past 30-day High-Risk Sex	19%	8%	0.13	10%	5%	0.63
Goal 4: Improve Socio-Economic Status						
Past 30-day Employed (part time or full time)	27%	58%	0.001	33%	60%	0.007
Past 30-day Unstable Housing	48%	37%	0.13	43%	36%	0.56
Goal 5: Increase Treatment Engagement						
Past 30-day Outpatient Mental Health			<0.001			<0.001
None	58%	29%		56%	25%	
<4 Month	18%	19%		21%	33%	
4+ Month	24%	51%		23%	42%	
Past 30-day Receiving Care for Medical Problems	56%	72%	0.23	50%	83%	0.07
Past 30-day Peer Group Participation	39%	36%	0.83	41%	37%	0.63
Past 30-day Rating of Providers' Communication			0.06			0.03
Fair to Poor	35%	24%		35%	24%	
Good	41%	35%		33%	24%	
Good to Excellent	24%	41%		33%	52%	
Prescribed MAT	48%	88%	<0.001	52%	91%	<0.001

* Paired T-test, Signed Rank, McNemar's

Table 4. Progress from Baseline to 6 and 12 Months: Howard Center Involved Participants

	Baseline to Month 6			Baseline to Month 12		
	Baseline	**Month 6**	**p-value***	**Baseline**	**Month 12**	**p-value***
Goal 1: Decrease Substance Use						
Past 30-day Non-Prescribed Opioids All	87%	45%	<0.001	88%	43%	<0.001
Past 30-day Non-Prescribed Opioids All Non-MAT	61%	36%	<0.001	63%	35%	<0.001
Past 30-day Non-Prescribed Buprenorphine	68%	15%	<0.001	61%	13%	<0.001
Past 30-day Non-Prescribed Methadone	20%	5%	0.001	19%	4%	0.001
Past 30-day Binge Drinking	21%	14%	0.33	13%	7%	0.34
Past 30-day THC	61%	56%	0.48	63%	59%	0.63
Past 30-day Cocaine	57%	61%	0.26	56%	66%	0.02
Past 30-day Tobacco	84%	91%	0.11	81%	86%	0.55
Goal 2: Improve Behavioral/Mental Health						
Past 30-day Severe Depression			0.50			0.38
No depression	38%	41%		33%	35%	
<14 days	25%	27%		29%	35%	
14+ days	37%	33%		38%	31%	
Past 30-day Severe Anxiety, %			0.01			0.13
No anxiety	20%	33%		15%	18%	
<5 days	15%	10%		11%	21%	
5+ days	65%	57%		74%	61%	
Past 30-day PTSD (+)	41%	40%	1.0	40%	30%	0.17
ARC Social Support Score, mean	3.1	3.3	0.23	3.2	3.5	0.18
Goal 3: Improve Physical Health						
Past 30-day High Risk Sex	28%	22%	0.69	16%	9%	0.63
Goal 4: Improve Socio-Economic Status						
Past 30-day Employed (part time or full time)	19%	58%	<0.001	32%	53%	0.03
Past 30-day Unstable Housing	31%	37%	0.45	34%	38%	0.85
Goal 5: Increase Treatment Engagement						
Past 30-day Outpatient Mental Health			<0.001			<0.001
None	64%	24%		61%	27%	
<4 Month	24%	16%		25%	25%	
4+ Month	13%	60%		14%	48%	
Past 30-day Receiving Care for Medical Problems	76%	76%	1.0	59%	88%	0.18
Past 30-day Peer Group Participation	41%	49%	0.14	36%	41%	0.45
Past 30-day Rating of Providers' Communication			0.64			0.37
Fair to Poor	40%	36%		33%	29%	
Good	26%	38%		24%	24%	
Good to Excellent	34%	26%		43%	48%	
Prescribed MAT	75%	88%	0.002	79%	89%	0.03

*Paired T-test, Signed Rank, McNemar's

Table 5. Progress from Baseline to 6 and 12 Months: NMC-CPC Involved Participants

	Baseline to Month 6			Baseline to Month 12		
	Baseline	**Month 6**	**p-value***	**Baseline**	**Month 12**	**p-value***
Goal 1: Decrease Substance Use						
Past 30-day Non-Prescribed Opioids All	92%	37%	<0.001	94%	35%	<0.001
Past 30-day Non-Prescribed Opioids All Non-MAT	45%	30%	0.001	51%	31%	<0.001
Past 30-day Non-Prescribed Buprenorphine	83%	14%	<0.001	83%	8%	<0.001
Past 30-day Non-Prescribed Methadone	6%	2%	0.07	7%	1%	0.04
Past 30-day Binge Drinking	12%	10%	0.63	16%	7%	0.049
Past 30-day THC	61%	57%	0.24	61%	59%	0.82
Past 30-day Cocaine	27%	38%	0.002	32%	39%	0.06
Past 30-day Tobacco	92%	96%	0.45	89%	93%	0.34
Goal 2: Improve Behavioral/Mental Health						
Past 30-day Severe Depression			0.05			0.01
No depression	38%	42%		39%	45%	
<14 days	26%	33%		24%	33%	
14+ days	37%	25%		37%	22%	
Past 30-day Severe Anxiety, %			0.03			<0.001
No anxiety	20%	31%		17%	39%	
<5 days	17%	12%		17%	16%	
5+ days	63%	57%		65%	45%	
Past 30-day PTSD (+)	36%	32%	0.57	34%	22%	0.06
ARC Social Support Score, mean	3.0	3.7	<0.001	3.1	4.0	<0.001
Goal 3: Improve Physical Health						
Past 30-day High-Risk Sex	13%	8%	0.55	15%	9%	0.55
Goal 4: Improve Socio-Economic Status						
Past 30-day Employed (part time or full time)	43%	70%	0.001	36%	81%	<0.001
Past 30-day Unstable Housing	35%	31%	0.57	31%	28%	0.70
Goal 5: Increase Treatment Engagement						
Past 30-day Outpatient Mental Health			0.12			0.28
None	48%	38%		45%	34%	
<4 Month	19%	23%		20%	29%	
4+ Month	33%	39%		35%	37%	
Past 30-day Receiving Care for Medical Problems	58%	87%	0.003	60%	77%	0.15
Past 30-day Peer Group Participation	38%	31%	0.20	46%	30%	0.02
Past 30-day Rating of Providers' Communication			0.18			0.07
Fair to Poor	29%	20%		32%	23%	
Good	39%	39%		30%	23%	
Good to Excellent	33%	41%		38%	54%	
Prescribed MAT	30%	87%	<0.001	29%	87%	<0.001

* Paired T-test, Signed Rank, McNemar's

Appendix D: Evaluation AIM 2, Part 2: Predictors of Non-Prescribed Opioid Use

Predictors of Non-Prescribed Opioid Use at Months 4-7 Post-Baseline, All & by Sub-Group

Table 1. Logistic Regression: Predictors of Non-Prescribed Opioid Use Months 4-7, All Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Buprenorphine, Months 4-7	.42	.22-.79	-2.67	0.008
Cocaine Use, Months 4-7	2.6	1.4-4.8	3.01	0.003
Non-Prescribed Sedative Use, Month 4-7	4.0	1.1-14.2	2.15	0.031
ARC Social Support Score at Month 6	.84	.69-1.0	-1.82	0.069

† Pseudo R2 = 0.1193, p = <0.0001; H-L chi2 (8) = 5.94, p=0.6541; AUROC= 0.7165; Mean VIF: 1.06

Predictors of Non-Prescribed Opioid Use at Months 4-7, All Participants: ROC Curve

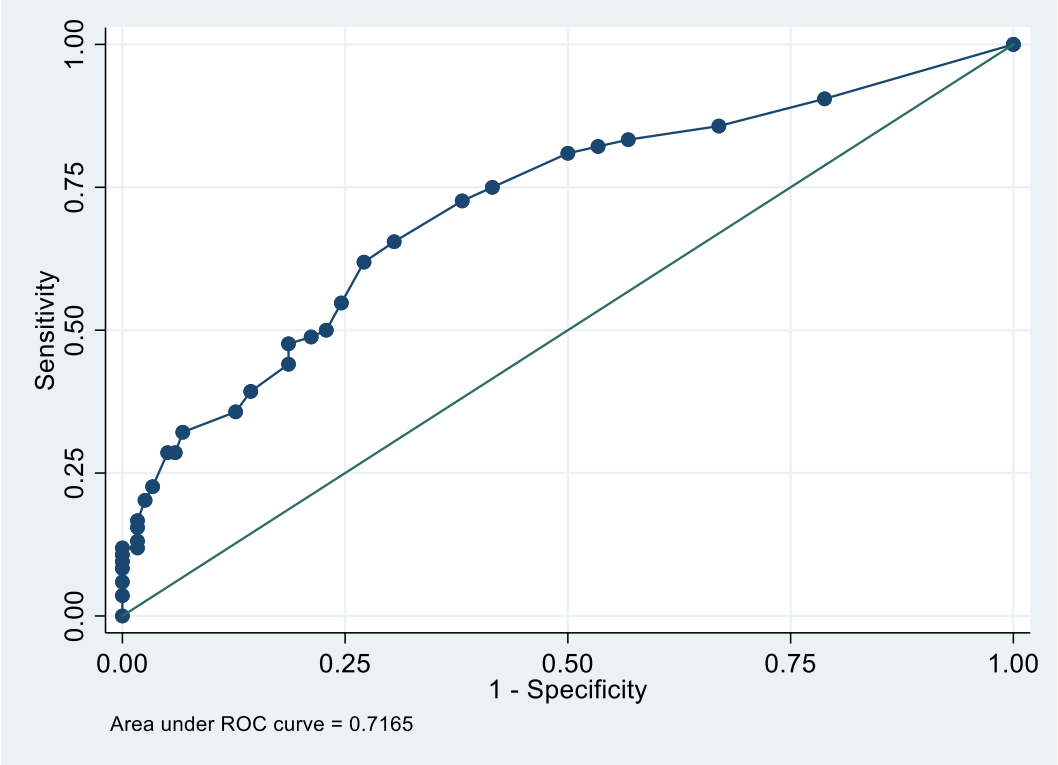


Table 2. Logistic Regression: Predictors of Non-Prescribed Opioid Use Months 4-7, Corrections-Involved Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Buprenorphine, Months 4-7	.48	.19-1.2	-1.60	0.110
Cocaine Use, Months 4-7	3.3	1.4-7.8	2.69	0.007
Non-Prescribed Sedative Use, Months 4-7	6.1	.94-38.8	1.90	0.058
Binge Drinking at Month 6	6.5	1.7-25.2	2.70	0.007
ARC Social Support Score at Month 6	.68	.51-.90	-2.65	0.008

† Pseudo R2 = 0.2259, p = <0.0001; H-L chi2 (8) = 5.51, p=0.7015; AUROC= 0.7975; Mean VIF:1.06

Predictors of Non-Prescribed Opioid Use at Months 4-7 among Corrections-Involved Participants: ROC Curve

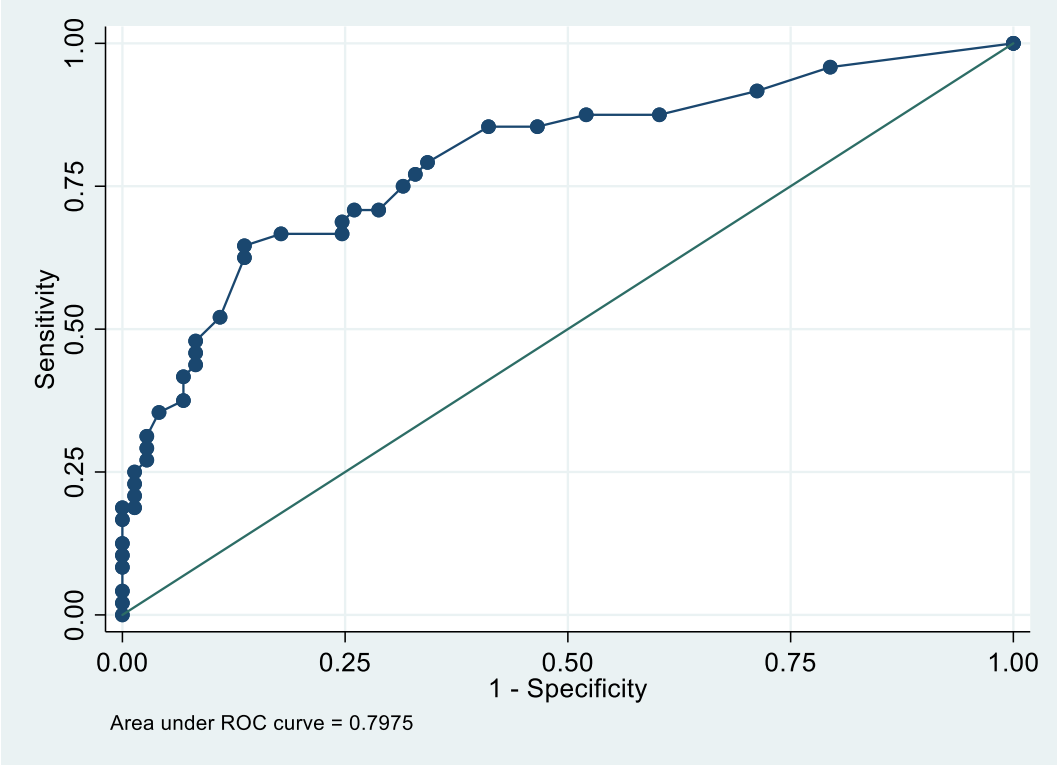


Table 3. Logistic Regression: Predictors of Non-Prescribed Opioid Use Months 4-7, DCF-Involved Participants†

Characteristics	Odds Ratio	95% Confidence Interval	z	P>|z|
Cocaine Use, Months 4-7	4.7	1.2-18.3	2.26	0.024
PTSD at Month 6	9.8	2.2-43.3	3.02	0.003
Employment at Baseline	7.9	1.6-39.3	2.52	0.012
Unstable Housing at Baseline	4.8	1.2-19.9	2.18	0.029

† Pseudo R2 = 0.3457, p = <0.0001; H-L chi2 (8) = 7.25, p=0.5102; AUROC= 0.8661; Mean VIF: 1.05

Predictors of Non-Prescribed Opioid Use at Months 4-7 among DCF-Involved Participants: ROC Curve

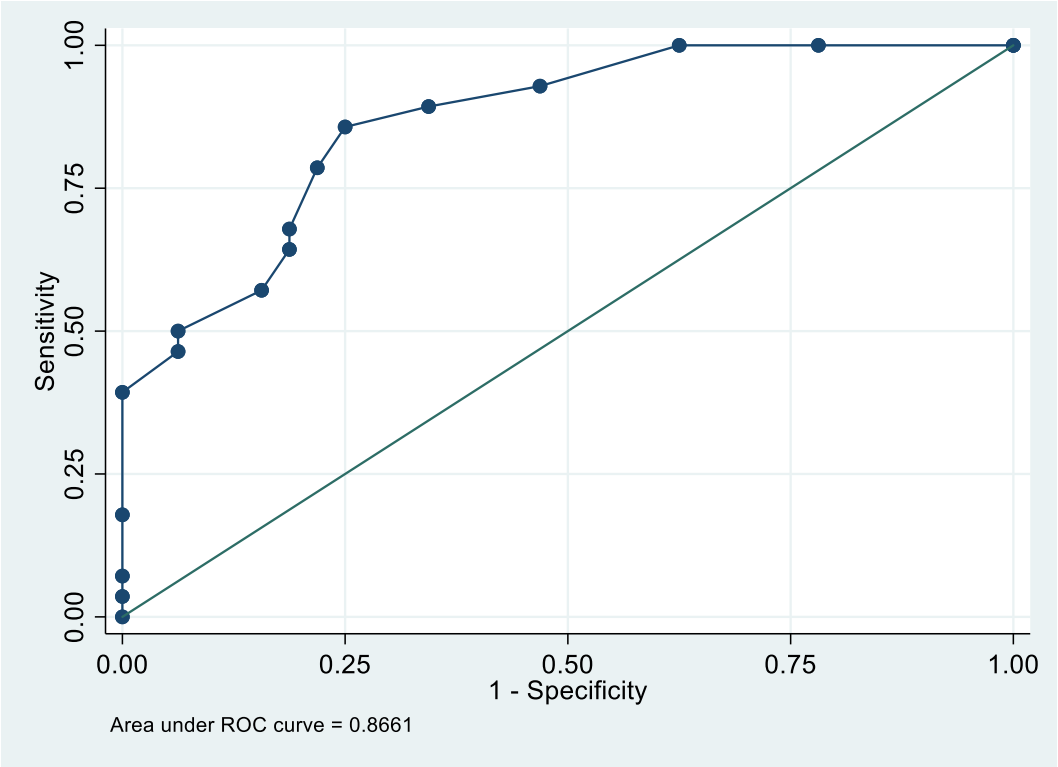


Table 4. Logistic Regression: Predictors of Non-Prescribed Opioid Use at Months 4-7, Howard Center†

Characteristics	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Buprenorphine, Months 4-7	.22	0.1-0.8	-2.34	0.019
Cocaine Use, Months 4-7	1.4	0.4-4.9	0.55	0.580
Binge Drinking at Baseline	17.6	1.7-184.5	2.39	0.017
PTSD at Month 6	4.1	1.1-15.3	2.11	0.035
ARC Social Support Score at Month 6	.62	0.41-0.93	-2.29	0.022

† Pseudo R2 = 0.3485, p = <0.0001; H-L chi2 (8) = 8.02, p=0.4320; AUROC= 0.8605; Mean VIF: 1.18

Predictors of Non-Prescribed Opioid Use at Months 4-7 at the Howard Center: ROC Curve

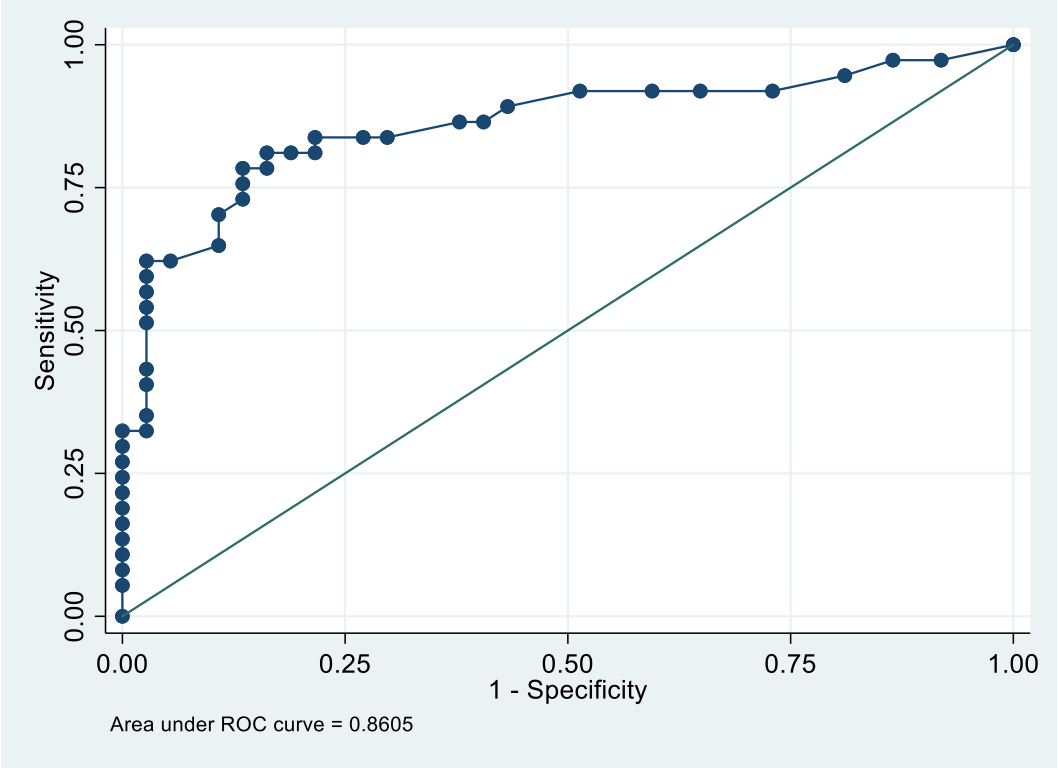
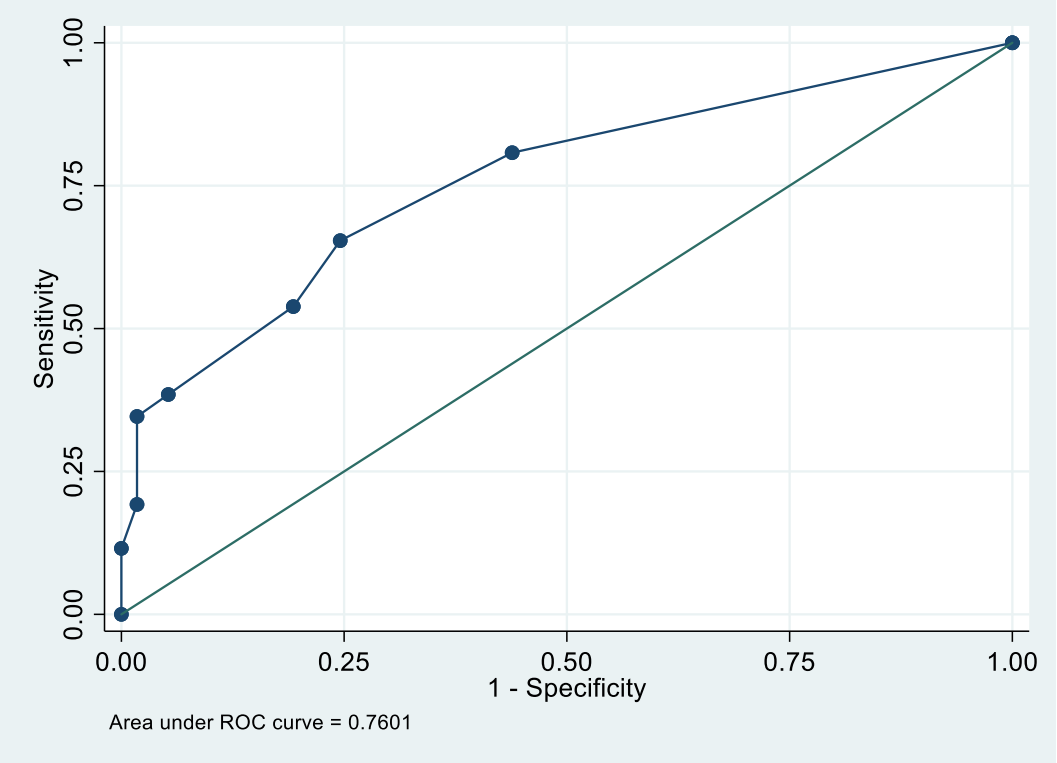


Table 5. Logistic Regression: Predictors of Non-Prescribed Opioid Use at Months 4-7, NMC-CPC†

Characteristics	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Buprenorphine, Months 4-7	.25	.07-.92	-2.09	0.037
Cocaine Use, Months 4-7	5.6	1.8-17.5	2.95	0.003
Employment, Month 6	.31	.10-.96	-2.02	0.043

† Pseudo R2 = 0.1887, p = 0.0002; H-L chi2 (3) = 0.24, p=0.9707; AUROC= 0.7601; Mean VIF: 1.02

Predictors of Non-Prescribed Opioid Use at Months 4-7 at the NMC-CPC: ROC Curve



Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7 Post-Baseline, All Participants & by Sub-Group

Table 1. Logistic Regression: Predictors of Non-Prescribed Opioid Use (Excluding MAT) Months 4-7, All Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Methadone, Months 4-7	3.7	1.9-7.2	3.89	<0.001
Cocaine Use, Months 4-7	2.0	1.1-3.7	2.26	0.024
Binge Drinking at Baseline	3.3	1.6-6.8	3.21	0.001
Non-Prescribed Sedative Use, Month 0-1	2.8	1.4- 5.6	2.96	0.003

† Pseudo R2 = 0.1761, p = <0.0001; H-L chi2 (5) = 3.15, p=0.6774; AUROC= 0.7592; Mean VIF: 1.14

Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7, All Participants: ROC Curve

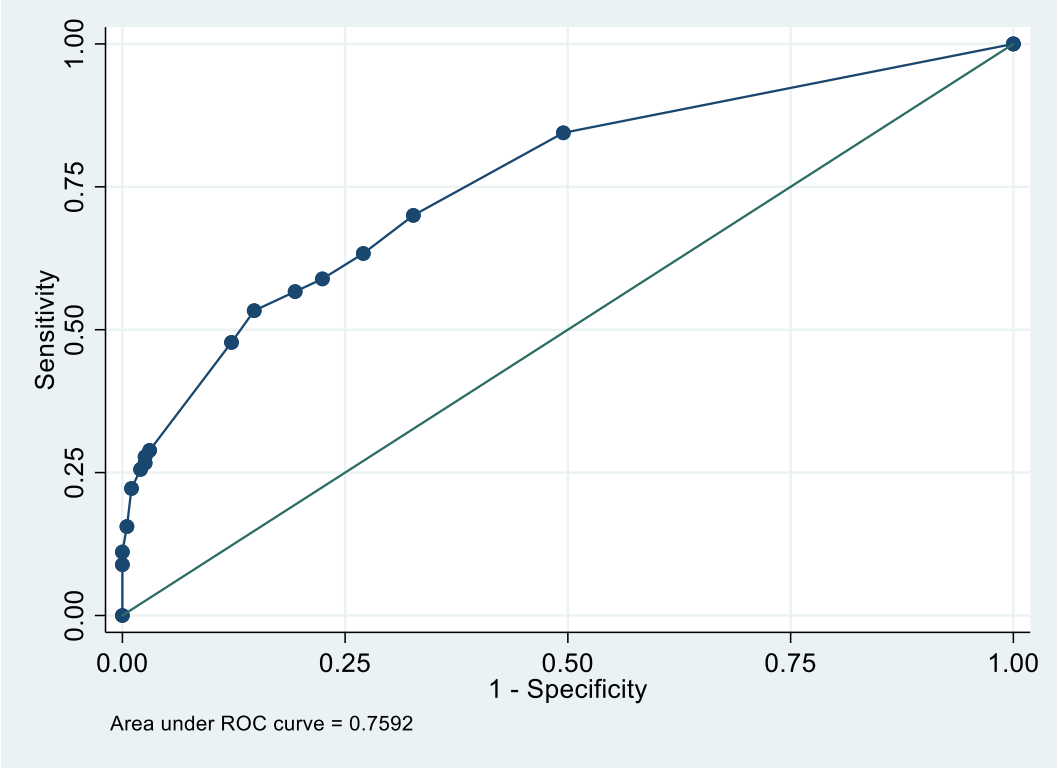


Table 2. Logistic Regression: Predictors of Non-Prescribed Opioid Use (Excluding MAT) Months 4-7, Corrections-Involved Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Methadone, Months 4-7	3.9	1.7- 9.1	3.21	0.001
Cocaine Use, Months 4-7	4.0	1.8- 9.1	3.37	0.001
Binge Drinking at Baseline	4.4	1.7- 11.4	3.06	0.002
ARC Social Support Score at Baseline	.83	.66- 1.0	-1.68	0.093

† Pseudo R2 = 0.2484, p = <0.0001; H-L chi2 (8) = 10.89, p=0.2077; AUROC= 0.8157; Mean VIF: 1.11

Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7 among Corrections-Involved Participants: ROC Curve

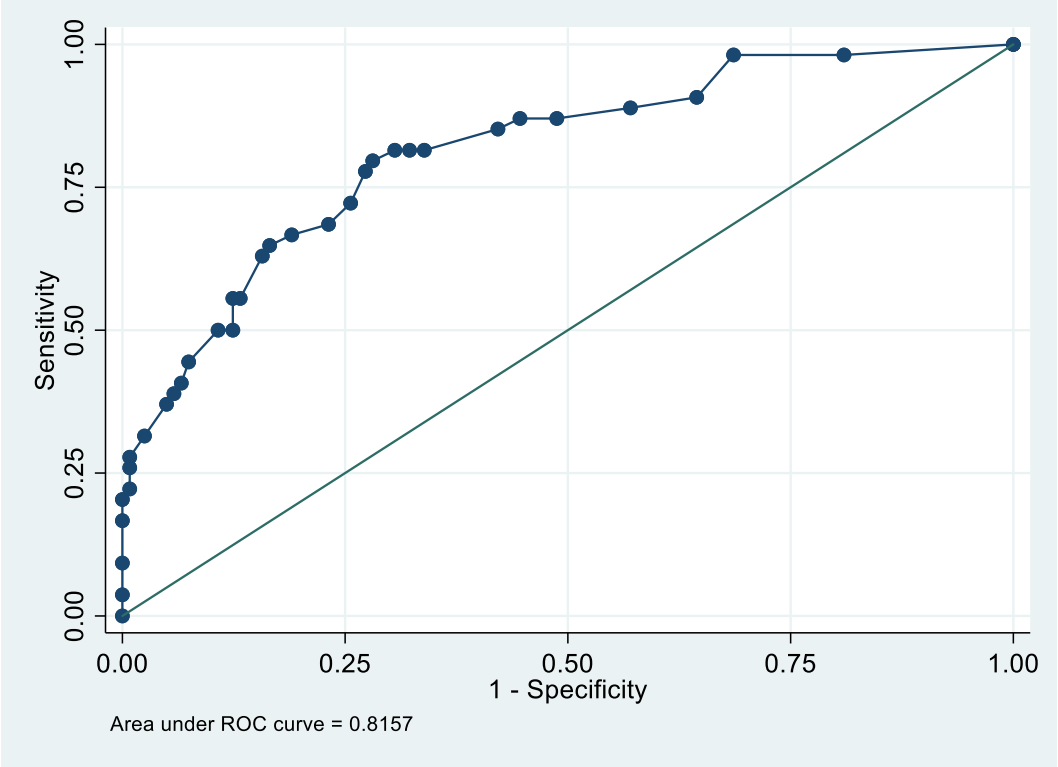


Table 3. Logistic Regression: Predictors of Non-Prescribed Opioid Use (Excluding MAT) Months 4-7, DCF-Involved Participants†

Characteristics	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Methadone, Months 4-7	5.6	1.4- 23.0	2.41	0.016
Binge Drinking at Baseline	6.4	1.3- 31.9	2.28	0.022
PTSD at Month 6	2.6	.71- 9.2	1.44	0.151
Employed at Baseline	2.4	.66- 8.8	1.33	0.183

† Pseudo R2 = 0.2566, p = 0.0001; H-L chi2 (5) = 6.09, p=0.2980; Area Under ROC Curve= 0.7683; Mean VIF: 1.13

Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7 among DCF-Involved Participants: ROC Curve

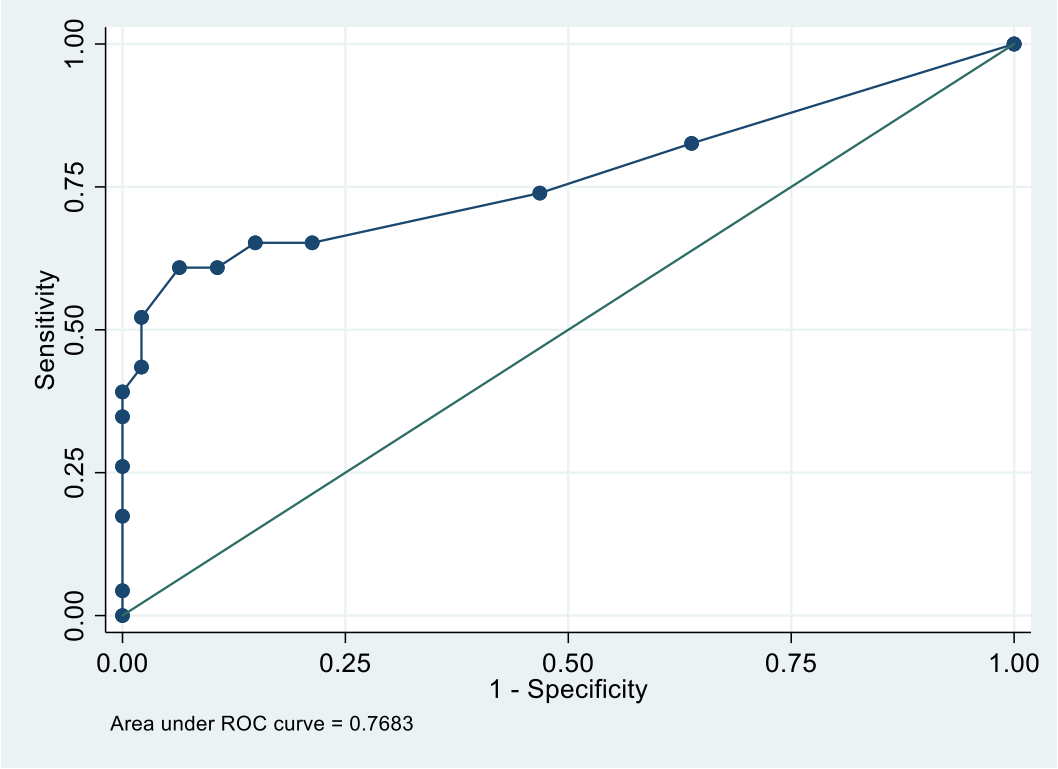


Table 4. Logistic Regression: Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7, Howard Center†

Characteristics	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Methadone, Months 4-7	10.4	2.2-48.6	2.98	0.003
Binge Drinking at Baseline	8.4	1.2-61.1	2.11	0.035
Non-Prescribed Sedative Use, Months 0-1	17.9	2.9-109.1	3.13	0.002
Past 30-day Severe Depression, 14+ Days at Month 6	3.9	.91-16.3	1.83	0.067

† Pseudo R2 = 0.4067, p = <0.0001; H-L chi2 (5) = 0.49, p=0.9923; AUROC= 0.8778; Mean VIF: 1.15

Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7 at the Howard Center: ROC Curve

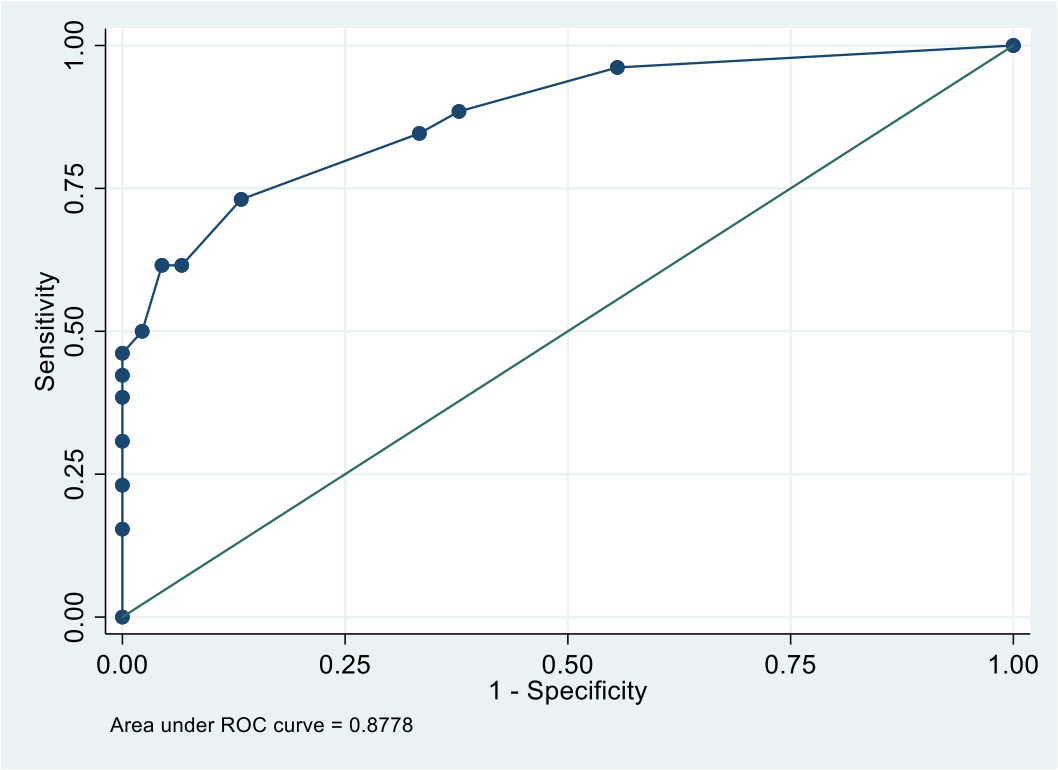
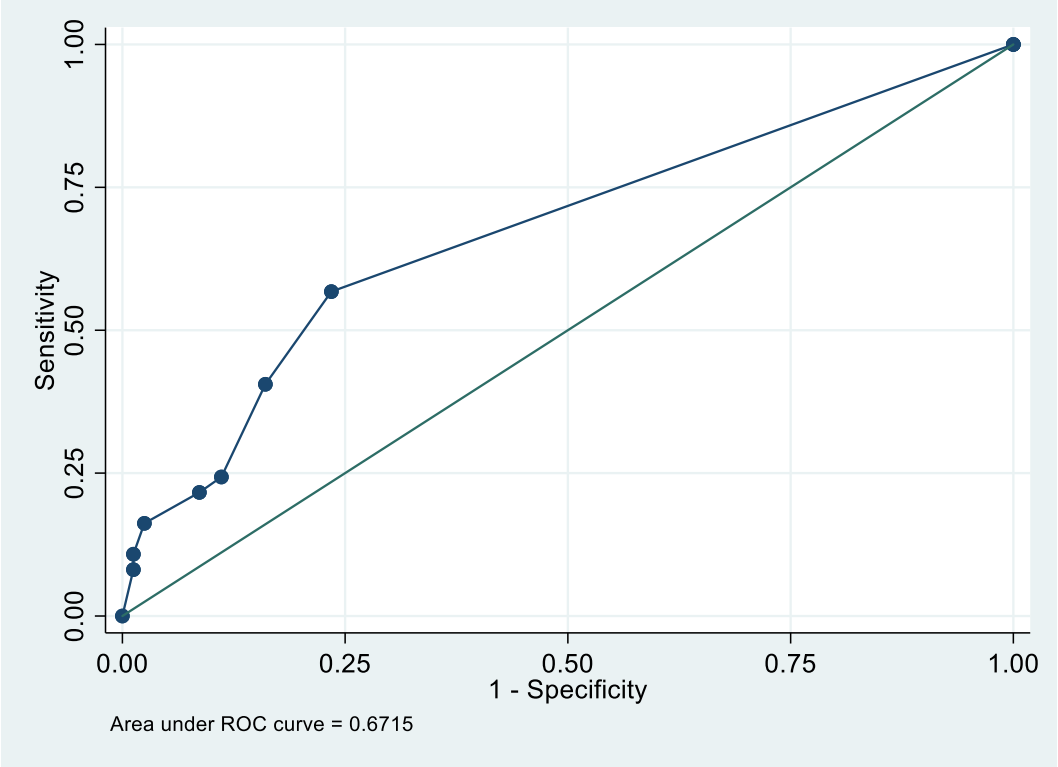


Table 5. Logistic Regression: Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7, NMC-CPC†

Characteristics	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Methadone, Months 4-7	2.9	.71-11.7	1.48	0.140
Cocaine Use, Months 0-1	1.8	.65-4.8	1.11	0.267
Past 30-day Suicidal Thoughts at Baseline	2.5	.89-6.9	1.74	0.082

† Pseudo R2 = 0.0748, p = 0.0119; H-L chi2 (3) = 5.09, p=0.1655; Area Under ROC Curve= 0.6715; Mean VIF: 1.18

Predictors of Non-Prescribed Opioid Use (Excluding MAT) at Months 4-7 at the NMC-CPC: ROC Curve



Predictors of Non-Prescribed Buprenorphine & Methadone at Baseline, All Participants & by Sub-Group

Table 1. Logistic Regression: Baseline Predictors of Non-Prescribed Buprenorphine Use at Baseline, All Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
THC Use, Months 0-1	1.7	1.1-2.8	2.25	0.024
Past 30-Day Suicidal Thoughts at Baseline	2.2	1.1-4.2	2.33	0.020
Yearly Income Below Federal Poverty Line at Baseline	.50	.30-.83	-2.67	0.008
Past 30-day Residential Treatment/Halfway House at Baseline	.56	.33-.98	-2.03	0.042

† Pseudo R2 = 0.0670, p = <0.0001; H-L chi2 (6) = 4.38, p=0.6256; Area Under ROC Curve= 0.6747; Mean VIF: 1.07

Predictors of Non-Prescribed Buprenorphine Use at Baseline, All Participants: ROC Curve

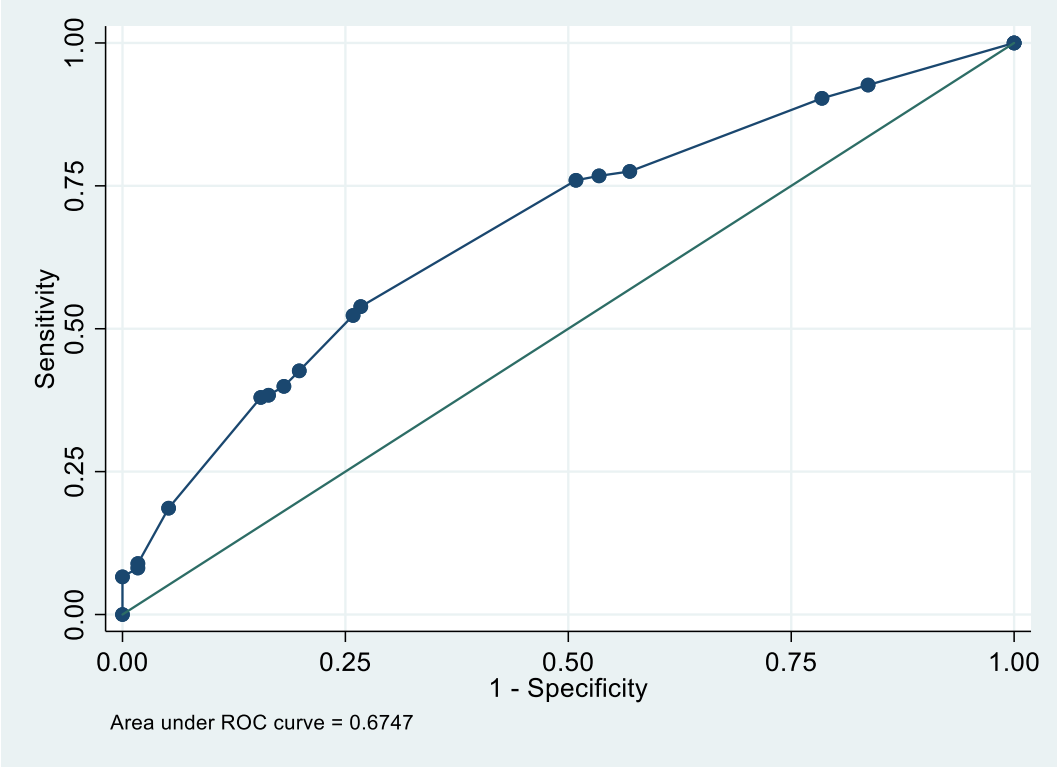


Table 2. Logistic Regression: Baseline Predictors of Non-Prescribed Buprenorphine Use at Baseline, Corrections-Involved Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Level of Care at Baseline (Hub vs. Spoke)	.43	.24-.78	-2.81	0.005
THC Use, Months 0-1	1.8	1.0-3.1	1.98	0.048
Past 30-Day Suicidal Thoughts at Baseline	3.2	1.3-7.7	2.57	0.010
Yearly Income Below Federal Poverty Line at Baseline	.50	.27-.93	-2.19	0.028

† Pseudo R2 = 0.0915, p = <0.0001; H-L chi2 (6) = 5.96, p=0.4272; Area Under ROC Curve= 0.7068; Mean VIF: 1.04

Predictors of Non-Prescribed Buprenorphine Use at Baseline, Corrections-Involved Participants: ROC Curve

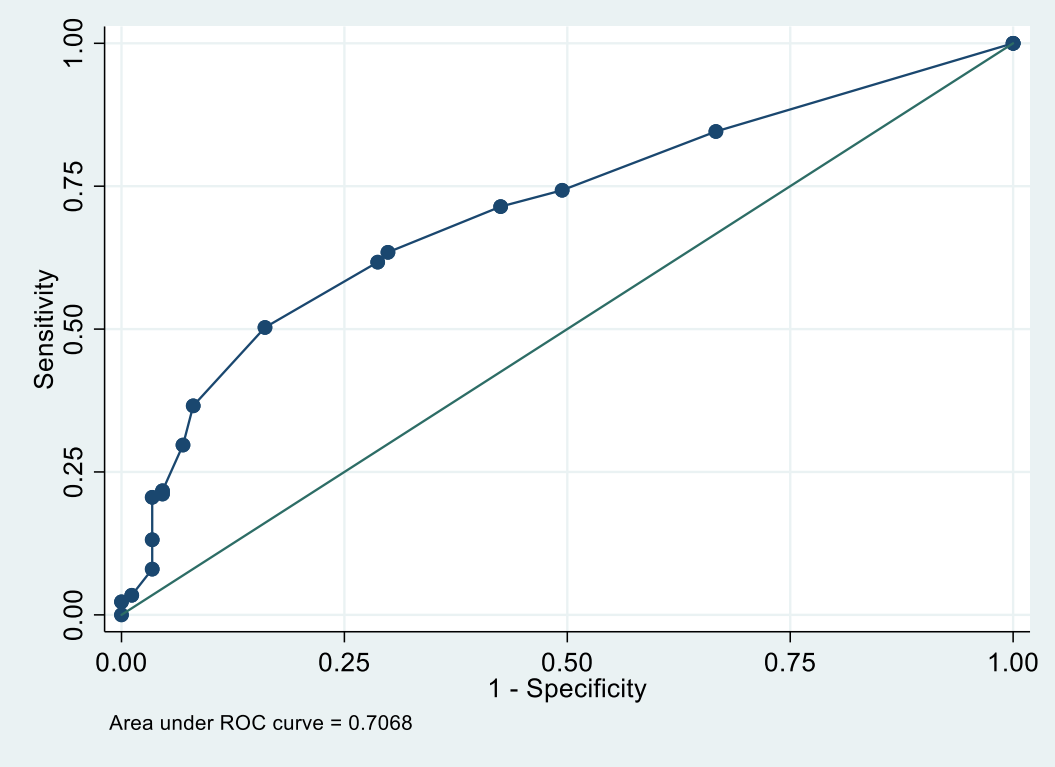


Table 3. Logistic Regression: Baseline Predictors of Non-Prescribed Buprenorphine Use at Baseline, DCF-Involved Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Level of Care at Baseline (Hub vs. Spoke)	.10	.03-.33	-3.76	<0.001
Prescribed Buprenorphine, Months 0-1	5.3	1.6-17.8	2.72	0.006
THC Use, Months 0-1	7.1	2.5-20.5	3.61	<0.001
Yearly Income Below Federal Poverty Line at Baseline	.24	.08-.73	-2.52	0.012
Residential Treatment/Halfway House at Baseline	.44	.14-1.4	-1.37	0.171

† Pseudo R2 = 0.2617, p = <0.0001; H-L chi2 (7) = 9.65, p=0.2091; AUROC= 0.8254; Mean VIF: 1.10

Predictors of Non-Prescribed Buprenorphine Use at Baseline, DCF-Involved Participants: ROC Curve

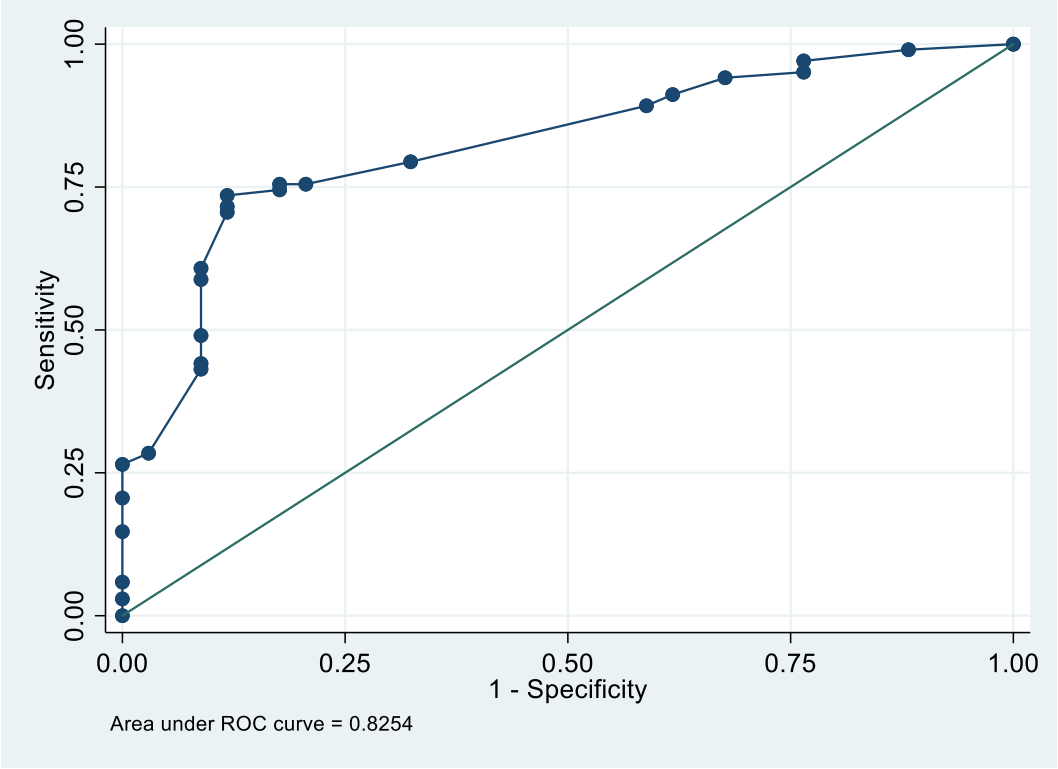


Table 4. Logistic Regression: Baseline Predictors of Non-Prescribed Buprenorphine Use at Baseline, Howard Center†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Buprenorphine, Months 0-1	2.1	1.0- 4.2	2.00	0.046
THC Use, Months 0-1	2.3	1.1- 4.7	2.18	0.029
Past 30-Day Suicidal Thoughts at Baseline	7.8	2.2- 27.7	3.19	0.001
Yearly Income Below Federal Poverty Line at Baseline	.67	.31- 1.4	-1.03	0.304

† Pseudo R2 = 0.1283, p = <0.0001; H-L chi2 (7) = 4.02, p=0. 7779; AUROC= 0.7183; Mean VIF: 1.08

Predictors of Non-Prescribed Buprenorphine Use at Baseline, Howard Center: ROC Curve

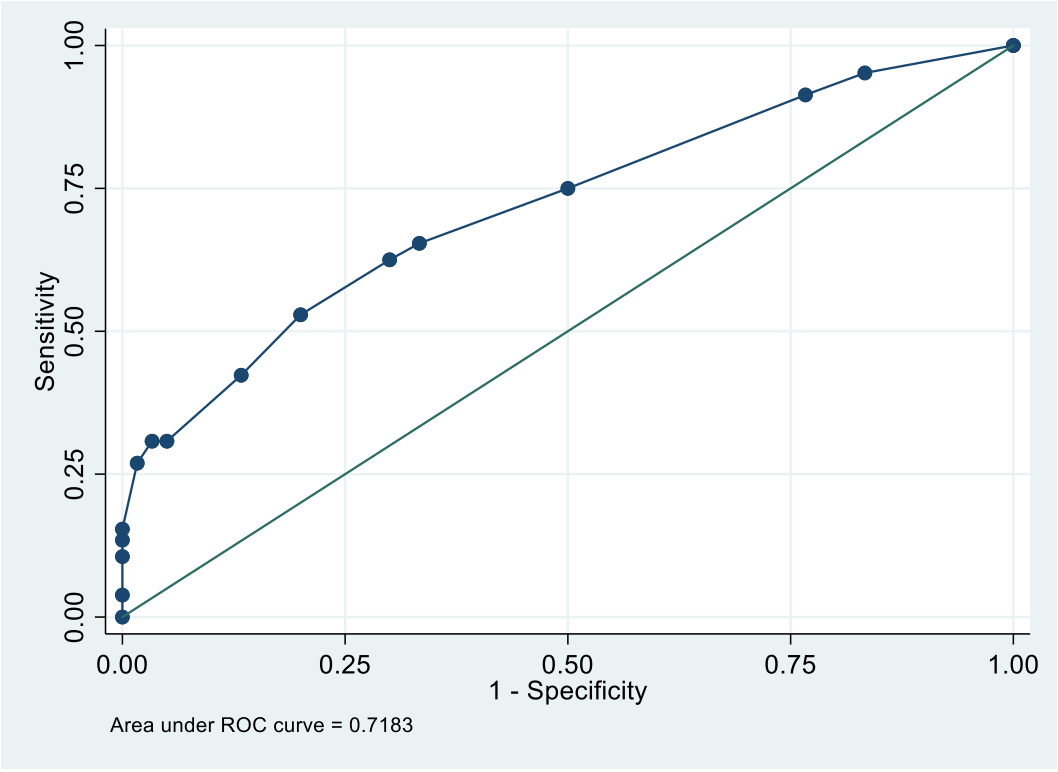


Table 5. Logistic Regression: Baseline Predictors of Non-Prescribed Buprenorphine Use at Baseline, NMC-CPC†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Involved with Corrections	.41	.15-1.1	-1.71	0.087
Amphetamine Use, Months 0-1	7.0	.86- 57.1	1.82	0.069
Involved with DCF	2.2	.85-5.5	1.62	0.106
Employed at Baseline	3.6	1.2- 10.4	2.33	0.020

† Pseudo R2 = 0.1244, p = 0.0012 ; H-L chi2 (7) = 3.46, p=0.8398; AUROC= 0.7430; Mean VIF: 1.04

Predictors of Non-Prescribed Buprenorphine Use at Baseline, NMC-CPC: ROC Curve

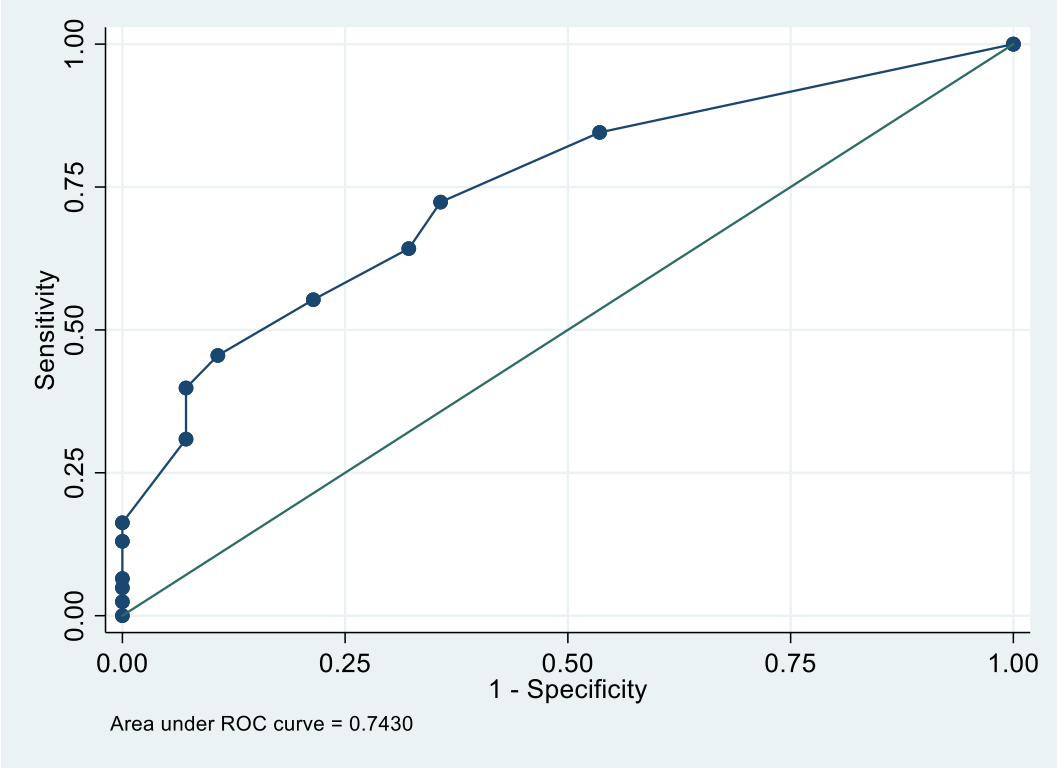


Table 6. Logistic Regression: Baseline Predictors of Non-Prescribed Methadone Use at Baseline, All Participants†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Methadone, Months 0-1	2.7	1.1- 6.4	2.18	0.029
Binge Drinking at Baseline	2.6	1.2- 5.3	2.52	0.012
PTSD at Baseline	2.9	1.4- 5.7	2.98	0.003
Residential Treatment/Halfway House at Baseline	.17	.04-.73	-2.38	0.017

† Pseudo R2 = 0.1305, p = <0.0001; H-L chi2 (5) = 3.11, p=0.6828; AUROC= 0.7521; Mean VIF: 1.02

Predictors of Non-Prescribed Methadone Use at Baseline, All Participants: ROC Curve

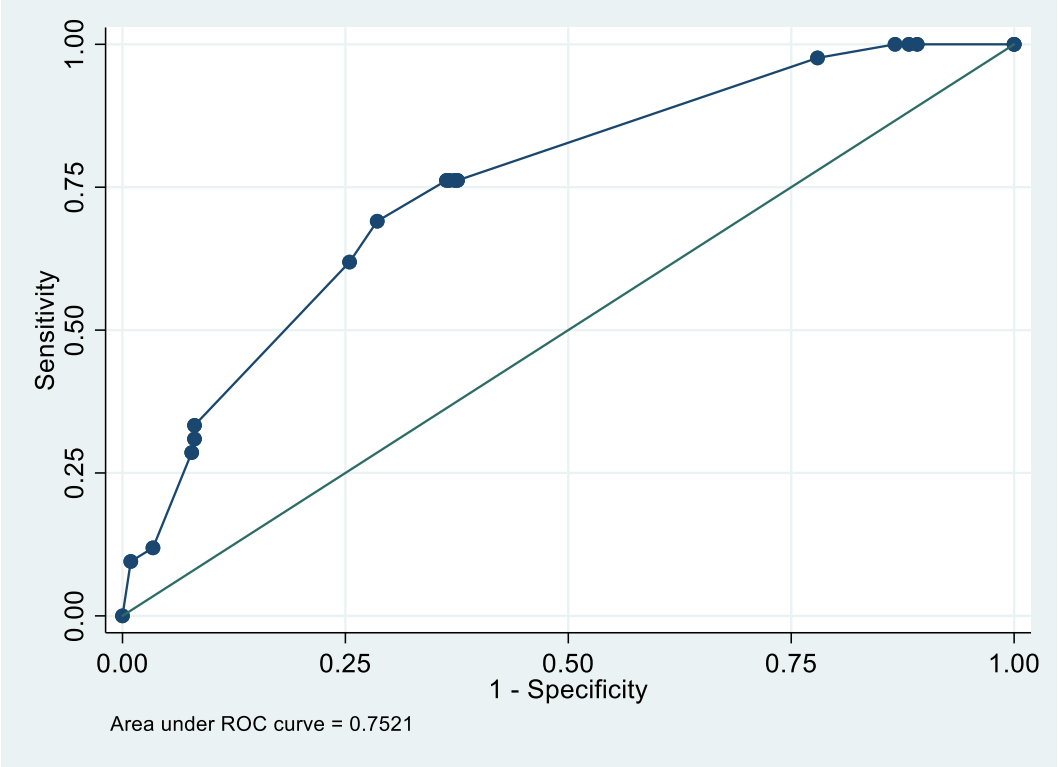
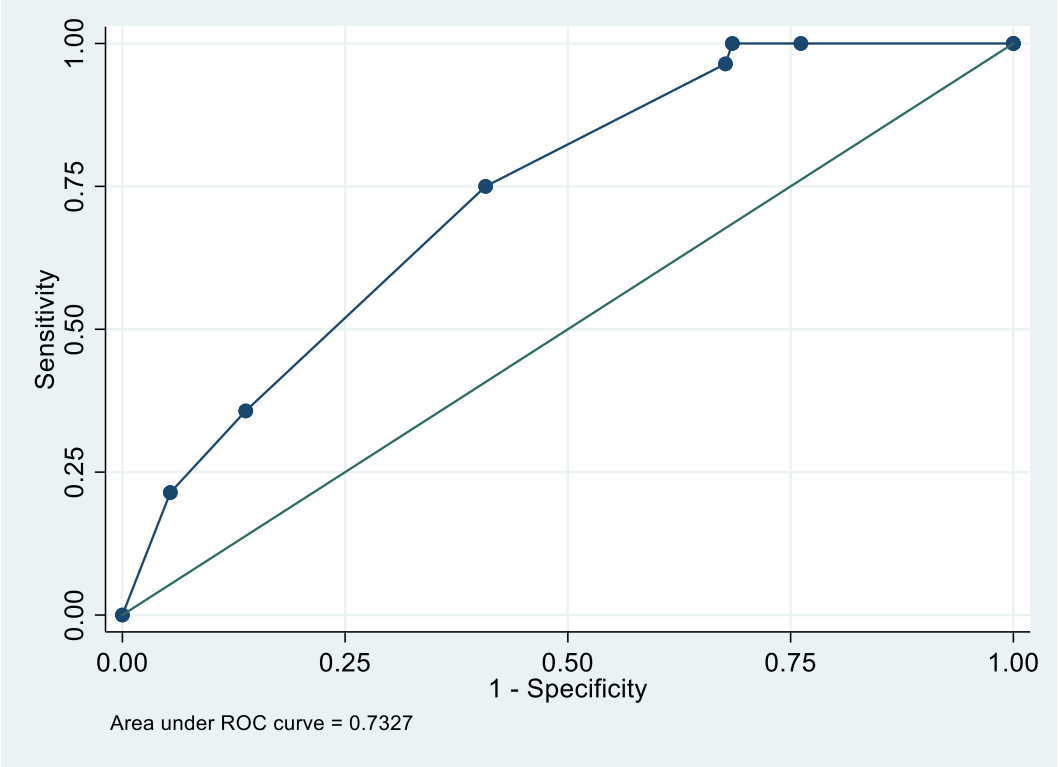


Table 7. Logistic Regression: Baseline Predictors of Non-Prescribed Methadone Use at Baseline, Howard Center†

Factors	Odds Ratio	95% Confidence Interval	z	P>|z|
Prescribed Buprenorphine, Months 0-1	.44	.18-1.1	-1.78	0.075
Binge Drinking at Baseline	3.0	1.2-7.7	2.29	0.022
Residential Treatment/Halfway House at Baseline	.11	.01-.85	-2.11	0.035

† Pseudo R2 = 0.1401, p = 0.0001; H-L chi2 (4) = 1.59, p= 0.8101; AUROC= 0.7327; Mean VIF: 1.07

Predictors of Non-Prescribed Methadone Use at Baseline, Howard Center: ROC Curve



Appendix E: AIM 3 Main Effects Tables

Effects of Cocaine Use (Yes/No) * Time on Use of Non-Prescribed Opioids

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Cocaine Use	1	497	36.43	<.0001
Time	2	461	67.07	<.0001
Cocaine Use*Time	2	461	1.07	0.3453

Cocaine Use*Time Least Squares Means													
Cocaine Use	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	1.6212	0.1686	461	9.62	<.0001	0.05	1.2899	1.9525	0.8350	0.02323	0.7841	0.8757
0	2	-0.9105	0.1732	461	-5.26	<.0001	0.05	-1.2510	-0.5701	0.2869	0.03544	0.2225	0.3612
0	3	-1.0080	0.2068	461	-4.88	<.0001	0.05	-1.4143	-0.6017	0.2674	0.04050	0.1956	0.3540
1	1	3.4817	0.4508	461	7.72	<.0001	0.05	2.5958	4.3675	0.9702	0.01305	0.9306	0.9875
1	2	0.1906	0.1755	461	1.09	0.2781	0.05	-0.1543	0.5354	0.5475	0.04348	0.4615	0.6308
1	3	0.1406	0.1858	461	0.76	0.4495	0.05	-0.2245	0.5058	0.5351	0.04623	0.4441	0.6238

Tests of Effect Slices for Cocaine Use*Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	1	461	14.94	0.0001
2	1	461	19.94	<.0001
3	1	461	17.07	<.0001

Tests of Effect Slices for Cocaine Use*Time Sliced By Cocaine Use				
Cocaine Use	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	461	72.16	<.0001
1	2	461	26.05	<.0001

Effects of Cocaine Use (Yes/No) * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Cocaine Use	1	496	64.30	<.0001
Time	2	459	25.77	<.0001
Cocaine Use*Time	2	459	1.98	0.1394

Cocaine Use*Time Least Squares Means													
Cocaine Use	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	-0.6366	0.1309	459	-4.86	<.0001	0.05	-0.8938	-0.3794	0.3460	0.02962	0.2903	0.4063
0	2	-1.4564	0.2014	459	-7.23	<.0001	0.05	-1.8521	-1.0606	0.1890	0.03087	0.1356	0.2572
0	3	-1.3029	0.2277	459	-5.72	<.0001	0.05	-1.7504	-0.8554	0.2137	0.03826	0.1480	0.2983
1	1	1.2794	0.1877	459	6.82	<.0001	0.05	0.9106	1.6482	0.7824	0.03196	0.7131	0.8387
1	2	-0.07411	0.1739	459	-0.43	0.6702	0.05	-0.4159	0.2677	0.4815	0.04342	0.3975	0.5665
1	3	-0.03572	0.1908	459	-0.19	0.8516	0.05	-0.4108	0.3393	0.4911	0.04770	0.3987	0.5840

Tests of Effect Slices for Cocaine Use*Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	1	459	70.13	<.0001
2	1	459	26.99	<.0001
3	1	459	18.19	<.0001

Tests of Effect Slices for Cocaine Use*Time Sliced By Cocaine Use				
Cocaine Use	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	459	8.69	0.0002
1	2	459	17.22	<.0001

Effects of Social Support Score * Time on Use of Non-Prescribed Opioids

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Social Support	5	675	2.44	0.0335
Time	2	115	57.31	<.0001
Social Support*time	10	115	0.30	0.9795

Social Support*Time Least Squares Means													
Social Support	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	2.5849	0.6183	115	4.18	<.0001	0.05	1.3602	3.8097	0.9299	0.04031	0.7958	0.9783
0	2	0.3499	0.4825	115	0.73	0.4698	0.05	-0.6059	1.3057	0.5866	0.1170	0.3530	0.7868
0	3	-0.2220	0.8224	115	-0.27	0.7877	0.05	-1.8510	1.4071	0.4447	0.2031	0.1358	0.8033
1	1	2.6706	0.5747	115	4.65	<.0001	0.05	1.5323	3.8090	0.9353	0.03479	0.8223	0.9783
1	2	0.3888	0.5206	115	0.75	0.4566	0.05	-0.6423	1.4200	0.5960	0.1253	0.3447	0.8053
1	3	-0.3940	0.5522	115	-0.71	0.4769	0.05	-1.4878	0.6998	0.4027	0.1328	0.1842	0.6681
2	1	2.5695	0.5212	115	4.93	<.0001	0.05	1.5372	3.6018	0.9289	0.03443	0.8231	0.9735
2	2	0.2323	0.3942	115	0.59	0.5569	0.05	-0.5486	1.0132	0.5578	0.09724	0.3662	0.7336
2	3	-0.1693	0.4514	115	-0.38	0.7083	0.05	-1.0635	0.7249	0.4578	0.1121	0.2566	0.6737
3	1	2.5047	0.4346	115	5.76	<.0001	0.05	1.6437	3.3656	0.9245	0.03035	0.8380	0.9666
3	2	-0.3685	0.3698	115	-1.00	0.3212	0.05	-1.1011	0.3641	0.4089	0.08939	0.2495	0.5900
3	3	-0.2845	0.3910	115	-0.73	0.4684	0.05	-1.0590	0.4901	0.4294	0.09581	0.2575	0.6201
4	1	1.8327	0.3152	115	5.82	<.0001	0.05	1.2084	2.4570	0.8621	0.03747	0.7700	0.9211
4	2	-0.2606	0.3065	115	-0.85	0.3970	0.05	-0.8676	0.3465	0.4352	0.07533	0.2958	0.5858
4	3	-0.4649	0.3385	115	-1.37	0.1722	0.05	-1.1353	0.2055	0.3858	0.08020	0.2432	0.5512
5	1	1.5209	0.2648	115	5.74	<.0001	0.05	0.9963	2.0454	0.8207	0.03897	0.7303	0.8855
5	2	-0.6512	0.2280	115	-2.86	0.0051	0.05	-1.1029	-0.1994	0.3427	0.05137	0.2492	0.4503
5	3	-0.7344	0.2391	115	-3.07	0.0027	0.05	-1.2080	-0.2607	0.3242	0.05239	0.2300	0.4352

Tests of Effect Slices for Social Support *Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	5	115	1.67	0.1472
2	5	115	1.55	0.1806
3	5	115	0.39	0.8531

Tests of Effect Slices for Social Support *Time Sliced By Social Support				
Social Support	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	115	5.43	0.0056
1	2	115	8.18	0.0005
2	2	115	8.65	0.0003
3	2	115	15.37	<.0001
4	2	115	15.50	<.0001
5	2	115	23.18	<.0001

Effects of Social Support Score * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Social Support	5	670	4.96	0.0002
Time	2	112	14.02	<.0001
Social Support*time	10	112	1.22	0.2844

Social Support*Time Least Squares Means													
Social Support	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	0.3484	0.3006	112	1.16	0.2489	0.05	-0.2472	0.9441	0.5862	0.07292	0.4385	0.7199
0	2	0.08107	0.3486	112	0.23	0.8165	0.05	-0.6096	0.7717	0.5203	0.08700	0.3521	0.6839
0	3	-0.1872	0.7375	112	-0.25	0.8001	0.05	-1.6483	1.2740	0.4533	0.1828	0.1613	0.7814
1	1	1.1164	0.3140	112	3.55	0.0006	0.05	0.4942	1.7387	0.7533	0.05836	0.6211	0.8505
1	2	0.2930	0.4273	112	0.69	0.4943	0.05	-0.5536	1.1395	0.5727	0.1046	0.3650	0.7576
1	3	-0.6617	0.5365	112	-1.23	0.2200	0.05	-1.7248	0.4013	0.3403	0.1205	0.1512	0.5990
2	1	0.4493	0.2659	112	1.69	0.0939	0.05	-0.07758	0.9761	0.6105	0.06323	0.4806	0.7263
2	2	-0.6319	0.4080	112	-1.55	0.1242	0.05	-1.4402	0.1765	0.3471	0.09245	0.1915	0.5440
2	3	-0.4188	0.4151	112	-1.01	0.3152	0.05	-1.2413	0.4037	0.3968	0.09936	0.2242	0.5996
3	1	0.5959	0.2508	112	2.38	0.0192	0.05	0.09889	1.0929	0.6447	0.05746	0.5247	0.7489
3	2	-0.6158	0.4372	112	-1.41	0.1617	0.05	-1.4820	0.2504	0.3507	0.09956	0.1851	0.5623
3	3	-0.7118	0.4370	112	-1.63	0.1062	0.05	-1.5776	0.1541	0.3292	0.09650	0.1711	0.5384
4	1	-0.2368	0.2050	112	-1.16	0.2504	0.05	-0.6429	0.1693	0.4411	0.05053	0.3446	0.5422
4	2	-0.5568	0.2646	112	-2.10	0.0376	0.05	-1.0811	-0.03249	0.3643	0.06128	0.2533	0.4919
4	3	-0.8451	0.3346	112	-2.53	0.0129	0.05	-1.5081	-0.1821	0.3005	0.07033	0.1812	0.4546
5	1	-0.7730	0.2159	112	-3.58	0.0005	0.05	-1.2007	-0.3453	0.3158	0.04665	0.2313	0.4145
5	2	-1.4605	0.2661	112	-5.49	<.0001	0.05	-1.9877	-0.9332	0.1884	0.04069	0.1205	0.2823
5	3	-1.1566	0.2470	112	-4.68	<.0001	0.05	-1.6459	-0.6672	0.2393	0.04496	0.1617	0.3391

Tests of Effect Slices for Social Support *Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	5	112	7.17	<.0001
2	5	112	3.73	0.0037
3	5	112	0.73	0.6023

Tests of Effect Slices for Social Support *Time Sliced By Social Support				
Social Support	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	112	0.50	0.6077
1	2	112	4.87	0.0094
2	2	112	3.04	0.0518
3	2	112	4.79	0.0101
4	2	112	1.39	0.2543
5	2	112	2.55	0.0827

Effects of Prescribed Methadone (Yes/No) * Time on Use of Non-Prescribed Opioids

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Prescribed Methadone	1	480	7.03	0.0083
Time	2	475	30.94	<.0001
Prescribed Methadone*Time	2	475	0.86	0.4232

Prescribed Methadone*Time Least Squares Means													
Prescribed Methadone	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	2.0138	0.1599	475	12.59	<.0001	0.05	1.6996	2.3280	0.8822	0.01661	0.8455	0.9112
0	2	-0.6759	0.1396	475	-4.84	<.0001	0.05	-0.9502	-0.4016	0.3372	0.03120	0.2788	0.4009
0	3	-0.6737	0.1530	475	-4.40	<.0001	0.05	-0.9742	-0.3731	0.3377	0.03421	0.2740	0.4078
1	1	2.4655	0.5828	475	4.23	<.0001	0.05	1.3202	3.6107	0.9217	0.04207	0.7892	0.9737
1	2	0.3480	0.2488	475	1.40	0.1625	0.05	-0.1408	0.8369	0.5861	0.06035	0.4649	0.6978
1	3	-0.04625	0.2688	475	-0.17	0.8635	0.05	-0.5745	0.4820	0.4884	0.06717	0.3602	0.6182

Tests of Effect Slices for Prescribed Methadone*Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	1	475	0.56	0.4552
2	1	475	12.88	0.0004
3	1	475	4.12	0.0431

Tests of Effect Slices for Prescribed Methadone*Time Sliced By Prescribed Methadone				
Prescribed Methadone	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	475	102.10	<.0001
1	2	475	7.72	0.0005

Effects of Prescribed Methadone (Yes/No) * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Prescribed Methadone	1	480	34.48	<.0001
Time	2	475	14.10	<.0001
Prescribed Methadone*Time	2	475	2.12	0.1217

Prescribed Methadone*Time Least Squares Means													
Prescribed Methadone	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	-0.07837	0.1033	475	-0.76	0.4484	0.05	-0.2813	0.1246	0.4804	0.02578	0.4301	0.5311
0	2	-1.2585	0.1618	475	-7.78	<.0001	0.05	-1.5765	-0.9404	0.2212	0.02789	0.1713	0.2808
0	3	-1.0341	0.1697	475	-6.09	<.0001	0.05	-1.3676	-0.7006	0.2623	0.03284	0.2030	0.3317
1	1	1.2809	0.3610	475	3.55	0.0004	0.05	0.5716	1.9903	0.7826	0.06142	0.6391	0.8798
1	2	0.4177	0.2503	475	1.67	0.0958	0.05	-0.07411	0.9096	0.6029	0.05992	0.4815	0.7129
1	3	-0.1092	0.2728	475	-0.40	0.6891	0.05	-0.6452	0.4268	0.4727	0.06799	0.3441	0.6051

Tests of Effect Slices for Prescribed Methadone*Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	1	475	13.10	0.0003
2	1	475	31.62	<.0001
3	1	475	8.29	0.0042

Tests of Effect Slices for Prescribed Methadone*Time Sliced By Prescribed Methadone				
Prescribed Methadone	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	475	28.89	<.0001
1	2	475	5.26	0.0055

Effects of Prescribed Buprenorphine (Yes/No) * Time on Use of Non-Prescribed Opioids

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Prescribed Buprenorphine	1	567	24.31	<.0001
Time	2	388	79.73	<.0001
Prescribed Buprenorphine *Time	2	388	1.52	0.2205

Prescribed Buprenorphine*Time Least Squares Means													
Prescribed Buprenorphine	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	2.3384	0.2164	388	10.80	<.0001	0.05	1.9129	2.7640	0.9120	0.01737	0.8713	0.9407
0	2	0.4384	0.2086	388	2.10	0.0362	0.05	0.02835	0.8484	0.6079	0.04971	0.5071	0.7002
0	3	0.07704	0.2304	388	0.33	0.7383	0.05	-0.3759	0.5300	0.5193	0.05751	0.4071	0.6295
1	1	1.7300	0.2280	388	7.59	<.0001	0.05	1.2817	2.1783	0.8494	0.02917	0.7827	0.8983
1	2	-0.8126	0.1523	388	-5.34	<.0001	0.05	-1.1120	-0.5131	0.3073	0.03242	0.2475	0.3745
1	3	-0.8659	0.1684	388	-5.14	<.0001	0.05	-1.1969	-0.5349	0.2961	0.03509	0.2320	0.3694

Tests of Effect Slices for Prescribed Buprenorphine *Time Sliced By Time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	1	388	3.75	0.0537
2	1	388	23.46	<.0001
3	1	388	10.92	0.0010

Tests of Effect Slices for Prescribed Buprenorphine *Time Sliced By Prescribed Buprenorphine				
Prescribed Buprenorphine	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	388	28.55	<.0001
1	2	388	55.84	<.0001

Effects of Prescribed Buprenorphine (Yes/No) * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Type III Tests of Fixed Effects				
Effect	**N DF**	**D DF**	**F Value**	**Pr > F**
Prescribed Buprenorphine	1	567	13.33	0.0003
Time	2	388	12.72	<.0001
Prescribed Buprenorphine *Time	2	388	4.73	0.0093

Prescribed Buprenorphine*Time Least Squares Means													
Prescribed Buprenorphine	**Time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Mean**	**Standard Error Mean**	**Lower Mean**	**Upper Mean**
0	1	0.1325	0.1226	388	1.08	0.2803	0.05	-0.1085	0.3736	0.5331	0.03052	0.4729	0.5923
0	2	-0.08516	0.2083	388	-0.41	0.6829	0.05	-0.4947	0.3243	0.4787	0.05198	0.3788	0.5804
0	3	-0.3600	0.2400	388	-1.50	0.1344	0.05	-0.8318	0.1118	0.4110	0.05809	0.3033	0.5279
1	1	-0.08923	0.1612	388	-0.55	0.5802	0.05	-0.4061	0.2277	0.4777	0.04021	0.3998	0.5567
1	2	-1.2083	0.1695	388	-7.13	<.0001	0.05	-1.5416	-0.8751	0.2300	0.03002	0.1763	0.2942
1	3	-1.0116	0.1776	388	-5.70	<.0001	0.05	-1.3608	-0.6624	0.2667	0.03473	0.2041	0.3402

Tests of Effect Slices for Buprenorphine*Time Sliced By time				
Time	**N DF**	**D DF**	**F Value**	**Pr > F**
1	1	388	1.20	0.2741
2	1	388	17.49	<.0001
3	1	388	4.76	0.0297

Tests of Effect Slices for Prescribed Buprenorphine *Time Sliced By Prescribed Buprenorphine				
Prescribed Buprenorphine	**N DF**	**D DF**	**F Value**	**Pr > F**
0	2	388	1.77	0.1722
1	2	388	16.86	<.0001

Appendix F: AIM 3 Post-Hoc Tables

Effects of Cocaine Use (Yes/No) * Time on Use of Non-Prescribed Opioids

Simple Effect Comparisons of Cocaine Use*time Least Squares Means By time													
Simple Effect Level	**Cocaine Use**	**Cocaine Use**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
time 1	0	1	-1.8605	0.4813	461	-3.87	0.0001	0.05	-2.8063	-0.9147	0.156	0.060	0.401
time 2	0	1	-1.1011	0.2466	461	-4.47	<.0001	0.05	-1.5857	-0.6165	0.333	0.205	0.540
time 3	0	1	-1.1486	0.2780	461	-4.13	<.0001	0.05	-1.6949	-0.6023	0.317	0.184	0.548

Simple Effect Comparisons of Cocaine Use*time Least Squares Means By Cocaine Use													
Simple Effect Level	**time**	**time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
Cocaine Use 0	1	2	2.5317	0.2250	461	11.25	<.0001	0.05	2.0895	2.9739	12.575	8.081	19.569
Cocaine Use 0	1	3	2.6292	0.2589	461	10.16	<.0001	0.05	2.1204	3.1379	13.862	8.335	23.056
Cocaine Use 0	2	3	0.09745	0.2174	461	0.45	0.6541	0.05	-0.3297	0.5246	1.102	0.719	1.690
Cocaine Use 1	1	2	3.2911	0.4743	461	6.94	<.0001	0.05	2.3590	4.2231	26.872	10.581	68.248
Cocaine Use 1	1	3	3.3410	0.4671	461	7.15	<.0001	0.05	2.4231	4.2589	28.248	11.281	70.731
Cocaine Use 1	2	3	0.04992	0.1935	461	0.26	0.7966	0.05	-0.3304	0.4302	1.051	0.719	1.538

Effects of Cocaine Use (Yes/No) * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Simple Effect Comparisons of Cocaine Use*time Least Squares Means By time													
Simple Effect Level	**Cocaine Use**	**Cocaine Use**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
time 1	0	1	-1.9161	0.2288	459	-8.37	<.0001	0.05	-2.3657	-1.4664	0.147	0.094	0.231
time 2	0	1	-1.3823	0.2661	459	-5.19	<.0001	0.05	-1.9052	-0.8594	0.251	0.149	0.423
time 3	0	1	-1.2672	0.2971	459	-4.26	<.0001	0.05	-1.8511	-0.6833	0.282	0.157	0.505

Simple Effect Comparisons of Cocaine Use*time Least Squares Means By Cocaine Use													
Simple Effect Level	**time**	**time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
Cocaine Use 0	1	2	0.8197	0.2037	459	4.02	<.0001	0.05	0.4193	1.2201	2.270	1.521	3.388
Cocaine Use 0	1	3	0.6663	0.2362	459	2.82	0.0050	0.05	0.2021	1.1305	1.947	1.224	3.097
Cocaine Use 0	2	3	-0.1534	0.2303	459	-0.67	0.5056	0.05	-0.6061	0.2992	0.858	0.545	1.349
Cocaine Use 1	1	2	1.3535	0.2373	459	5.70	<.0001	0.05	0.8873	1.8198	3.871	2.428	6.171
Cocaine Use 1	1	3	1.3151	0.2605	459	5.05	<.0001	0.05	0.8032	1.8271	3.725	2.233	6.216
Cocaine Use 1	2	3	-0.03839	0.1888	459	-0.20	0.8389	0.05	-0.4093	0.3326	0.962	0.664	1.395

Effects of Social Support Score * Time on Use of Non-Prescribed Opioids

Simple Effect Comparisons of Social Support*time Least Squares Means By time													
Simple Effect Level	**Social Support**	**Social Support**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
time 1	0	1	-0.08571	0.8442	115	-0.10	0.9193	0.05	-1.7578	1.5864	0.918	0.172	4.886
time 1	0	2	0.01540	0.8087	115	0.02	0.9848	0.05	-1.5864	1.6172	1.016	0.205	5.039
time 1	0	3	0.08023	0.7558	115	0.11	0.9156	0.05	-1.4169	1.5773	1.084	0.242	4.842
time 1	0	4	0.7522	0.6940	115	1.08	0.2807	0.05	-0.6225	2.1269	2.122	0.537	8.389
time 1	0	5	1.0641	0.6726	115	1.58	0.1164	0.05	-0.2683	2.3964	2.898	0.765	10.984
time 1	1	2	0.1011	0.7758	115	0.13	0.8965	0.05	-1.4356	1.6378	1.106	0.238	5.144
time 1	1	3	0.1659	0.7206	115	0.23	0.8183	0.05	-1.2613	1.5932	1.181	0.283	4.920
time 1	1	4	0.8379	0.6554	115	1.28	0.2037	0.05	-0.4604	2.1362	2.312	0.631	8.467
time 1	1	5	1.1498	0.6328	115	1.82	0.0718	0.05	-0.1036	2.4032	3.158	0.902	11.058
time 1	2	3	0.06483	0.6786	115	0.10	0.9241	0.05	-1.2794	1.4090	1.067	0.278	4.092
time 1	2	4	0.7368	0.6090	115	1.21	0.2288	0.05	-0.4696	1.9432	2.089	0.625	6.981
time 1	2	5	1.0487	0.5846	115	1.79	0.0754	0.05	-0.1092	2.2066	2.854	0.897	9.085
time 1	3	4	0.6720	0.5369	115	1.25	0.2132	0.05	-0.3915	1.7354	1.958	0.676	5.671
time 1	3	5	0.9838	0.5090	115	1.93	0.0557	0.05	-0.02429	1.9920	2.675	0.976	7.330
time 1	4	5	0.3119	0.4116	115	0.76	0.4502	0.05	-0.5035	1.1272	1.366	0.604	3.087
time 2	0	1	-0.03894	0.7098	115	-0.05	0.9563	0.05	-1.4450	1.3671	0.962	0.236	3.924
time 2	0	2	0.1176	0.6231	115	0.19	0.8506	0.05	-1.1167	1.3519	1.125	0.327	3.865
time 2	0	3	0.7184	0.6080	115	1.18	0.2398	0.05	-0.4859	1.9227	2.051	0.615	6.839
time 2	0	4	0.6105	0.5716	115	1.07	0.2878	0.05	-0.5218	1.7428	1.841	0.593	5.713
time 2	0	5	1.0011	0.5337	115	1.88	0.0632	0.05	-0.05613	2.0583	2.721	0.945	7.832
time 2	1	2	0.1565	0.6530	115	0.24	0.8110	0.05	-1.1369	1.4500	1.169	0.321	4.263
time 2	1	3	0.7574	0.6386	115	1.19	0.2381	0.05	-0.5075	2.0222	2.133	0.602	7.555
time 2	1	4	0.6494	0.6041	115	1.08	0.2846	0.05	-0.5472	1.8460	1.914	0.579	6.334
time 2	1	5	1.0400	0.5683	115	1.83	0.0699	0.05	-0.08575	2.1658	2.829	0.918	8.721
time 2	2	3	0.6008	0.5406	115	1.11	0.2687	0.05	-0.4699	1.6715	1.824	0.625	5.320
time 2	2	4	0.4929	0.4993	115	0.99	0.3257	0.05	-0.4962	1.4819	1.637	0.609	4.402
time 2	2	5	0.8835	0.4554	115	1.94	0.0549	0.05	-0.01869	1.7856	2.419	0.981	5.963
time 2	3	4	-0.1079	0.4803	115	-0.22	0.8226	0.05	-1.0593	0.8435	0.898	0.347	2.324
time 2	3	5	0.2827	0.4345	115	0.65	0.5167	0.05	-0.5780	1.1433	1.327	0.561	3.137

time 2	4	5	0.3906	0.3820	115	1.02	0.3087	0.05	-0.3661	1.1473	1.478	0.693	3.150
time 3	0	1	0.1721	0.9906	115	0.17	0.8624	0.05	-1.7901	2.1343	1.188	0.167	8.451
time 3	0	2	-0.05265	0.9382	115	-0.06	0.9553	0.05	-1.9110	1.8057	0.949	0.148	6.084
time 3	0	3	0.06252	0.9107	115	0.07	0.9454	0.05	-1.7413	1.8664	1.065	0.175	6.465
time 3	0	4	0.2430	0.8894	115	0.27	0.7852	0.05	-1.5187	2.0046	1.275	0.219	7.423
time 3	0	5	0.5124	0.8565	115	0.60	0.5508	0.05	-1.1841	2.2090	1.669	0.306	9.106
time 3	1	2	-0.2247	0.7132	115	-0.32	0.7533	0.05	-1.6375	1.1881	0.799	0.194	3.281
time 3	1	3	-0.1096	0.6766	115	-0.16	0.8716	0.05	-1.4499	1.2307	0.896	0.235	3.424
time 3	1	4	0.07088	0.6477	115	0.11	0.9130	0.05	-1.2120	1.3538	1.073	0.298	3.872
time 3	1	5	0.3403	0.6018	115	0.57	0.5728	0.05	-0.8516	1.5323	1.405	0.427	4.629
time 3	2	3	0.1152	0.5972	115	0.19	0.8474	0.05	-1.0678	1.2982	1.122	0.344	3.663

Simple Effect Comparisons of Social Support Score*time Least Squares Means By Social Support Score

Simple Effect Level	time	time	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Odds Ratio	Upper Odds Ratio
Social Support	1	2	2.2350	0.7331	115	3.05	0.0029	0.05	0.7828	3.6872	9.347	2.188	39.935
Social Support	1	3	2.8069	1.0320	115	2.72	0.0075	0.05	0.7628	4.8510	16.558	2.144	127.867
Social Support	2	3	0.5719	0.8792	115	0.65	0.5167	0.05	-1.1697	2.3135	1.772	0.310	10.109
Social Support	1	2	2.2818	0.7414	115	3.08	0.0026	0.05	0.8132	3.7504	9.794	2.255	42.538
Social Support	1	3	3.0647	0.7867	115	3.90	0.0002	0.05	1.5063	4.6230	21.427	4.510	101.800
Social Support	2	3	0.7829	0.7188	115	1.09	0.2784	0.05	-0.6409	2.2067	2.188	0.527	9.085
Social Support	1	2	2.3372	0.6405	115	3.65	0.0004	0.05	1.0686	3.6059	10.352	2.911	36.815
Social Support	1	3	2.7388	0.6922	115	3.96	0.0001	0.05	1.3678	4.1099	15.469	3.927	60.938
Social Support	2	3	0.4016	0.5292	115	0.76	0.4495	0.05	-0.6466	1.4498	1.494	0.524	4.262
Social Support	1	2	2.8732	0.5540	115	5.19	<.0001	0.05	1.7759	3.9705	17.694	5.906	53.010
Social Support	1	3	2.7892	0.5811	115	4.80	<.0001	0.05	1.6381	3.9402	16.267	5.146	51.429
Social Support	2	3	-0.08403	0.4868	115	-0.17	0.8633	0.05	-1.0484	0.8803	0.919	0.351	2.412
Social Support	1	2	2.0933	0.4282	115	4.89	<.0001	0.05	1.2451	2.9415	8.111	3.473	18.944
Social Support	1	3	2.2976	0.4594	115	5.00	<.0001	0.05	1.3876	3.2077	9.951	4.005	24.722
Social Support	2	3	0.2044	0.4087	115	0.50	0.6180	0.05	-0.6052	1.0139	1.227	0.546	2.756
Social Support	1	2	2.1720	0.3447	115	6.30	<.0001	0.05	1.4893	2.8547	8.776	4.434	17.370
Social Support	1	3	2.2552	0.3543	115	6.37	<.0001	0.05	1.5534	2.9570	9.537	4.728	19.240
Social Support	2	3	0.08322	0.2567	115	0.32	0.7464	0.05	-0.4253	0.5918	1.087	0.654	1.807

Effects of Social Support Score * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Simple Effect Comparisons of Social Support Score *time Least Squares Means By time													
Simple Effect Level	Social Support	Social Support	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Odds Ratio	Upper Odds Ratio
time 1	0	1	-0.7680	0.4347	112	-1.77	0.0800	0.05	-1.6294	0.09338	0.464	0.196	1.098
time 1	0	2	-0.1008	0.4013	112	-0.25	0.8021	0.05	-0.8960	0.6944	0.904	0.408	2.002
time 1	0	3	-0.2475	0.3915	112	-0.63	0.5286	0.05	-1.0232	0.5283	0.781	0.359	1.696
time 1	0	4	0.5852	0.3638	112	1.61	0.1106	0.05	-0.1357	1.3061	1.795	0.873	3.692
time 1	0	5	1.1214	0.3701	112	3.03	0.0030	0.05	0.3881	1.8547	3.069	1.474	6.390
time 1	1	2	0.6672	0.4115	112	1.62	0.1078	0.05	-0.1482	1.4825	1.949	0.862	4.404
time 1	1	3	0.5205	0.4019	112	1.30	0.1980	0.05	-0.2758	1.3169	1.683	0.759	3.732
time 1	1	4	1.3532	0.3750	112	3.61	0.0005	0.05	0.6102	2.0962	3.870	1.841	8.135
time 1	1	5	1.8894	0.3811	112	4.96	<.0001	0.05	1.1343	2.6445	6.615	3.109	14.076
time 1	2	3	-0.1466	0.3655	112	-0.40	0.6891	0.05	-0.8709	0.5776	0.864	0.419	1.782
time 1	2	4	0.6860	0.3357	112	2.04	0.0434	0.05	0.02085	1.3512	1.986	1.021	3.862
time 1	2	5	1.2223	0.3425	112	3.57	0.0005	0.05	0.5436	1.9009	3.395	1.722	6.692
time 1	3	4	0.8327	0.3239	112	2.57	0.0115	0.05	0.1909	1.4745	2.299	1.210	4.369
time 1	3	5	1.3689	0.3309	112	4.14	<.0001	0.05	0.7132	2.0246	3.931	2.040	7.573
time 1	4	5	0.5362	0.2977	112	1.80	0.0743	0.05	-0.05359	1.1260	1.710	0.948	3.083
time 2	0	1	-0.2119	0.5514	112	-0.38	0.7015	0.05	-1.3045	0.8806	0.809	0.271	2.412
time 2	0	2	0.7130	0.5366	112	1.33	0.1867	0.05	-0.3503	1.7762	2.040	0.704	5.907
time 2	0	3	0.6969	0.5591	112	1.25	0.2153	0.05	-0.4110	1.8047	2.007	0.663	6.078
time 2	0	4	0.6379	0.4376	112	1.46	0.1478	0.05	-0.2293	1.5050	1.892	0.795	4.504
time 2	0	5	1.5415	0.4386	112	3.51	0.0006	0.05	0.6726	2.4105	4.672	1.959	11.139
time 2	1	2	0.9249	0.5908	112	1.57	0.1203	0.05	-0.2456	2.0954	2.522	0.782	8.128
time 2	1	3	0.9088	0.6113	112	1.49	0.1399	0.05	-0.3024	2.1200	2.481	0.739	8.331
time 2	1	4	0.8498	0.5026	112	1.69	0.0936	0.05	-0.1460	1.8455	2.339	0.864	6.331
time 2	1	5	1.7534	0.5034	112	3.48	0.0007	0.05	0.7561	2.7508	5.774	2.130	15.655
time 2	2	3	-0.01611	0.5980	112	-0.03	0.9786	0.05	-1.2009	1.1687	0.984	0.301	3.218
time 2	2	4	-0.07509	0.4863	112	-0.15	0.8776	0.05	-1.0386	0.8884	0.928	0.354	2.431
time 2	2	5	0.8286	0.4871	112	1.70	0.0917	0.05	-0.1366	1.7937	2.290	0.872	6.012
time 2	3	4	-0.05899	0.5110	112	-0.12	0.9083	0.05	-1.0715	0.9536	0.943	0.342	2.595
time 2	3	5	0.8447	0.5118	112	1.65	0.1017	0.05	-0.1694	1.8588	2.327	0.844	6.416
time 2	4	5	0.9037	0.3753	112	2.41	0.0177	0.05	0.1601	1.6472	2.469	1.174	5.193
time 3	0	1	0.4746	0.9120	112	0.52	0.6038	0.05	-1.3324	2.2816	1.607	0.264	9.792

time 3	0	2	0.2317	0.8463	112	0.27	0.7848	0.05	-1.4451	1.9084	1.261	0.236	6.742
time 3	0	3	0.5246	0.8572	112	0.61	0.5418	0.05	-1.1738	2.2231	1.690	0.309	9.236
time 3	0	4	0.6579	0.8098	112	0.81	0.4183	0.05	-0.9466	2.2625	1.931	0.388	9.607
time 3	0	5	0.9694	0.7777	112	1.25	0.2152	0.05	-0.5716	2.5103	2.636	0.565	12.309
time 3	1	2	-0.2429	0.6784	112	-0.36	0.7209	0.05	-1.5871	1.1012	0.784	0.205	3.008
time 3	1	3	0.05003	0.6920	112	0.07	0.9425	0.05	-1.3211	1.4211	1.051	0.267	4.142
time 3	1	4	0.1833	0.6323	112	0.29	0.7724	0.05	-1.0695	1.4362	1.201	0.343	4.205
time 3	1	5	0.4948	0.5907	112	0.84	0.4040	0.05	-0.6755	1.6651	1.640	0.509	5.286
time 3	2	3	0.2930	0.6027	112	0.49	0.6279	0.05	-0.9013	1.4872	1.340	0.406	4.425
time 3	2	4	0.4263	0.5332	112	0.80	0.4257	0.05	-0.6302	1.4827	1.532	0.533	4.405
time 3	2	5	0.7377	0.4830	112	1.53	0.1295	0.05	-0.2193	1.6948	2.091	0.803	5.446
time 3	3	4	0.1333	0.5504	112	0.24	0.8090	0.05	-0.9572	1.2238	1.143	0.384	3.400
time 3	3	5	0.4448	0.5020	112	0.89	0.3775	0.05	-0.5498	1.4394	1.560	0.577	4.218
time 3	4	5	0.3115	0.4159	112	0.75	0.4555	0.05	-0.5126	1.1355	1.365	0.599	3.113

Simple Effect Comparisons of Social Support Score *time Least Squares Means By Social Support Score													
Simple Effect Level	time	time	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Odds Ratio	Upper Odds Ratio
Social Support	1	3	0.2674	0.3026	112	0.88	0.3789	0.05	-0.3322	0.8670	1.307	0.717	2.380
Social Support	1	3	0.5356	0.7652	112	0.70	0.4854	0.05	-0.9806	2.0518	1.708	0.375	7.782
Social Support	2	3	0.2682	0.7390	112	0.36	0.7173	0.05	-1.1959	1.7324	1.308	0.302	5.654
Social Support	1	2	0.8234	0.4464	112	1.84	0.0677	0.05	-0.06100	1.7079	2.278	0.941	5.517
Social Support	1	3	1.7782	0.6023	112	2.95	0.0038	0.05	0.5847	2.9716	5.919	1.794	19.524
Social Support	2	3	0.9547	0.6337	112	1.51	0.1347	0.05	-0.3008	2.2103	2.598	0.740	9.118
Social Support	1	2	1.0811	0.4633	112	2.33	0.0214	0.05	0.1632	1.9991	2.948	1.177	7.383
Social Support	1	3	0.8681	0.4741	112	1.83	0.0698	0.05	-0.07129	1.8074	2.382	0.931	6.095
Social Support	2	3	-0.2131	0.4751	112	-0.45	0.6546	0.05	-1.1544	0.7282	0.808	0.315	2.071
Social Support	1	2	1.2117	0.5226	112	2.32	0.0222	0.05	0.1762	2.2471	3.359	1.193	9.460
Social Support	1	3	1.3077	0.5047	112	2.59	0.0108	0.05	0.3077	2.3076	3.698	1.360	10.050
Social Support	2	3	0.09599	0.6230	112	0.15	0.8778	0.05	-1.1384	1.3304	1.101	0.320	3.783
Social Support	1	3	0.3200	0.2864	112	1.12	0.2663	0.05	-0.2475	0.8875	1.377	0.781	2.429
Social Support	1	3	0.6083	0.3789	112	1.61	0.1112	0.05	-0.1425	1.3591	1.837	0.867	3.893
Social Support	2	3	0.2883	0.3576	112	0.81	0.4218	0.05	-0.4202	0.9968	1.334	0.657	2.710
Social Support	1	2	0.6875	0.3230	112	2.13	0.0355	0.05	0.04744	1.3275	1.989	1.049	3.771
Social Support	1	3	0.3836	0.3135	112	1.22	0.2237	0.05	-0.2375	1.0047	1.467	0.789	2.731
Social Support	2	3	-0.3039	0.2058	112	-1.48	0.1425	0.05	-0.7116	0.1038	0.738	0.491	1.109

Effects of Prescribed Methadone (Yes/No) * Time on Use of Non-Prescribed Opioids

Simple Effect Comparisons of Prescribed Methadone*time Least Squares Means By time											
Simple Effect Level	**Prescribed Methadone**	**Prescribed Methadone**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**
time 1	0	1	-0.4517	0.6044	475	-0.75	0.4552	0.05	-1.6393	0.7359	0.637
time 2	0	1	-1.0239	0.2853	475	-3.59	0.0004	0.05	-1.5844	-0.4634	0.359
time 3	0	1	-0.6274	0.3093	475	-2.03	0.0431	0.05	-1.2352	-0.01969	0.534

Simple Effect Comparisons of Prescribed Methadone*time Least Squares Means By Prescribed Methadone													
Simple Effect Level	**time**	**_time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
Prescribed Methadone	1	2	2.6897	0.1982	475	13.57	<.0001	0.05	2.3002	3.0791	14.727	9.976	21.739
Prescribed Methadone	1	3	2.6874	0.2112	475	12.72	<.0001	0.05	2.2723	3.1025	14.694	9.702	22.254
Prescribed Methadone	2	3	-0.00222	0.1584	475	-0.01	0.9888	0.05	-0.3134	0.3089	0.998	0.731	1.362
Prescribed Methadone	1	2	2.1174	0.6183	475	3.42	0.0007	0.05	0.9025	3.3324	8.310	2.466	28.007
Prescribed Methadone	1	3	2.5117	0.6391	475	3.93	<.0001	0.05	1.2559	3.7675	12.326	3.511	43.274
Prescribed Methadone	2	3	0.3943	0.3131	475	1.26	0.2085	0.05	-0.2209	1.0095	1.483	0.802	2.744

Effects of Prescribed Methadone (Yes/No) * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Simple Effect Comparisons of Prescribed Methadone*time Least Squares Means By time											
Simple Effect Level	**Prescribed Methadone**	**Prescribed Methadone**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**
time 1	0	1	-1.3593	0.3755	475	-3.62	0.0003	0.05	-2.0971	-0.6215	0.257
time 2	0	1	-1.6762	0.2981	475	-5.62	<.0001	0.05	-2.2619	-1.0905	0.187
time 3	0	1	-0.9249	0.3213	475	-2.88	0.0042	0.05	-1.5561	-0.2936	0.397

Simple Effect Comparisons of Prescribed Methadone*time Least Squares Means By Prescribed Methadone													
Simple Effect Level	**time**	**time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
Prescribed Methadone	1	2	1.1801	0.1604	475	7.36	<.0001	0.05	0.8649	1.4953	3.255	2.375	4.461
Prescribed Methadone	1	3	0.9557	0.1768	475	5.41	<.0001	0.05	0.6083	1.3031	2.601	1.837	3.681
Prescribed Methadone	2	3	-0.2244	0.1672	475	-1.34	0.1803	0.05	-0.5530	0.1042	0.799	0.575	1.110
Prescribed Methadone	1	2	0.8632	0.4112	475	2.10	0.0363	0.05	0.05526	1.6711	2.371	1.057	5.318
Prescribed Methadone	1	3	1.3901	0.4300	475	3.23	0.0013	0.05	0.5452	2.2350	4.015	1.725	9.347
Prescribed Methadone	2	3	0.5269	0.3247	475	1.62	0.1053	0.05	-0.1111	1.1650	1.694	0.895	3.206

Effects of Prescribed Buprenorphine (Yes/No) * Time on Use of Non-Prescribed Opioids

Simple Effect Comparisons of Prescribed Buprenorphine*time Least Squares Means By time											
Simple Effect Level	Prescribed Buprenorphine	Prescribed Buprenorphine	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio
time 1	0	1	0.6084	0.3144	388	1.94	0.0537	0.05	-0.00969	1.2265	1.837
time 2	0	1	1.2510	0.2583	388	4.84	<.0001	0.05	0.7432	1.7587	3.494
time 3	0	1	0.9429	0.2854	388	3.30	0.0010	0.05	0.3819	1.5040	2.567

Simple Effect Comparisons of Prescribed Buprenorphine*time Least Squares Means By Prescribed Buprenorphine													
Simple Effect Level	time	_time	Estimate	Standard Error	DF	t Value	Pr > |t|	Alpha	Lower	Upper	Odds Ratio	Lower Odds Ratio	Upper Odds Ratio
Prescribed Buprenorphine	1	2	1.9000	0.2911	388	6.53	<.0001	0.05	1.3277	2.4724	6.686	3.772	11.850
Prescribed Buprenorphine	1	3	2.2614	0.3174	388	7.13	<.0001	0.05	1.6374	2.8854	9.596	5.142	17.911
Prescribed Buprenorphine	2	3	0.3614	0.2568	388	1.41	0.1602	0.05	-0.1435	0.8662	1.435	0.866	2.378
Prescribed Buprenorphine	1	2	2.5426	0.2517	388	10.10	<.0001	0.05	2.0478	3.0374	12.713	7.751	20.851
Prescribed Buprenorphine	1	3	2.5959	0.2670	388	9.72	<.0001	0.05	2.0711	3.1208	13.409	7.933	22.664
Prescribed Buprenorphine	2	3	0.05331	0.1784	388	0.30	0.7652	0.05	-0.2974	0.4040	1.055	0.743	1.498

Effects of Prescribed Buprenorphine (Yes/No) * Time on Use of Non-Prescribed Opioids, Excluding Non-Prescribed MAT

Simple Effect Comparisons of bup_pres_r*time Least Squares Means By time													
Simple Effect Level	**Prescribed Buprenorphine**	**Prescribed Buprenorphine**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
time 1	0	1	0.2218	0.2025	388	1.10	0.2741	0.05	-0.1764	0.6199	1.248	0.838	1.859
time 2	0	1	1.1232	0.2685	388	4.18	<.0001	0.05	0.5952	1.6511	3.075	1.813	5.213
time 3	0	1	0.6516	0.2985	388	2.18	0.0297	0.05	0.06465	1.2385	1.919	1.067	3.451

Simple Effect Comparisons of bup_pres_r*time Least Squares Means By bup_pres_r													
Simple Effect Level	**time**	**_time**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**	**Alpha**	**Lower**	**Upper**	**Odds Ratio**	**Lower Odds Ratio**	**Upper Odds Ratio**
bup_pres_r 0	1	2	0.2177	0.2199	388	0.99	0.3228	0.05	-0.2146	0.6501	1.243	0.807	1.916
bup_pres_r 0	1	3	0.4925	0.2645	388	1.86	0.0633	0.05	-0.02746	1.0126	1.636	0.973	2.753
bup_pres_r 0	2	3	0.2748	0.2667	388	1.03	0.3035	0.05	-0.2496	0.7993	1.316	0.779	2.224
bup_pres_r 1	1	2	1.1191	0.1955	388	5.73	<.0001	0.05	0.7348	1.5034	3.062	2.085	4.497
bup_pres_r 1	1	3	0.9224	0.2162	388	4.27	<.0001	0.05	0.4972	1.3475	2.515	1.644	3.848
bup_pres_r 1	2	3	-0.1967	0.1826	388	-1.08	0.2821	0.05	-0.5558	0.1624	0.821	0.574	1.176

Appendix G: Loss to Follow-Up Baseline Characteristic Tables

Table 1. Baseline Characteristics of Participants with Non-Prescribed Opioid (Excluding MAT) Follow-up Info during Months 4-7 vs. Loss to Follow-Up by VT State Agency Involvement

Baseline Characteristics	Dept. of Corrections			Dept. of Children & Families		
	Opioid Information at follow-up n=188, 65%	Loss to follow-up n=101, 35%	p-value*	Opioid Information at follow-up n=110, 73%	Loss to follow-up n=41, 27%	p-value*
Socio-demographics						
Female (vs. male)	34%	26%	0.15	49%	41%	0.40
Age, median (IQR)	32 (28-37)	31 (26-37)	0.26	32 (28-36)	30 (26-36)	0.11
Enrolled in Burlington	51%	34%	0.006	46%	27%	0.03
Enrolled in St. Albans	40%	37%	0.53	48%	46%	0.84
Past 30-day Income *12 <=$12,140	69%	65%	0.46	65%	51%	0.11
Past 30-day Employed (part time or full time)	28%	38%	0.11	34%	31%	0.78
Past 30-day Unstable Housing	33%	30%	0.66	45%	38%	0.51
Substance Use						
Past 30-day Non-Prescribed Opioids All, Baseline - Month 1	84%	83%	0.85	93%	90%	0.62
Past 30-day Non-Prescribed Opioids All Non-MAT, Baseline-Month 1	53%	41%	0.04	55%	49%	0.49
Past 30-day Non-Prescribed Buprenorphine, Baseline - Month 1	66%	67%	0.91	77%	71%	0.41
Past 30-day Non-Prescribed Methadone, Baseline - Month 1	10%	10%	0.89	12%	18%	0.39
Past 30-day Heroin Use	40%	32%	0.16	37%	41%	0.64
Past 30-day THC, Baseline – Month 1	58%	57%	0.88	65%	73%	0.42
Past 30-day Tobacco	88%	91%	0.46	96%	94%	0.69
Past 30-day Cocaine, Baseline - Month 1	38%	45%	0.23	37%	44%	0.44
Past 30-day Injected Drug Use	36%	24%	0.03	32%	24%	0.37
Past 30-day Binge Drinking, Baseline	17%	18%	0.75	19%	5%	0.03
Past 30-day Amphetamine Use, Baseline - Month 1	13%	12%	0.93	10%	20%	0.13
Past 30-day Sedative Use, Baseline - Month 1	18%	8%	0.02	19%	12%	0.36
Mental/Behavioral Health						
Past 30-day Severe Depression: 14+ days	38%	24%	0.013	39%	34%	0.55
Past 30-day Severe Anxiety: 5+ days	69%	56%	0.03	68%	73%	0.53
Past 30-day PTSD (+)	39%	35%	0.51	43%	48%	0.63
Past 30-day Suicidal Thoughts	22%	12%	0.05	28%	16%	0.14
ARC Social Support Score, mean (SD)	3.0 (1.7)	3.2 (1.6)	0.25	2.9 (1.6)	3.1 (1.4)	0.38
Past 30-day Trouble Controlling Violent Behavior	16%	15%	0.72	17%	15%	0.70
Treatment						
Outpatient Mental Health: 4+ Month	16%	18%	0.06	23%	24%	0.39
Past 30-day Peer Group Participation	46%	50%	0.54	39%	46%	0.42
Prescribed MAT, Baseline – Month 1	56%	40%	0.012	50%	29%	0.02
Past 30-day Sober-living Facility or Residential Program	28%	25%	0.55	15%	24%	0.18
Past 30-day ER Visit	14%	10%	0.33	21%	12%	0.22
Physical Health						
Past 30-day Trouble Understanding, Concentrating, Remembering	55%	41%	0.02	62%	46%	0.08
Hep C (+)	32%	37%	0.44	19%	44%	0.003
Criminal Justice						
Past 30-days Arrested	18%	21%	0.55	13%	27%	0.04
On Probation or Parole	66%	70%	0.51	32%	46%	0.10
Child in Custody due to CPO	22%	26%	0.54	44%	63%	0.05

*ANOVA, Pearson's chi-square, Wilcoxon rank sum. Due to the number of tests and associated Type 1 error, p-value was reduced from the standard p<0.05 to p<0.02 significance.

Table 2. Baseline Characteristics of Participants with Non-Prescribed Opioid (Excluding MAT) Follow-up Info during Months 8-12 vs. Loss to Follow-Up by VT State Agency Involvement

Baseline Characteristics	Dept. of Corrections			Dept. of Children & Families		
	Opioid Information at follow-up n=159, 55%	Loss to follow-up n=130, 45%	p-value*	Opioid Information at follow-up n=95, 63%	Loss to follow-up n=56, 37%	p-value*
Socio-demographics						
Female (vs. male)	35%	27%	0.16	47%	46%	0.91
Age, median (IQR)	32 (28-37)	31 (27-37)	0.35	32 (28-35)	31 (28-37)	0.96
Enrolled in Burlington	50%	38%	0.06	47%	30%	0.04
Enrolled in St. Albans	47%	29%	0.002	51%	43%	0.36
Past 30-day Income *12 <=$12,140	70%	65%	0.39	64%	57%	0.39
Past 30-day Employed (part time or full time)	27%	38%	0.09	35%	31%	0.61
Past 30-day Unstable Housing	36%	27%	0.16	46%	38%	0.41
Substance Use						
Past 30-day Non-Prescribed Opioids All, Baseline - Month 1	86%	81%	0.22	94%	89%	0.33
Past 30-day Non-Prescribed Opioids All Non-MAT, Baseline-Month 1	58%	39%	0.001	55%	50%	0.53
Past 30-day Non-Prescribed Buprenorphine, Baseline - Month 1	67%	66%	0.83	77%	73%	0.62
Past 30-day Non-Prescribed Methadone, Baseline - Month 1	11%	9%	0.52	12%	16%	0.48
Past 30-day Heroin Use	42%	31%	0.04	38%	39%	0.87
Past 30-day THC, Baseline – Month 1	62%	52%	0.08	62%	77%	0.06
Past 30-day Tobacco	86%	92%	0.13	95%	98%	0.39
Past 30-day Cocaine, Baseline - Month 1	39%	41%	0.78	37%	43%	0.45
Past 30-day Injected Drug Use	37%	25%	0.03	29%	30%	0.91
Past 30-day Binge Drinking, Baseline	19%	15%	0.34	19%	9%	0.10
Past 30-day Amphetamine Use, Baseline - Month 1	13%	11%	0.54	13%	13%	0.94
Past 30-day Sedative Use, Baseline - Month 1	18%	11%	0.09	16%	18%	0.78
Mental/Behavioral Health						
Past 30-day Severe Depression: 14+ days	37%	28%	0.09	39%	36%	0.75
Past 30-day Severe Anxiety: 5+ days	66%	63%	0.52	65%	76%	0.16
Past 30-day PTSD (+)	37%	39%	0.71	39%	53%	0.11
Past 30-day Suicidal Thoughts	23%	12%	0.02	26%	21%	0.51
ARC Social Support Score, mean (SD)	2.9 (1.7)	3.2 (1.7)	0.22	3.0 (1.6)	2.8 (1.5)	0.38
Past 30-day Trouble Controlling Violent Behavior	14%	18%	0.46	17%	16%	0.90
Treatment						
Outpatient Mental Health: 4+ Month	19%	14%	0.02	23%	23%	0.05
Past 30-day Peer Group Participation	47%	47%	0.97	39%	45%	0.49
Prescribed MAT, Baseline – Month 1	54%	46%	0.17	53%	30%	0.008
Past 30-day Sober-living Facility or Residential Program	26%	28%	0.76	18%	16%	0.71
Past 30-day ER Visit	14%	11%	0.43	19%	18%	0.87
Physical Health						
Past 30-day Trouble Understanding, Concentrating, Remembering	55%	43%	0.06	60%	55%	0.51
Hep C (+)	31%	37%	0.32	16%	44%	<0.001
Criminal Justice						
Past 30-days Arrested	18%	20%	0.68	13%	23%	0.09
On Probation or Parole	64%	72%	0.14	38%	32%	0.48
Child in Custody due to CPO	24%	23%	0.92	42%	62%	0.02

*ANOVA, Pearson's chi-square, Wilcoxon rank sum. Due to the number of tests and associated Type 1 error, p-value was reduced from the standard p<0.05 to p<0.02 significance.

Appendix H: Operational Definitions

Table VI.E.1. 20 Outcome Measures Operational Definitions Table

Goal 1: Decrease Substance Use	
Non-Prescribed Opioid Use	This measure is a dichotomous yes (1) / no (0) account of whether participants used any opioids. The measure is a combination of EMR urine screen data, self-reported data collected using the SAMHSA CSAT GPRA survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. yes=self-reported (+) or urine screen (+); no=urine screen (-) Opioids included: buprenorphine, methadone, oxycodone, hydrocodone, morphine, propoxyphene (Darvon), codeine, Tylenol 2,3,4, Dilaudid (hydromorphone), Demerol, heroin and fentanyl. Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
Non-Prescribed Non-MAT Opioid Use	This measure is a dichotomous yes (1) / no (0) account of whether participants used non-MAT opioids. The measure is a combination of EMR urine screen data, self-reported data collected using the SAMHSA CSAT GPRA survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. yes=self-reported (+) or urine screen (+); no=urine screen (-). Opioids included: oxycodone, hydrocodone, morphine, propoxyphene (Darvon), codeine, Tylenol 2,3,4, Dilaudid (hydromorphone), Demerol, heroin and fentanyl. Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
Non-Prescribed Buprenorphine Use	This measure is a dichotomous (Yes/No) measure of whether participants used buprenorphine without a prescription. The measure is a combination of EMR urine screen data, self-reported data collected using the SAMHSA CSAT GPRA survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. yes=self-reported (+) or urine screen (+); no=urine screen (-). Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
Non-Prescribed Methadone Use	This measure is a dichotomous yes (1) / no (0) account of whether participants used methadone without a prescription. The measure is a combination of EMR urine screen data, self-reported data collected using the SAMHSA CSAT GPRA survey tool, the ASSIST survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. yes=self-reported (+) or urine screen (+); no=urine screen (-). Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
Cocaine Use	This measure is a dichotomous yes (1) / no (0) account of whether participants used cocaine. The measure is a combination of EMR urine screen data, self-reported data collected using the SAMHSA CSAT GPRA survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. yes=self-reported (+) or urine screen (+); no=urine screen (-). Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
THC Use	This measure is a dichotomous yes (1) / no (0) account of whether participants used THC. The measure is a combination of EMR urine screen data, self-reported data collected using the SAMHSA CSAT GPRA survey tool and urine screens administered at intake, 6-month and 12-month follow-up by research assistants. yes=self-reported (+) or urine screen (+); no=urine screen (-). Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)

Tobacco Use	This measure is a dichotomous yes (1) / no (0) account of whether participants report having used any tobacco in the prior 90 days. The self-reported information is collected using the ASSIST survey tool and is a dichotomization of responses to a Likert scale question. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)
Binge Drinking	This measure is a dichotomous yes (1) / no (0) account of whether men had 5+ alcohol drinks in one sitting or women had 4+ drinks and felt intoxicated or 5 drinks in one sitting in the prior 30 days. The self-reported measure is collected using the SAMHSA CSAT GPRA survey tool and was created by dichotomizing a continuous measure of # of days. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)
Goal 2: Improve Behavioral/Mental Health	
PTSD	This measure is a dichotomous yes (1) / no (0) account of whether participants screen (+) for PTSD. The self-reported information is collected using the PCL-5 survey tool with a threshold of 33 indicating possible PTSD. Three time points include: Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)
Severe Depression No depression <14 days 14+ days	This measure is an account of the severe depression a participant has experienced in the prior 30 days. The self-reported measure is collected using the SAMHSA CSAT GPRA survey tool and is created by categorizing a continuous measure of # of days. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)
Severe Anxiety No anxiety <5 days 5+ days	This measure is an account of the severe anxiety a participant has experienced in the prior 30 days. The self-reported measure is collected using the SAMHSA CSAT GPRA survey tool and is created by categorizing a continuous measure of # of days. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)
ARC Social Support Score	This measure is an ordinal (0-5) score derived from a single domain of the Assessment for Recovery Capital Tool that measures a participant's social supports. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13). One point is added to the score for a yes to each of the following questions: 1) "I am happy with my personal life" 2) "I am satisfied with my involvement with my family" 3) "I get lots of support from friends" 4) "I get the emotional help and support I need from my family" 5) "I have a special person that I can share my joys and sorrows with."
Goal 3: Improve Physical Health	
Engaging in High-Risk Sex	This measure is a dichotomous yes (1) / no (0) account of whether participants have participated in high-risk sex during the past 30 days. The self-reported information is collected using HIV Risk Tool. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13). High risk sex includes: • Unprotected sex with a casual partner • IV drug user and had unprotected sex • Unprotected sex with main partner and suspect main partner is having sex with someone else

Goal 4: Improve Socio-Economic Status	
Unstable Housing	This measure is a dichotomous yes (1) / no (0) account of whether participants had stable housing in the prior 30 days. The self-reported measure is collected using the SAMHSA CSAT GPRA survey tool and is a dichotomization of a categorical housing question. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13) Stably housed includes: • Housed: Own/rent apartment, room, or house • Housed: Halfway house, Institution (hospital, nursing home, jail/prison) • Housed: Residential treatment Unstably housed includes: • Shelter (safe havens, transitional living center [TLC], low-demand facilities, reception centers, other temporary day or evening facility) • Street/outdoors (sidewalk, doorway, park, public or abandoned building) • Housed: Someone else's apartment, room, or house Exclusions: 18-24 year olds
Employment (Part-Time or Full-Time)	This measure is a dichotomous yes (1) / no (0) account of whether participants are employed in the prior 30 days. The self-reported measure is collected using the SAMHSA CSAT GPRA survey tool and is a dichotomization of a categorical employment question. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13) Employed includes: • Employed, full-time (35+ hours per week) • Employed, part-time Unemployed includes: • looking for work • Unemployed, volunteer work • Unemployed, not looking for work Exclusions: • Unemployed, disabled • Unemployed, retired

Goal 5: Increase Treatment Engagement	
Rating of Communication between Providers	This measure is self-reported, past 30-days how well current providers have communicated with each other about their care in the past 30 days using the Dartmouth Recent Services survey. The metric has been categorized into a three category measure from a 5 point Likert scale. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13) • Excellent to Very Good Communication • Good Communication • Fair to Poor Communication
Receiving Care for Existing Medical Problems	This measure is a dichotomous yes (1) / no (0) account of whether a participant is receiving care for current medical problems using the Dartmouth Recent Services Survey. Exclusions: participants who report no current medical problems. The self-reported information is collected using Dartmouth's Recent Services Survey. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)
Prescribed MAT	This measure is a dichotomous yes (1) / no (0) account of whether participants used medication assisted treatment in a prescribed manner in the prior 30 days. The measure is a combination of EMR chart review data, EMR urine screen data, the Dartmouth Recent Services Survey and urine screens administered at intake, 6-month and 12-month follow-up. Opioid agonists included: buprenorphine and methadone. Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
Use of Outpatient Treatment for Mental Health	This measure is a dichotomous yes (1) / no (0) account of whether participants utilized 4+/any month outpatient treatment for mental health. The combination of EMR chart review data and data collected using the self-report SAMHSA CSAT GPRA survey tool. Three time points include: 1 (30 days prior to intake to 30 days after intake), 2 (months 4-7) and 3 (months 8-13)
Use of Peer Supports	This measure is a dichotomous yes (1) / no (0) account of whether participants utilized peer support in the prior 30 days. The self-reported measure is collected using the SAMHSA CSAT GPRA survey tool and was created by dichotomizing a continuous measure of # of days. Three time points include: 1 (30 days prior to intake to intake), 2 (months 5-7) and 3 (months 11-13)

Appendix I: Data Quality Assessment and Mitigation

Table VI.F.1. VT MAT-PDOA Program Evaluation Cross-Reference Interview Questions

Outcome	Interview Question	Data Collection Tool
Injection Drug Use	In the past 30 days, have you injected drugs?	SAMHSA CSAT GPRA
	During the past 30 days, about how many times did you inject drugs?	STTR HIV Risk
Injection Drug Use	In the past 30 days, how often did you use a syringe/needle, cooker, cotton, or water that someone else used?	SAMHSA CSAT GPRA
	Of the ( ) times that you injected drugs, did you ever share works/a cooker/mix with someone?	STTR HIV Risk
Custody of Children	For how many of your children have you lost parental rights?	SAMHSA CSAT GPRA
	Do you currently have custody of your children?	Recent Services Survey
Incarcerated, past 30 days	In the past 30 days, how many nights have you spent in jail/prison?	SAMHSA CSAT GPRA
	In the past 30 days, how many days have you been in jail or prison?	Recent Services Survey
Parole/probation	Are you currently on parole or probation?	SAMHSA CSAT GPRA
	Are you currently on parole or probation?	Recent Services Survey
General Health	How would you rate your overall health right now?	SAMHSA CSAT GPRA
	In general, how would you rate your health?	Recent Services Survey
Inpatient Physical, past 30 days	During the past 30 days, did you receive inpatient treatment for a physical complaint?	SAMHSA CSAT GPRA
	In the past 30 days, how many days have you been hospitalized for medical problems?	Recent Services Survey
Inpatient Psych, past 30 days	During the past 30 days, did you receive inpatient treatment mental or emotional difficulties?	SAMHSA CSAT GPRA
	In the past 30 days, how many days have you been hospitalized for psychiatric problems?	Recent Services Survey
Inpatient Substance Use Treatment, past 30 days	During the past 30 days did you receive inpatient treatment for alcohol or substance abuse?	SAMHSA CSAT GPRA
	In the past 30 days, how many days have you been hospitalized for detoxification?	Recent Services Survey
	In the past 30 days, how many days have you been in a residential addiction treatment program?	Recent Services Survey
ER, past 30 days	During the past 30 days, did you receive emergency room treatment for a physical complaint?	SAMHSA CSAT GPRA
	During the past 30 days, did you receive emergency room treatment for mental or emotional difficulties?	SAMHSA CSAT GPRA

	During the past 30 days, did you receive emergency room treatment for alcohol or substance abuse?	SAMHSA CSAT GPRA
	In the past 30 days, how many days have you been in the emergency room?	Recent Services Survey
Sexual contact, past 30 days	Altogether, how many sexual contacts (vaginal, oral, or anal) did you have?	SAMHSA CSAT GPRA
	How many times in the last 30 days did you have vaginal sex with your main sexual partner?	STTR HIV Risk
	How many times in the last 30 days did you have anal sex with your main sex partner?	STTR HIV Risk
	How many times in the last 30 days did you have vaginal sex with a casual partner	STTR HIV Risk
	How many times in the last 30 days when you had sex with casual partners, did you receive any anal sex?	STTR HIV Risk
Unprotected sex, past 30 days	Altogether, how many unprotected sexual contacts did you have?	SAMHSA CSAT GPRA
	Of the ( ) times, how many times was a male or female condom used? (vaginal sex)	STTR HIV Risk
	Of the ( ) times, how many times was a male or female condom used? (anal sex)	STTR HIV Risk
	Of these times that you had vaginal sex with a casual partner, how many times was a male or female condom used?	STTR HIV Risk
	Of these times that you had anal sex with a casual parter, how many times was a male or female condom used?	STTR HIV Risk
Tested for HIV	Have you ever been tested for HIV?	SAMHSA CSAT GPRA
	Have you ever been tested for HIV?	STTR HIV/HCV/STI
HIV Test Results	Do you know the results of your HIV testing?	SAMHSA CSAT GPRA
	What was the result of your last HIV test?	STTR HIV/HCV/STI
	Have you ever been told that you had HIV?	STTR HIV/HCV/STI
Psych Medication, past 30 days	In the past 30 days, not due to use of alcohol or other drugs, how many days have you been prescribed medication for psychological/emotional problem?	SAMHSA CSAT GPRA
	In the past 30 days, on how many days did you take a medication prescribed to you to help with emotional or psychological problems?	Recent Services Survey
Re-experiencing	Did any of these experiences feel so frightening, horrible, or upsetting that, in the past and/or present you have had nightmares about it or thought about it when you did not want to?	SAMHSA CSAT GPRA
	In the past month, how much were you bothered by repeated, disturbing, and unwanted memories of the stressful experience?	PCL-5 (Health Survey)
	In the past month, how much were you bothered by repeated, disturbing dreams of the stressful experience?	PCL-5 (Health Survey)

	Have you re-experienced the awful event in a distressing way (nightmares, intense recollection, flashbacks, or physical reactions) in the past month?	BHQ (Health Survey)
Avoidance	Did any of these experiences feel so frightening, horrible, or upsetting that, in the past and/or present you tried hard not to think about it or went out of your way to avoid situations that remind you of it?	SAMHSA CSAT GPRA
	In the past month, how much were you bothered by avoiding thoughts, or feelings related to the stressful experience?	PCL-5 (Health Survey)
	In the past month, how much were you bothered by avoiding external reminders of the stressful experience?	PCL-5 (Health Survey)
Hyperarousal	Did any of these experiences feel so frightening, horrible, or upsetting that, in the past and/or present you were constantly on guard, watchful, or easily startled?	SAMHSA CSAT GPRA
	In the past month, how much were you bothered by being "superalert" or watchful or on guard?	PCL-5 (Health Survey)
	In the past month, how much were you bothered by feeling jump or easily startled?	PCL-5 (Health Survey)
Peer Support Services	In the past 30 days did you attend any voluntary self-help groups for recovery that were not affiliated with a religious or faith-based organization?...	SAMHSA CSAT GPRA
	In the past 30 days, how many 12-Step or peer support group meetings did you attend?	Recent Services Survey
Violence and Trauma	Have you ever experienced violence or trauma in any setting ? Have you ever experienced or witnessed or had to deal with an extremely traumatic event that included actual or threatened death or serious injury to you or someone else?	SAMHSA CSAT GPRA BHQ (Health Survey)

Table VI.F.2. Cross-Reference Response Outcome Logic Model

IF YES	THEN YES
Have you re-experienced the awful event in a distressing way (nightmares, intense recollection, flashbacks, or physical reactions) in the past month?	Have you ever experienced violence or trauma in any setting?
In the past month, how much were you bothered by repeated, disturbing, and unwanted memories of the stressful experience? **AND/OR** In the past month, how much were you bothered by repeated, disturbing dreams of the stressful experience?	Did any of these experiences feel so frightening, horrible, or upsetting that, in the past and/or present you have had nightmares about it or thought about it when you did not want to? **AND** Have you re-experienced the awful event in a distressing way (nightmares, intense recollection, flashbacks, or physical reactions) in the past month?
In the past month, how much were you bothered by avoiding thoughts, or feelings related to the stressful experience? **AND/OR** In the past month, how much were you bothered by avoiding external reminders of the stressful experience?	Did any of these experiences feel so frightening, horrible, or upsetting that, in the past and/or present you tried hard not to think about it or went out of your way to avoid situations that remind you of it?
In the past month, how much were you bothered by being "super alert" or watchful or on guard? **AND/OR** In the past month, how much were you bothered by feeling jumpy or easily startled?	Did any of these experiences feel so frightening, horrible, or upsetting that, in the past and/or present you were constantly on guard, watchful, or easily startled?

Appendix J: Implementation Metrics Tables

Table II.G.1. NMC Comprehensive Pain (Spoke) Implementation Metrics over 36-Month Evaluation Period

Implementation Metrics	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12
Participants enrolled	0	49	28	N/A	59	79	121	145	169	192	208	208
Participants on MAT	0	25	25	N/A	29	52	73	107	129	146	161	162
Participants on Vivitrol	0	N/A	N/A	N/A	5	0	0	0	0	0	0	0
Participants using peer support	0	N/A	N/A	N/A	9	48	82	96	95	106	116	112
Participants attending MRE group	0	N/A	N/A	N/A	1	5	21	20	38	17	7	0
Participants on a waitlist	0	N/A	N/A	N/A	16	32	40	26	24	23	16	0
Participants who received at least one service during quarter	0	N/A	N/A	N/A	16	32	40	26	24	23	16	0
Participants incarcerated or inpatient for whom initiated coordination to outpatient	0	N/A	N/A	N/A	2	6	2	15	22	27	7	1
Number of PCMH/N meetings	0	N/A	N/A	N/A	3	3	3	3	3	2	3	3
Interagency agreements developed	0	N/A	N/A	N/A	3	3	3	3	3	3	3	3
Shared care plans developed	0	N/A	N/A	N/A	0	10	1	8	14	14	16	16
Number of staff delivering ICT	0	N/A	N/A	N/A	1	1	1	1	1	1	1	1
Number of staff delivering ICBT	0	N/A	N/A	N/A	1	1	1	1	1	1	1	1
Number of staff delivering Seeking Safety	0	N/A	N/A	N/A	0	1	0	0	0	0	0	0
Number of staff delivering IDDT	0	N/A	N/A	N/A	1	1	1	1	1	1	1	1
Number of staff delivering MRE	0	N/A	N/A	N/A	1	1	1	1	1	1	1	1

Table II.H.2. Howard Center (Hub) Implementation Metrics over 36-Month Evaluation Period

Implementation Metrics	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12
Participants enrolled	0	43	74	57	91	120	117	119	136	113	86	N/A
Participants on MAT	0	38	55	34	66	109	81	98	95	70	41	N/A
Participants on Vivitrol	0	0	1	1	1	1	1	0	0	0	0	N/A
Participants using peer support	0	1	3	13	19	14	18	33	48	23	11	N/A
Participants attending MRE group	0	0	2	11	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Participants on a waitlist	0	0	9	N/A	0	0	4	1	2	1	0	N/A
Participants who received at least one service during quarter	0	0	9	7	N/A	N/A	4	1	2	1	N/A	N/A
Participants incarcerated or inpatient for whom initiated coordination to outpatient	0	N/A	N/A	N/A	6	17	9	13	5	11	9	N/A
Number of PCMH/N meetings	0	2	2	3	2	3	3	3	2	3	3	N/A
Interagency agreements developed	0	1	1	1	1	1	2	2	0	0	0	N/A
Shared care plans developed	0	0	0	0	0	3	6	15	16	10	9	N/A
Number of staff delivering ICT	0	8	5	4	4	5	2	4	5	1	0	N/A
Number of staff delivering ICBT	0	0	N/A	0	3	5	2	4	3	3	3	N/A
Number of staff delivering Seeking Safety	0	0	4	7	4	5	4	3	7	3	4	N/A
Number of staff delivering IDDT	0	0	N/A	0	0	0	1	2	1	2	0	N/A
Number of staff delivering MRE	0	0	1	1	1	2	2	1	0	1	0	N/A