

City University of New York (CUNY)

## CUNY Academic Works

---

Dissertations, Theses, and Capstone Projects

CUNY Graduate Center

---

9-2015

### **Assessing the Impact of Restrictions to Medicaid Coverage of Methadone and Buprenorphine on Opioid Users' Access to and Utilization of Substance Use Treatment**

Courtney McKnight

*Graduate Center, City University of New York*

[How does access to this work benefit you? Let us know!](#)

More information about this work at: [https://academicworks.cuny.edu/gc\\_etds/1048](https://academicworks.cuny.edu/gc_etds/1048)

Discover additional works at: <https://academicworks.cuny.edu>

---

This work is made publicly available by the City University of New York (CUNY).

Contact: [AcademicWorks@cuny.edu](mailto:AcademicWorks@cuny.edu)

**Assessing the Impact of Restrictions to Medicaid Coverage of Methadone and Buprenorphine on  
Opioid Users' Access to and Utilization of Substance Use Treatment**

**by**

**COURTNEY MCKNIGHT**

A dissertation submitted to the Graduate Faculty in Public Health in partial fulfillment of the  
requirements for the degree of Doctor of Public Health, The City University of New York

2015

2015

COURTNEY McKNIGHT

All Rights Reserved

**This manuscript has been read and accepted for the Graduate Faculty in Public Health in satisfaction  
of the dissertation requirement for the degree of  
Doctor of Public Health**

Dr. Nicholas Freudenberg

\_\_\_\_\_  
Date

\_\_\_\_\_  
Chair of Examining Committee

Dr. Denis Nash

\_\_\_\_\_  
Date

\_\_\_\_\_  
Executive Officer

Dr. William T. Gallo

Dr. Nancy Sohler

Dr. Jonathan Prince

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

## **Abstract**

### **Assessing the Impact of Restrictions to Medicaid Coverage of Methadone and Buprenorphine on Opioid Users' Access to and Utilization of Substance Use Treatment**

by

Courtney McKnight

Adviser: Professor William T. Gallo

Opioid use and dependence have increased dramatically since the early 2000s. As of 2013, an estimated 2.4 million people were considered to be dependent on opioids. Medication assisted treatment (MAT), such as methadone and buprenorphine, is the most effective form of treatment for opioid dependence; yet, since 2002, MAT use has decreased steadily.

Medicaid is the largest purchaser of MAT in the United States; however, Medicaid coverage of MAT varies by state. As of 2008, fourteen states did not cover either methadone or buprenorphine, or both. This dissertation examines the factors associated with Medicaid coverage of methadone and buprenorphine, and explores the impact of this coverage on the length of time individuals waited to enter substance use treatment, and the extent to which Medicaid coverage of methadone is associated with MAT utilization.

This dissertation utilized a combination of individual-level, program-level and state-level data. Individual-level data came from the Treatment Episodes Data Set-Admissions (TEDS-A). Program-level data were obtained from the Uniform Facility Data Set (UFDS) and the National Survey of Substance Abuse Treatment Services (N-SSATS). State-level data regarding Medicaid coverage of MAT were obtained from three sources: (1) McCarty et al's study, "Methadone Maintenance and State Medicaid Managed Care Programs"; (2) Ducharme et al's study, "State policy influence on the early diffusion of buprenorphine in community treatment programs"; and, (3) the State Financing for Medication Assisted Treatment study.

The main findings of this study indicate that state wealth is correlated with Medicaid coverage of MAT, Medicaid coverage of MAT is associated with an increase in treatment wait time and Medicaid coverage of methadone is associated with greater odds of MAT use. This dissertation did not include any analyses since the passage of the Patient Protection and Affordable Care Act (PPACA), which in 2014, required that all public and private health insurance programs cover substance use treatment services. While this prioritization will undoubtedly increase access to substance use treatment, not all services must be covered. Given this, variability in the accessibility of treatment will likely persist. Further research should continue to monitor the accessibility and utilization of substance use treatment, with particular focus on MAT.

## **Acknowledgements**

I would like to express my appreciation to those individuals that have helped make this dissertation possible.

I am immensely grateful to Drs. William T. Gallo and Nancy Sohler for their guidance and support throughout my graduate studies. Their encouragement has allowed me to grow and their humor and patience have kept me sane. I would also like to thank Drs. Nicholas Fruedenberg and Jonathan Prince for their time, attention and support throughout the conception and writing of this dissertation.

To my family, Thomas, Vegas and Nika, my love and gratitude for each of you is endless. Your constant support and expressions of admiration kept me going through the most difficult periods of this program and dissertation. I look forward to having more time to relax, laugh and hug you all!

To my Mom, Dad and brother, Sean, thank you for always being there, for always believing in me and for always being proud of me. Your support has been essential and your love has been a gift.

## Table of Contents

List of Figures .....	viii
List of Tables .....	ix
Chapter 1: Introduction and Objectives.....	1
Chapter 2: Background and Significance .....	5
Chapter 3: Data and Methods .....	14
Chapter 4: Conceptual Framework .....	42
Chapter 5: State-level Analysis of Economic and Need Factors and Medicaid Coverage of Methadone and Buprenorphine Treatment in the United States (Aim 1 Analysis) .....	45
Chapter 6: Medicaid Coverage of Methadone and Buprenorphine and Waiting Time to Enter Substance Use Treatment (Aim 2 Analysis).....	58
Chapter 7: Medicaid Coverage of Methadone and Utilization of Medication Assisted Treatment (Aim 3 Analysis).....	80
Chapter 8: Discussion and Conclusion .....	95
Appendix .....	108
References .....	159



## List of Figures

1.1	Factors Influencing State Adoption of Medicaid Optional Services, Schneider & Jacoby .....	109
1.2	Factors Influencing State Medicaid Coverage of Methadone and Buprenorphine, Utilizing an Adapted Version of the Schneider & Jacoby Framework .....	110
1.3	Analytic Sample for Aim 1, State-Level Analysis of Economic and Need Factors and Medicaid Coverage of Methadone and Buprenorphine.....	111
2A.1	Analytic Sample, Treatment Wait Time and Medicaid Coverage of Methadone .....	114
2B.1	Analytic Sample, Treatment Wait Time and Medicaid Coverage of Buprenorphine .....	129
3.1	Analytic Sample for Aim 3, Utilization of MAT and Medicaid Coverage of Methadone .....	144

## List of Tables

1.1	Medicaid Coverage of Methadone (1998, 2008) and Buprenorphine (2006, 2008) .....	112
1.2	Results of Bivariate Logistic Regression Analyses for Medicaid Coverage and Economic and Need Factors.....	113
2A.1	Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Methadone Analysis, 2008 .....	115
2A.2	Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Methadone Analysis, 1998 .....	117
2A.3	Descriptive Characteristics of Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, Combined 1998-2008 .....	119
2A.4	Comparison of Characteristics of Bootstrapped Listwise Deletion Sample by Medicaid Coverage of Methadone, Combined 1998-2008 .....	120
2A.5	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, Combined 1998-2008 .....	121
2A.6	Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, Combined 1998-2008 .....	122
2A.7	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 2008 .....	123
2A.8	Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 2008 .....	124
2A.9	Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 2008 .....	125
2A.10	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 1998 .....	126
2A.11	Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 1998 .....	127
2A.12	Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 1998 .....	128
2B.1	Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Buprenorphine Analysis, 2008 .....	130

2B.2	Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Buprenorphine Analysis, 2006 .....	132
2B.3	Descriptive Characteristics of Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, Combined 2006-2008 .....	134
2B.4	Comparison of Characteristics of Bootstrapped Listwise Deletion Sample by Medicaid Coverage of Buprenorphine, Combined 2006-2008 .....	135
2B.5	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, Combined 2006-2008 .....	136
2B.6	Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, Combined 2006-2008.....	137
2B.7	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2008.....	138
2B.8	Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2008.....	139
2B.9	Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2008.....	140
2B.10	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2006.....	141
2B.11	Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2006.....	142
2B.12	Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2006.....	143
3.1	Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Utilization of MAT and Medicaid Coverage of Methadone, 2008.....	145
3.2	Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Utilization of MAT and Medicaid Coverage of Methadone, 1998.....	147
3.3	Descriptive Characteristics of Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, Combined 1998-2008 .....	149
3.4	Comparison of Characteristics of Bootstrapped Listwise Deletion Sample by Medicaid Coverage of Methadone, Combined 1998-2008 .....	150
3.5	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, Combined 1998-2008 .....	151
3.6	Model Building Summary Using Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, Combined 1998-2008 .....	152

3.7	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, 2008 .....	153
3.8	Model Building Summary Using Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone 2008 .....	154
3.9	Model Building Summary Using Multiple Imputation Sample for Utilization of MAT and Medicaid Coverage of Methadone, 2008 .....	155
3.10	Model Building Summary Using Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, 1998 .....	156
3.11	Model Building Summary Using Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, 1998 .....	157
3.12	Model Building Summary Using Multiple Imputation Sample for Utilization of MAT and Medicaid Coverage of Methadone, 1998 .....	158

## **Chapter 1: Introduction and Objectives**

Dependence on opioids, including heroin and prescription pain relievers, has increased significantly in the United States over the last decade.<sup>1</sup> Between 2002 and 2013, the number of individuals considered to be opioid dependent grew 41% from approximately 1.7 million to 2.4 million people.<sup>2,3</sup> As opioid dependence has increased, so has the utilization of substance use treatment services. Between 2002 and 2012, the proportion of admission to substance use treatment programs for individuals reporting opioid use increased from 18% to 26%.<sup>1</sup>

Broadly speaking, there are two types of treatment for opioid dependence: (1) drug-free inpatient/outpatient, which includes inpatient hospitalization and rehabilitation programs, as well as outpatient programs such as 12-step programs; and, (2) medication assisted treatment (MAT), which included methadone and buprenorphine. MAT is the most effective form of substance use treatment for opioid dependence.<sup>4,5</sup> MAT, such as methadone and buprenorphine, suppresses the analgesic effect that opioids produce, as well as reduces withdrawal symptoms associated with opioid dependence.<sup>6</sup> Despite evidence supporting MAT as the most effective form of treatment for opioid dependence, only 28% of heroin dependent individuals and 18% of other opioid dependent individuals used MAT in 2012.<sup>1</sup>

In the United States, Medicaid beneficiaries represent the largest group of opioid dependent individuals, and Medicaid is the largest purchaser of buprenorphine and methadone.<sup>7,8</sup> As a result, Medicaid coverage of opioid treatment services has the potential to impact a large proportion of individuals with opioid dependence in the United States. As a combined state/federal program, state Medicaid programs have significant latitude in determining coverage for optional benefits, including some types of substance use treatment. As a result, Medicaid coverage of substance use treatment services varies significantly by state. For MAT, state variability ranges from full, unrestricted coverage, to partial coverage which includes restrictions such as pre-authorization requirements or lifetime limits on MAT use, and in some states, neither methadone nor buprenorphine are covered at all.<sup>9</sup>

This study seeks to gain a better understanding of the factors that influence Medicaid coverage of MAT, and whether coverage of MAT is associated with increased access to methadone and buprenorphine treatment. To understand the factors that influence Medicaid coverage of MAT, I examine two main categories of predictors: economic and need factors. Examples of economic factors include: state Federal Medical Assistance Percentages (FMAP) rate, percent of total residents that are Medicaid beneficiaries, per capita income, state expenditures, and the amount of funding that is received through federal block grants for substance use treatment services. Need factors include the number of substance use treatment facilities and the number of opioid dependent individuals in each state.

To gain a better understanding of the relationship between Medicaid coverage of MAT and the accessibility of substance use treatment for opioid dependent individuals, I examine the associations between Medicaid coverage of methadone and buprenorphine and the amount of time individuals seeking treatment are required to wait prior to treatment entry, as well as Medicaid coverage of methadone and MAT utilization.

## **Dissertation Specific Aims**

The specific aims for this dissertation project are:

**Aim 1:** Identify state-level factors that are correlated with Medicaid coverage of methadone and buprenorphine

**Aim 1a:**

Assess whether state-level economic factors such as Federal Medical Assistance Percentages (FMAP), percent of total residents that are Medicaid beneficiaries, per capita income, and amount of funding received through federal block grants for substance use treatment services are correlated with Medicaid coverage of methadone and buprenorphine.

**Aim 1b:**

Assess whether the need for opioid treatment, measured by the number of substance use treatment facilities and the number of opioid dependent individuals, is correlated with Medicaid coverage of methadone and buprenorphine.

**Aim 2:** Determine whether individuals enrolled in substance use treatment in states with Medicaid coverage of methadone or buprenorphine experience decreased wait times for substance use treatment entry, as compared with individuals enrolled in substance use treatment in states with no Medicaid coverage of methadone or buprenorphine.

**Aim 3:** Determine whether opioid dependent individuals seeking substance use treatment in states with Medicaid coverage of methadone are more likely to utilize medication assisted treatment, as compared to opioid dependent individuals seeking substance use treatment in states without Medicaid coverage of methadone.

## **Dissertation Overview**

The following paragraph provides an overview of the chapters included in this dissertation.

In Chapter 2, Background and Significance, I provide a review of the literature related to each study aim. I also include an overview of the public health burden of opioid dependence, current treatments for opioid dependence and Medicaid coverage of MAT. In Chapter 3, Data and Measures, I describe the data sources used in each aim of this study, the methods for creating the analytic samples and the methods used to handle missing data. In Chapter 4, I review the theoretical framework used to guide the construction of Aim 1 and the addition of state-level predictor variables utilized in Aims 2 and 3. In Chapters 5, 6 and 7, I describe the findings from each of the three analyses. Finally, in Chapter 8, I review the limitations of the study, synthesize the findings across study aims and discuss the relevance of these findings within the policy context of current day Medicaid coverage of substance use treatment in the United States.



## **Chapter 2: Background and Significance**

This dissertation has two primary objectives: (1) to understand the factors associated with state Medicaid coverage of methadone and buprenorphine, the primary medications used to treat opioid dependent individuals; and, (2) to demonstrate the impact of this coverage on the accessibility of substance use treatment. To achieve this, three separate analyses have been conducted. The first analysis, described in greater detail in Chapter 5, examines the association between state-level factors representing the economic situation of the state and the need for treatment within a state, and Medicaid coverage of methadone and buprenorphine. The remaining two analyses focus on understanding the impact of Medicaid coverage of methadone and buprenorphine on individuals seeking substance use treatment. The first of these two analyses, described in detail in Chapter 6, investigates the association between Medicaid coverage of methadone and buprenorphine (examined separately) and the amount of time individuals wait to enter substance use treatment. The second analysis, detailed in Chapter 7, explores the association between Medicaid coverage of methadone and the utilization of MAT.

This chapter provides an overview of the literature related to these analyses, including the public health significance of opioid dependence in the United States, a review of treatment for opioid dependence, with a detailed description of MAT, and a review of the current literature regarding utilization of MAT in the United States.

### **Public Health Burden of Opioid Dependence**

Opioid dependence, whether the result of nonmedical use of prescription opioids such as Oxycodone and Hydrocodone, or heroin use, poses a significant public health problem in the United States as it has been linked to drug overdose, polydrug use, sexual risk behaviors for HIV and other infectious diseases, and injection drug use.<sup>10-15</sup> In 2013, 4.5 million Americans reported nonmedical use

of prescription opioids within the previous twelve months, the second most frequently used illicit drug category behind marijuana.<sup>16</sup>

While nonmedical use of prescription opioids remains significant, recent trend data indicate that it is decreasing in the United States.<sup>16</sup> Heroin use, however, has been steadily increasing.<sup>17–20</sup> Between 2007 and 2013, there was a consistent increase in heroin use (within the past year) among persons 12 years or older.<sup>16</sup> Evidence suggests that the concurrent increase in heroin use and decrease in nonmedical prescription opioid use is the result of two factors: changes to the formulation of prescription opioids that made it more difficult to crush, and therefore inject and/or inhale prescription opioids, and the transition from nonmedical prescription opioid use to heroin use among prescription opioid dependent individuals.<sup>21–23</sup> Similar to prescription opioids, heroin dependence has significant health consequences, including HIV and hepatitis C infection, drug overdose, injection drug use, bacterial and soft tissue infections such as endocarditis and cellulitis, as well as unsafe sex and drug behaviors.<sup>24–31</sup>

Opioid dependence, whether the result of prescription opioid or heroin use, carries a significant monetary cost. Health care costs associated with opioid dependence are considerable, at approximately \$25 billion, and the overall societal costs due to opioid dependence, including health care costs, incarceration and workplace costs such as lost employment, are estimated at \$55.7 billion.<sup>32</sup>

### **Treatment for Opioid Dependence**

The increase in heroin use and continued high rate of nonmedical use of opioids in the United States has resulted in a substantial increase in the use of substance use treatment. Between 2002 and 2013, the number of individuals seeking treatment for heroin increased from 277,000 to 526,000 and from 360,000 to 746,000 for prescription opioid users.<sup>16</sup>

Broadly speaking, there are two main categories of treatment currently available for opioid dependence: drug-free inpatient/outpatient treatment, which includes inpatient therapeutic

communities and outpatient support groups (primarily focused on abstinence); and medication-assisted treatment (MAT), which includes methadone, buprenorphine and naltrexone. Of these forms of treatment, methadone and buprenorphine are the most effective approach to treating opioid addiction. These two treatments are the focus of this dissertation.<sup>4,5</sup>

### **Medication Assisted Treatment**

Opioids stimulate feelings of euphoria, drowsiness and decreased anxiety by binding to and activating opioid receptors in the body.<sup>33</sup> Medications used to treat opioid dependence are classified by their effect on these receptors. Opioid agonists, such as heroin, codeine and methadone, both bind to and activate these receptors, allowing users to experience feelings of euphoria.<sup>33</sup> Opioid antagonists such as naloxone also bind to these receptors, but they block the euphoric effects of these drugs, and have the potential to reverse the effects altogether.<sup>34</sup> Naloxone, for example, is used to reverse opioid overdoses by removing opioid agonists from these receptor sites, effectively putting the patient in a state of withdrawal. Finally, between the categories of agonists and antagonists are partial agonists, such as buprenorphine. Partial opioid agonists bind to opioid receptors, providing some agonist effects but these effects are limited by the antagonist properties.<sup>34</sup>

Methadone and buprenorphine are particularly effective at suppressing withdrawal symptoms, due to their agonist properties, while simultaneously creating blocking effects for other opioids, such as heroin.<sup>35</sup> These medications create a tolerance to opioids which, over time, lessens the effect of other opioids.<sup>36</sup> This quality is an important benefit for the treatment of opioid dependence because it can reduce the likelihood of sustained or increased use of other opioids.

Methadone and buprenorphine have long half-lives, or lasting effects, making them ideal for the treatment of opioid dependence. Heroin has a half-life of approximately two to three hours, at which point opioid receptors begin to empty and the user begins to feel symptoms of withdrawal. In contrast,

the half-life of methadone ranges from 16-48 hours and approximately 24 hours for buprenorphine.<sup>33,36,37</sup> The extended half-lives of these medications make them particularly effective at reducing cravings by staving off withdrawal symptoms between doses.

Both methadone and buprenorphine can be used in detoxification and maintenance treatment. Methadone maintenance, as compared with inpatient detoxification, has been shown to retain patients for longer durations and is associated with significantly less heroin use than individuals utilizing inpatient detoxification.<sup>5</sup> Additionally, methadone maintenance treatment has been associated with reductions in HIV incidence, mortality, injection drug use, syringe sharing, and slower progression of HIV disease, and is safe for treating opioid dependence in pregnant women.<sup>38-46</sup> Buprenorphine, while not as effective as methadone treatment overall, is more effective at retaining heroin users in substance use treatment than users receiving a placebo.<sup>4,47,48</sup>

### **MAT Provision and Utilization**

In the United States, methadone is administered through opioid treatment programs (OTPs) that are certified and regulated by the Substance Abuse and Mental Health Services Administration (SAMHSA).<sup>49</sup> OTP regulations are strict, particularly regarding the frequency of methadone dosing, requiring most patients to report to the clinic for dosing five to six days per week.<sup>50</sup> This highly regulated environment is considered, by some, to be stigmatizing and a barrier to recovery.<sup>51-53</sup>

Given the restrictive nature of methadone provision in the United States, the approval of buprenorphine for the treatment of opioid dependence in office-based settings was ground-breaking. In 2000, President Bill Clinton signed the Drug Addiction Treatment Act of 2000 (DATA 2000), a bill that allowed for the expansion of medication assisted treatments to outpatient settings beyond methadone maintenance treatment programs. Two years later, buprenorphine was approved by the Food and Drug Administration for the treatment of opioid dependence. In addition to office-based settings,

buprenorphine can also be provided at methadone clinics and community based treatment programs by qualified physicians.<sup>54</sup> Evidence suggests that buprenorphine users are demographically different than methadone users, and include individuals residing in rural areas and users of prescription opioids, two factors which may help to expand the reach of MAT.<sup>55</sup>

Both the provision of MAT by substance use treatment programs and providers and the utilization of MAT by opioid dependent individuals is limited in the United States.<sup>9,49,55–58</sup> In 2010, 8% of all substance use treatment facilities in the United States provided MAT, and these programs served approximately one-quarter of all individuals attending substance use treatment.<sup>59</sup> Further, despite the increase in the use of substance use treatment among opioid dependent individuals over the last decade, MAT use decreased by 7%.<sup>1</sup>

Low MAT utilization is influenced by factors at several levels, including those related to individuals, organizations/providers as well as systems-level factors. At the individual-level, cocaine injecting or crack smoking<sup>60,61</sup>, homelessness<sup>62</sup>, recent or previous incarceration<sup>61,62</sup>, injection drug use<sup>60–62</sup>, previous negative experiences with MAT<sup>63–65</sup>, stigma associated with MAT, particularly methadone<sup>65–69</sup> and the punitive treatment structure of methadone programs<sup>70</sup> have been negatively associated with MAT utilization. Individual-level factors found to be positively associated with MAT use include being female<sup>61,62,71</sup>, married<sup>71</sup>, having Medicaid coverage<sup>62</sup>, heroin use<sup>60,62,64</sup>, older age<sup>61,62</sup> and having previously been in substance use treatment<sup>60,71</sup>.

The literature regarding the factors associated with the availability of MAT is largely focused on organizational-level factors of substance use treatment facilities. Factors positively associated with MAT provision include large organizational size<sup>54,72,73</sup>, receipt of public funding<sup>54,58,72</sup>, awareness of Medicaid and/or state contract policies regarding coverage<sup>74</sup>, having a physician on staff<sup>58,72</sup>, public versus private ownership<sup>54,72</sup>, and whether the program is located within a hospital setting<sup>54,73,75</sup>. In contrast, negative

staff perceptions of methadone and/or buprenorphine and treatment ideology, particularly those that follow 12-step philosophy, have been negatively associated with MAT provision.<sup>76–78</sup>

Provider-level barriers regarding the dispensing of MAT in the United States are focused on buprenorphine given that methadone can only be dispensed in certified substance use treatment facilities. Barriers to providing buprenorphine, as cited by potential or actual buprenorphine providers, include: insurance coverage/reimbursement concerns<sup>79–81</sup>, negative perceptions of substance users and/or buprenorphine<sup>81–83</sup>, lack of expertise or necessary training<sup>79–81,84–86</sup>, lack of time<sup>79,81,83,85</sup> and lack of support<sup>79–81,84,85,87</sup>.

Finally, the perspective least explored is the role of systems or state-level factors in methadone or buprenorphine provision, which is part of the focus of this dissertation. Factors such as local zoning restrictions that prohibit mobile dispensing of methadone and/or buprenorphine<sup>88</sup>, lack of support by state agencies for methadone and/or buprenorphine<sup>74,88</sup>, lack of state Medicaid coverage of methadone and/or buprenorphine<sup>54,89</sup> and buprenorphine prescribing regulations that require pre-authorization by some insurance companies<sup>88</sup> have all been found to be negatively associated with MAT provision. Two important positive associations must be noted, both of which have been found in research investigating the adoption of naltrexone. Both higher state public assistance expenditures (per capita) and the prevalence of alcohol abuse or dependence were positively associated with naltrexone adoption.<sup>89</sup> These findings suggest that states with a greater need for substance use treatment and those that are more invested in safety net programs are more likely to adopt naltrexone. These findings are novel and have yet to be explored with respect to methadone and buprenorphine provision.

The findings regarding state-level barriers and facilitators of methadone and buprenorphine demonstrate the important role that states play in setting the tone for the way these treatments are perceived. States have the authority to direct public funds toward or away from treatment programs; therefore, a state's endorsement (or rejection) of a given treatment modality or approach can have

significant impact on the extent to which substance use treatment programs adopt treatment options such as methadone and buprenorphine. To date, we are unaware of any research that has investigated the relationship between structural factors such as Medicaid coverage of MAT, and the use of MAT by opioid dependent individuals.

## **Treatment Wait Time**

Chapter 6 describes the findings from an analysis of the factors associated with substance use treatment wait time entrance and Medicaid coverage of methadone and buprenorphine. This analysis was not limited to individuals receiving treatment in programs providing MAT; rather, this association was explored among individuals across all modalities of substance use treatment. Therefore, this section provides a review of the literature related to wait time across substance use treatment modalities.

Treatment wait time is often reported as one of the most significant barriers to enrolling in substance use treatment.<sup>90–94</sup> The average time individuals wait to enter substance use treatment ranges from zero days, particularly in cities such as San Francisco and Baltimore that employ a treatment on demand model<sup>95</sup>, to one week<sup>96–99</sup>, 3 weeks<sup>100,101</sup> and over one month<sup>91,96,102,103</sup>. Delays in treatment entry have been associated with a lack of treatment enrollment<sup>91,104,105</sup>, shorter periods of treatment engagement<sup>98</sup>, an increased risk of mortality<sup>106</sup>, arrest<sup>107</sup>, untreated psychiatric problems<sup>108</sup>, HIV<sup>109</sup>, and a return to or initiation of injection drug use (IDU)<sup>110</sup>. Finally, an inverse relationship between wait time and treatment entry has been observed in several studies, such that the longer a person waits to enter treatment, the less likely they are to enroll in it.<sup>92,95,111–113</sup>

Methadone, in particular, has been associated with an increase in waiting time for treatment entry.<sup>114–116</sup> Andrews et al found that individuals initiating methadone treatment were three times more likely to wait one month or more to enter treatment as compared with individuals waiting to enter other outpatient programs.<sup>116</sup> Gryczynski et al also found significant delays for individuals seeking methadone

treatment, as compared with other treatment modalities. In their study, less than one quarter of individuals enrolling in methadone treatment were able to begin treatment within four months of initiating contact with a program.<sup>103</sup>

The literature regarding substance use treatment wait time is largely focused on factors related to individuals and organizations. Individual-level factors such as unemployment<sup>96</sup>, homelessness<sup>96</sup>, being African American<sup>103,116</sup>, cocaine use<sup>103,106</sup> and psychiatric problems<sup>103</sup> have all been associated with longer wait times for treatment entry. The associations between age<sup>96,106,117</sup> and gender<sup>100,102,105</sup> and treatment wait time have been inconsistent.

Organizational factors, particularly regarding program inefficiencies, are believed to contribute most significantly to wait times.<sup>90,98,118–121</sup> In fact, in the Treatment Episodes Data Set (TEDS), which was the main dataset utilized for the analysis of wait time, substance use treatment programs were directed to calculate treatment wait times as “the number of days the client must wait to begin treatment because of program capacity, treatment availability, admissions requirements, or other program requirements. It should not include time delays caused by client unavailability or client failure to meet any requirement or obligation”.<sup>122</sup> Specific organizational factors associated with delays to treatment entry include larger client caseload<sup>96,123</sup>, staff shortages,<sup>92</sup> provision of methadone<sup>116</sup>, inefficient phone scheduling systems<sup>99</sup>, central intake units<sup>94</sup> and increased proportion of clients receiving public assistance<sup>123</sup>; whereas for-profit programs<sup>117</sup>, programs with an increased number of patients attending daily<sup>96</sup> and programs with performance contracting<sup>101</sup>, or financial incentives for improvement in patient outcomes or organizational efficiencies, have been associated with reduced treatment wait times.

Structural level factors have been the least explored with regard to treatment wait times. Factors such as bureaucratic delays related to processing court-ordered treatments<sup>94,96</sup> and a lack of insurance<sup>94</sup> have been associated with increased wait times for treatment entry.



## **Medicaid Coverage of Methadone and Buprenorphine**

Medicaid is a combined federal/state program that provides health insurance for low-income individuals and families. The federal government offers guidelines to states regarding the extent to which medical services and medications should be covered by Medicaid. Ultimately, however, each state creates their own eligibility requirements, as well as coverage parameters for medical care and medications.<sup>124</sup> Prior to 2014, substance use treatment was considered an optional benefit under federal Medicaid guidelines, meaning that states were not required to cover it beyond detoxification. As a result, there was significant state variability in the extent to which substance use treatment was covered, particularly regarding methadone and buprenorphine. In some states, for example, neither buprenorphine nor methadone was covered by Medicaid; however, in other states Medicaid covered one or both medications as long as they were provided in specific settings or after physicians obtain pre-approval. As of 2008, the most recent year utilized in the analyses for this dissertation, 19 states had some form of restriction on the coverage of buprenorphine and/or methadone.<sup>9</sup>

Medicaid is the largest purchaser of both buprenorphine and methadone and Medicaid beneficiaries represent the largest group of opioid dependent individuals in the United States.<sup>7,8</sup> According to the National Survey on Drug Use and Health (NSDUH), approximately 14% of Medicaid beneficiaries have a substance use disorder, as compared with 10% of the general population.<sup>125</sup> Given this, Medicaid coverage of substance use treatment services has the potential to impact a significant number of individuals in the United States. In the remaining chapters of this dissertation, the results of three analyses will be presented related to Medicaid coverage of MAT, including (1) the factors correlated with Medicaid coverage of MAT, (2) the association between Medicaid coverage of methadone and buprenorphine and treatment wait time, and (3) the association between Medicaid coverage of methadone and the utilization of MAT.

## **Chapter 3: Data and Methods**

This dissertation includes both state-level (Aim 1) and individual-level (Aims 2 and 3) analyses of datasets that were compiled using multiple sources. In this chapter, I provide a description of each dataset, including a detailed explanation of each data source and the variables contained within, a description of how each analytical sample was created and the techniques used to handle missing data and the validation of study findings.

### **Data Sources and Variable Description**

#### Individual-level Data

The primary data source for this dissertation was the Treatment Episodes Dataset-Admissions (TEDS-A). The TEDS-A is an administrative data set composed of annual admissions of individuals 12 years of age and older to substance use treatment programs in the United States that are licensed or certified by State agencies.<sup>126</sup> TEDS-A is primarily composed of admissions to substance use treatment programs that receive public funds; however, some states also require non-publicly-funded programs to report demographic and treatment-related data, and therefore may be included in TEDS-A. Substance use treatment programs that are not likely to be contained within TEDS-A include programs that are not licensed by the State, including some hospitals, private-for-profit programs and programs operated by the Bureau of Prisons, the Department of Defense and the Veterans Administration.<sup>126</sup>

TEDS-A data are publicly available for download through the Substance Abuse and Mental Health Data Archive (SAMHDA), which is maintained by SAMHSA and available through the Institute for Social Research (ISR) website at the University of Michigan.<sup>127</sup> TEDS-A includes a mixture of self-reported and program-reported demographic characteristics such as gender, age group, race/ethnicity, among other variables, and treatment-related variables such as substances of abuse, substance use treatment history and treatment program type. While TEDS-A provides individual-level data for substance use treatment

episodes, these data describe encounters with substance use treatment, rather than individual clients. For example, if the same individual has entered substance use treatment four times within a calendar year, there will be four separate treatment episodes counted in TEDS-A, not one.

### TEDS-A Variables

All individual-level variables in Aims 2 and 3 came from the TEDS-A. Below is a description of each variable, as well as an explanation of any recodes that were made to them.

### TEDS-A – Independent Variables

Age: When initially collected by programs, age was a continuous variable. However, when the TEDS-A is cleaned for public use, SAMHDA recodes age into a categorical variable in order to protect the ages of the youngest and oldest individuals in substance use treatment. The resulting age categories by years are: 12-14, 15-17, 18-20, 21-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55 and over.

In Aim 2, based on the age distribution of the sample, age was recoded and dummy coded in the following manner: Less than 18, 18-24, 25-34, 35-44 and 45 and over. In Aim 3, based on the distribution of the sample, which had fewer very young individuals, age was recoded and dummy coded as: Less than 25, 25-34, 35-44 and 45 and over.

Male: In the original dataset, sex was coded as 1 for males and 2 for females. Sex was recoded for all analyses in this dissertation to female=0 (referent group) and male=1.

Race: The original race variable included 9 categories: Alaska Native, American Indian, Asian or Pacific Islander, Black or African American, White, Asian, Other single race, Two or more races (only for 2006 and 2008 TEDS-A), Native Hawaiian or other Pacific Islander. Based on the distribution of the sample, race was dummy coded into three main categories: White (referent group), Black and Other Race(s).

Hispanic: TEDS-A provided 6 options for ethnicity: Puerto Rican, Mexican, Cuban, Other specific Hispanic, Not of Hispanic Origin and Hispanic, specific origin not specified. Ethnicity was dummy coded into a binary variable where Puerto Rican, Mexican, Cuban, Other specific Hispanic and Hispanic, specific origin not specified became Hispanic=1, and individuals not of Hispanic origin were coded as Hispanic=0 (referent group).

Married: Marital status contained 4 original categories: never married, now married, separated and divorced/widowed. Based on the distribution of these categories, marital status was recoded into a binary variable where never married and divorced/widowed became married=0 (referent group) and married and separated individuals became married=1.

Marital status was a supplemental variable in TEDS-A, and therefore was not reported by every program. In the final Aim 2 dataset, before any missing data techniques were used, the largest amount of missing data for marital status in any one year or combined year, for either methadone or buprenorphine, was 27%. In the final Aim 3 dataset, before any missing data techniques were employed, the largest amount of missing data for marital status in any of the methadone analyses was 23%.

High School Ed: The original TEDS-A variable education contained 5 categories: 8 years or less, 9-11 years, 12 years, 13-15 years and 16 or more years. Education was recoded into a binary variable where 12 or more years of education became high school education=1 and less than 12 years became high school education=0 (referent group).

Employed: This variable reflects the employment status of individuals at the time of enrollment in a treatment program. The original employment categories were: full-time, part-time, unemployed and not in labor force. This variable was recoded into a binary variable where individuals working full or part-time were recoded as 1 and those individuals that were unemployed or not in the labor force were recoded as 0 (referent group).

Unstable Housing: This variable describes the living arrangement of individuals at the time of treatment entry. The original variable contained 3 categories: homeless, dependent living (individuals living in a residential facility, halfway house, group home or children less than 18 years of age who are living with parents, relatives, guardians or in foster care), and independent living (individuals living alone or with others without any supervision, including individuals 18 and older who live with their parents). Living arrangement was recoded to reflect unstable housing, where homeless and dependent living individuals were coded as 1 for unstably housed and individuals who were living independently were coded as 0 for unstably housed (referent group).

Living arrangement was a supplemental variable, and therefore not reported by every program. In the Aim 2 analyses before any missing data techniques were used, the largest amount of missing data for this variable in any one year or combined year, for either methadone or buprenorphine, was 12%. In the Aim 3 analyses before any missing data techniques were employed, the largest amount of missing data for this variable in any of the methadone analyses was 32%.

Primary Source of Income/Support: This variable describes the primary source of income, and for individuals under 18 years of age, the parent's primary source of income at the time of treatment admission. This variable was dummy coded using the original categories: wages/salary (referent group), public assistance, retirement/pension, disability, other and none. The primary source of income/support variable was also a supplemental variable, and therefore not reported by every program. In the final Aim 2 dataset, before any missing data techniques were used, the largest amount of missing data for any category of primary source of income in any one year or combined year, for either methadone or buprenorphine, was 45%. In the final Aim 3 dataset, before any missing data techniques were employed, the largest amount of missing data for any category of primary source of income in any of the methadone analyses was 60%.

Treatment Program Type: This variable describes 8 treatment types and/or settings in which treatment was provided. A description of each category follows, as well as an explanation of the recoded variable.

1. Detoxification/24 hour service/Hospital inpatient – Hospital settings in which acute care medical detoxification services were provided 24 hours per day for persons who might experience withdrawal complications.
2. Detoxification/24 hour service/Free-standing Residential – Non-hospital settings in which 24 hour per day care is provided for safe withdrawal and transition to ongoing treatment.
3. Rehabilitation/Residential-Hospital (Other than Detox) – Treatment services for alcohol or drugs that were provided within a hospital setting and included 24 hour per day medical care.
4. Rehabilitation/Residential-Short Term (30 days or fewer) – Non-acute care treatment services for alcohol or drugs for 30 days or less.
5. Rehabilitation/Residential-Long Term (More than 30 days) – Non-acute care treatment services for alcohol or drugs for longer than 30 days. This category includes programs such as halfway houses.
6. Ambulatory-Intensive Outpatient – Outpatient programs in which clients received at least two hours of treatment per day, for at least three days per week.
7. Ambulatory-Non-Intensive Outpatient – Outpatient programs in which clients received individual, family or group services. This category includes programs that provided MAT.
8. Ambulatory-Detoxification – Outpatient treatment programs in which clients received services and/or MAT to withdraw from alcohol or drugs.

In the Aim 2 dataset, treatment program type was recoded into three main categories of programs: detoxification, outpatient and rehab (referent). Detoxification/24 hour service/Hospital inpatient, Detoxification/24 hour service/Free-standing Residential and Ambulatory-Detoxification were recoded to detox=1 (all others=0). Rehabilitation/Residential-Hospital (Other than Detox), Rehabilitation/Residential-Short Term (30 days or fewer) and Rehabilitation/Residential-Long Term (more than 30 days) were recoded to rehab=1 (all others=0). Ambulatory-Intensive Outpatient and Ambulatory-Non-Intensive Outpatient were recoded to outpatient=1 (all others=0).

In the Aim 3 dataset, because of the distribution of programs, treatment program type was recoded so that Rehabilitation/Residential-Short Term (30 days or fewer) and Rehabilitation/Residential-Long Term (More than 30 days) became rehab=1 and all other programs were rehab=0.

Number of Substances Using: This variable indicates the number of substances that a person reported using at the time of treatment admission. The original variable had 4 categories, ranging from 0-3, to reflect the primary, secondary and tertiary substances used. This variable was dummy coded with 3 substances as the referent category. In the Aim 2 buprenorphine analysis and the Aim 3 analysis, there were no individuals reporting 0 substances of abuse during each of the study years so only one, two and three substances of abuse were used in these analyses.

IDU: This binary variable reflects whether a person reported injecting either their primary, secondary or tertiary substance of abuse at the time of admission.

Cocaine: This binary variable reflects whether cocaine was reported as the primary, secondary or tertiary substance of abuse at admission.

Heroin: This binary variable reflects whether heroin was reported as the primary, secondary or tertiary substance of abuse at admission.

Non-prescription Methadone: This binary variable reflects whether non-prescription methadone was reported as the primary, secondary or tertiary substance of abuse at admission.

Synthetic Opioids: This binary variable reflects whether synthetic opioids were reported as the primary, secondary or tertiary substance of abuse at admission.

Benzodiazepines: This binary variable reflects whether benzodiazepines were reported as the primary, secondary or tertiary substance of abuse at admission.

Any opioid use: This binary variable was created by combining the heroin, synthetic opioid and non-prescription methadone use variables, so that if a person reported using any of these drugs, opioids was coded as 1, and if they did not report using any one of them, opioids was coded as 0.

Psychiatric Problem: This binary variable indicates whether an individual has a psychiatric problem, as identified through self-report and/or program report. The psychiatric problem variable was a supplemental variable, and therefore was not reported by every program. In the final Aim 2 dataset, before any missing data techniques were used, the largest amount of missing data for psychiatric problem in any one year or combined year, for either methadone or buprenorphine, was 26%. In the final Aim 3 dataset, before any missing data techniques were employed, the largest amount of missing data for any category of primary source of income in any of the methadone analyses was 29%.

Primary Health Insurance Type: This variable indicates the primary type of health insurance coverage a person had at the time of treatment admission. The original variable was categorical but was dummy coded for these analyses using the original categories: private insurance (referent group), Medicaid, Medicare and none. Health insurance was a supplemental variable, and therefore was not reported by every program. In the final Aim 2 dataset, before any missing data techniques were used, the largest amount of missing data for any category of client insurance coverage in any one year or combined year, for either methadone or buprenorphine, was 50%. In the final Aim 3 dataset, before any missing data techniques were employed, the largest amount of missing data for any category of client insurance coverage in any of the methadone analyses was 54%.

#### TEDS-A – Dependent Variables

Days Waiting to Enter Treatment: This continuous variable was the outcome variable used in Aim 2. Treatment wait time reflects the number of days between a person's first contact with a program and their date of admission or receipt of their first clinical service. Treatment wait time reflects delays in treatment entry due to program capacity, treatment availability, admission requirements or other requirements related to the program. Programs are directed to not report any delays in treatment entry



that are caused by the unavailability of the client. The range of possible values for treatment wait time was 0 to 996 days.

Days waiting to enter treatment was a supplemental variable, and therefore was not reported by every program. In the final Aim 2 dataset, before any missing data techniques were used, the largest amount of missing data for treatment wait time in any one year or combined year, for either methadone or buprenorphine, was 24%.

Enrolled in MAT: For the Aim 3 analyses, the TEDS-A Medication Assisted Treatment variable was the outcome variable of interest. This binary variable indicated whether methadone or buprenorphine were part of an individual's treatment plan. This variable does not, however, specify which of the two MATs, methadone or buprenorphine, was used. The variable was coded as yes=1 and no=2 and was recoded to enrolled in MAT=1 and not enrolled in MAT=0.

### Structural Variables

Variables representing the state economic environment and need for substance use treatment within a state were utilized in Aim 1 of this study to investigate the correlation between two sets of factors, economic and need, and Medicaid coverage of methadone and buprenorphine. Some of the state-level factors from the Aim 1 analyses were included in the analyses for Aims 2 and 3 as fixed effects estimators to help account for the unobserved heterogeneity of the state environment. A description of each structural variable follows.

Federal Medical Assistance Percentages (FMAP): The Federal Medical Assistance Percentage is the proportion of funds that the federal government contributes to each state's Medicaid program. The FMAP varies by state and is largely based on the per capita income of the state.<sup>128</sup> On average, the FMAP rate is 57%, meaning that the federal government pays 57% of Medicaid costs. While the FMAP rate is

never lower than 50%, in 2013 it was over 70% for Arkansas, the District of Columbia, Idaho, Kentucky, Mississippi, South Carolina and West Virginia.<sup>129</sup> The FMAP rate is reassessed every three years in order to account for changes in a state's overall wealth. FMAP rates for this study were obtained for fiscal years 1998, 2006 and 2008 from the Department of Health and Human Services.<sup>130</sup> The fiscal year covers the period of October 1, 1997 – September 30, 1998, October 1, 2005 – September 30, 2006 and October 1, 2007 – September 30, 2008.

State Expenditures: State expenditure data were obtained from the National Association of State Budget Officers.<sup>131–133</sup> Some of the broad expense categories that are included in the annual state expenditure total are: education, public assistance, Medicaid, corrections, transportation and capital expenses. State expenditure totals were obtained for fiscal years (July 1-June 30) 1998, 2006 and 2008.

Percent of Residents Receiving Medicaid: Data regarding Medicaid beneficiaries were obtained from the Centers for Medicaid and Medicare (CMS), Medicaid Statistical Information System.<sup>134–136</sup> The total number of beneficiaries was obtained for each state and was then divided by each state's estimated population total (data obtained from the United States Census Bureau<sup>137</sup>), and then multiplied by 100. Medicaid beneficiary data were obtained for 1999 (1998 Medicaid beneficiary data were not available), 2006 and 2008.

Per Capita Income: Per capita income data were obtained from the United States Department of Commerce, Bureau of Economic Analysis for 1998, 2006 and 2008.<sup>138</sup> The per capita income in each state is calculated by summing the total personal income for all state residents, divided by the total midyear population, as estimated by the United States Census Bureau.

Substance Abuse Prevention and Treatment Block Grant (SABG) funding: SABG funds provide states with the opportunity to address their substance use prevention and treatment needs in ways that are unique to their individual communities. The amount each state receives is dependent upon population size, the total personal income for state residents and the amount of taxable resources in a state.<sup>139</sup> SABG data

were obtained from the Substance Abuse and Mental Health Services Administration for fiscal years 2006 and 2008 (1998 data were not available).<sup>140</sup> Data used for this study were limited to substance use treatment block grant funds, excluding state funding that was obtained for substance use prevention.

Rate of Individuals in Opioid Treatment: To calculate the opioid treatment rate, the number of opioid dependent individuals in 1998, 2006 and 2008 were obtained from the TEDS-A. TEDS-A data were limited to individuals reporting opioids as their primary, secondary or tertiary substance of abuse. To standardize the number of opioid dependent individuals seeking treatment across states, an opioid treatment rate of opioid dependent individuals per 10,000 population was calculated based on the number of opioid dependent individuals and the population of each state.

Methadone and Buprenorphine Program Rate: The number of opioid treatment programs were obtained from the Uniform Facility Data Set (UFDS) for 1998, and the National Survey of Substance Abuse Treatment Services (N-SSATS), formerly known as the UFDS, for 2006 and 2008.<sup>141</sup> The UFDS and N-SSATS include all private and publicly funded substance use treatment programs in the United States. The UFDS and N-SSATS data used for this study were limited to the total number of programs providing methadone in 1998 or 2008 and buprenorphine in 2006 and 2008. In order to standardize the number of programs per state, a program rate of programs per one million population was calculated based on the number of methadone and buprenorphine programs (calculated separately) and population of each state.

Medicaid Coverage of Methadone: State Medicaid coverage of methadone for 1998 and 2008 was obtained from two sources. For 1998, data were obtained from McCarty et al's article, "Methadone Maintenance and State Medicaid Managed Care Programs".<sup>142</sup> This article describes the results of a cross-sectional study of Medicaid coverage restrictions for methadone in each state in the U.S. in 1998.

For 2008, state Medicaid coverage of methadone was obtained from the State Financing for Medication Assisted Treatment study, which includes cross-sectional data on Medicaid coverage of both

methadone and buprenorphine.<sup>9</sup> For both study years, Medicaid coverage of methadone was dichotomized as yes/no.

Medicaid Coverage of Buprenorphine: State Medicaid coverage of buprenorphine in 2006 was gathered from Ducharme et al's article, "State Policy Influence on the Early Diffusion of Buprenorphine in Community Treatment Programs", which describes the results of a cross-sectional investigation of the organizational factors associated with state policy restrictions of Medicaid coverage of buprenorphine.<sup>54</sup> Similar to the 2008 data used for methadone, data for Medicaid coverage of buprenorphine in 2008 were obtained from the State Financing for Medication Assisted Treatment study. Similar to methadone, Medicaid coverage of buprenorphine was dichotomized as yes/no for both 2006 and 2008.

### **Construction of Analytic Samples**

Each study aim utilized a different sample based on available data for the predictors and outcome of interest in the study analyses. This section describes how each analytic sample was derived.

#### Aim 1

The Aim 1 dataset was developed by gathering state-level data for Medicaid coverage of methadone and buprenorphine, FMAP rates, percent of residents receiving Medicaid, per capita income, total state expenditures, SABG, rate of opioid dependent individuals in treatment and rate of methadone and buprenorphine programs. These data were entered into Microsoft Excel and were matched based on the state indicator variable. Matching was done for each state per study year. The final dataset was then exported to SAS 9.3 for analyses.

As a state-level exploration, the potential analytic sample for each analysis in Aim 1 began with N=50. Due to missing data on the outcome and/or main predictors of interest, the sample was then reduced in each study year and in the combined year analyses for both treatment types. As displayed in

Figure 1.3, the 1998 methadone analysis was reduced to N=48, excluding Nevada and West Virginia due to missing data. In 2008, the methadone sample was reduced to N=44 due to missing data, excluding the District of Columbia, Mississippi, North Carolina, North Dakota, Rhode Island and Texas. Finally, in the combined year analysis for methadone, the final sample was N=92 after excluding the District of Columbia, Mississippi, North Carolina, North Dakota, Nevada, Rhode Island, Texas and West Virginia due to missing data in one or both study years. The unit of analysis for the combined year sample was state-year.

Due to missing data on either the outcome variable or one of the predictor variables of interest, the 2006 buprenorphine sample was reduced to N=48, with Alaska and Georgia excluded from the analyses. The 2008 buprenorphine sample was limited to N=45 due to missing data from the District of Columbia, Mississippi, North Carolina, Rhode Island and South Carolina. Finally, the combined 2006-2008 buprenorphine sample, after excluding Alaska, the District of Columbia, Georgia, Mississippi, North Carolina, Rhode Island and South Carolina due to missing data, was limited to N=93. The unit of analysis for the combined year sample was state-year.

## Aim 2

Two datasets were constructed for the Aim 2 analyses, one dataset for the 1998, 2008 and combined 1998-2008 methadone analyses, and one dataset for the 2006, 2008 and combined 2006-2008 buprenorphine analyses. Each dataset was primarily composed of individual-level data from the TEDS-A, as well as state-level predictors utilized in the Aim 1 analyses. Both datasets included the following individual-level variables: sex, race, ethnicity, education, marital status, employment status, living arrangement, age, treatment program type, MAT use, psychiatric problems, reported drug use, including: heroin, cocaine, methamphetamines, non-prescription methadone, synthetic opioids, benzodiazepines, any opioids, the total number of substances reported at treatment admission, IDU,

health insurance type and primary source of income. In addition to the aforementioned individual-level data from TEDS-A, the methadone dataset included the following structural factors: Medicaid coverage of methadone, state per capita income, state methadone program treatment rate, percent of individuals receiving Medicaid and rate of opioid dependent individuals engaged in substance use treatment. The buprenorphine dataset included the following structural predictors: Medicaid coverage of buprenorphine, per capita income, SABG, percent of individuals receiving Medicaid, buprenorphine program treatment rate, and rate of opioid dependent individuals engaged in substance use treatment. TEDS-A data were matched with these structural variables based on the state indicator variable. For instance, if the methadone treatment rate for NJ was 40.5, every individual receiving treatment in NJ would have 40.5 for the methadone treatment rate variable in the final dataset. This matching was done for each study year and the data were then merged into a final dataset that contained both study years. In the final combined dataset, the unit of analysis was person-year.

#### Methadone dataset

Figure 2A.1 describes the analytic sample sizes for the methadone analyses performed for Aim 2, as well as the steps in which the sample was restricted. The initial methadone dataset contained a total of 3,721,278 individuals for the combined 1998-2008 period, with 1,704,606 individuals for 1998 and 2,016,672 for 2008. Each sample year was restricted to fourteen states in which there were sufficient data available for the outcome of interest, main predictor variables and the combined year analyses. These fourteen states included: Arizona, Colorado, Florida, Hawaii, Idaho, Iowa, Kansas, Louisiana, Montana, New Hampshire, New Mexico, Ohio, South Carolina and Wyoming. The largest amount of missing data for any one variable retained in the methadone dataset was 54%. Once the methadone sample was restricted to these fourteen states, there were 357,031 individuals in the 1998 dataset and 432,993 in the 2008 dataset.

Two different approaches, multiple imputation (MI) and listwise deletion (LD), were utilized to handle missing data in Aims 2 and 3 of this study [a more in-depth explanation of MI and LD is included later in this chapter]. MI was performed for each single study year (the combined study year sample size was too large). The MI sample, which was drawn from the fourteen state sample, was N= 1,364,735 for 1998 and N= 2,034,778 for 2008. For the LD analyses, each year and the combined year sample was restricted to only those individuals in which there were complete case data. The final LD sample was N=98,183 for 1998, N=162,242 for 2008 and a combined 1998-2008 sample of N=260,425.

Bootstrap Analysis (BA) was also conducted for each year and combined year dataset because it is known to produce stable, unbiased estimates that demonstrate good internal validity, which is crucial in large sample sizes<sup>143</sup> [a more in-depth explanation of MI and LD is included later in this chapter]. The BA models are presented as the final models for Aims 2 and 3.

Each BA consisted of an unrestricted random sample of individuals selected from each LD dataset. The initial BA samples were N=290 for 1998, N=243 for 2008 and N=259 for the 1998-2008 dataset. As part of the BA procedure, each sample was replicated in 100 separate datasets which were then combined to form a final sample. The final BA samples for the methadone analyses were N=29,500 for 1998, N=24,400 for 2008 and N=26,100 for the combined 1998-2008 dataset.

### Buprenorphine Dataset

Figure 2B.1 depicts the various sample sizes for the buprenorphine analyses. The main, 2006-2008 combined year dataset contained 3,721,278 individuals, 1,914,338 from 2006 and 2,016,672. A similar process was used to subset the buprenorphine data as was used for the methadone dataset. For the buprenorphine analyses, there were 24 states with sufficient data available for the outcome of interest, main predictor variables and the combined year analyses. These states included: Arizona, Arkansas, California, Colorado, Florida, Hawaii, Idaho, Illinois, Iowa, Kansas, Louisiana, Maryland, Michigan,

Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Dakota, Ohio, South Dakota, Utah and Wyoming. The largest amount of missing data for any one variable retained in the buprenorphine dataset was 50%. The sample size, after restricting the analyses to these twenty four states, was N=883,207 for 2006 and N=968,237 for 2008. This sample, based on individuals representing 24 states, was then utilized as the basis for MI. The MI sample was N= 4,258,996 for 2006 and N= 4,698,055 for 2008 (the combined study year sample size was too large to perform MI).

The next step was to restrict the sample for the LD analyses, or to only those individuals with complete case data. The LD sample was N=240,757 for 2006, N=320,656 for 2008 and N=561,413 for the combined 2006-2008. Similar to the methadone analyses, BA was performed on the LD sample. The buprenorphine BA analyses consisted of three initial unrestricted random samples for each study year, N=241 for 2006, N=257 for 2008 and N=253 for the combined 2006-2008 dataset. Each of these samples was replicated in 100 separate datasets which were then combined to form a final sample. The final BA samples for the buprenorphine analyses were N=24,100 for 2006, N=25,700 for 2008 and N=25,300 for the combined 2006-2008 dataset.

### Aim 3

The Aim 3 analyses utilized the primary methadone dataset described in Aim 2; however, the Aim 3 sample was restricted differently. Figure 3.1 provides an overview of the various analytic samples utilized in Aim 3, including the steps that were taken to restrict the sample for each analysis.

As shown in Figure 3.1, similar to Aim 2, the initial 1998-2008 combined methadone sample contained 3,721,278 individuals, 1,704,606 from 1998 and 2,016,672 from 2008. The main outcome for Aim 3 was use of medication assisted treatment, a treatment that is only appropriate for opioid users; therefore, the next step restricted the sample to only those individuals that reported opioids (including heroin, synthetic opioid or non-prescription methadone) as their primary, secondary or tertiary drug of



abuse at admission. Once the sample was restricted to opioid users, the 1998 sample was N=327,647 and N=511,448 for 2008.

Thirty-eight states had sufficient data available in both 1998 and 2008 for the outcome of interest and main predictor variables. The 38 states were: Alaska, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, Wisconsin and Wyoming. The largest amount of missing data for any one variable included in the sample was 60%. Once the remaining twelve states were excluded from the dataset, the 1998 sample was N=299,452 and the 2008 sample was N=461,004.

The 1998 and 2008 samples of opioid users from 38 states were then used as the basis for MI. The MI sample for 1998 was N=1,497,260 and the 2008 MI sample was N= 2,305,020. The next step was to restrict the 38 state sample for the LD analyses. The LD samples, once all cases with any missing data were removed, were N=8,311 for 1998, N=81,584 for 2008 and N=89,895 for the combined 1998-2008 sample.

Similar to Aim 2, bootstrapping was performed on each year's LD sample. The Aim 3 BA consisted of three unrestricted random samples for each of the study years, N=250 from the 1998 LD dataset, N=246 from the 2008 LD dataset and N=253 from the combined 1998-2008 dataset. Each of these samples was replicated in 100 separate datasets which were then combined to form final BA samples. The final BA samples were N=25,000 for 1998, N=24,600 for 2008 and N=25,300 for the combined 1998-2008 dataset.

## Missing Data

As an administrative dataset, the TEDS contains several variables that substance use treatment programs are required to report, as per state law. However, the TEDS also includes supplemental variables that are not mandatory for programs to report, such as treatment wait time, psychiatric problems, health insurance type, veteran status, source of income, marital status, criminal justice referral and payment source. Several of these variables were included in the analyses for Aims 2 and 3, and treatment waiting time was the outcome of interest in Aim 2. Because these variables were optional for programs to report, there was a significant amount of missing data to contend with. This section provides an overview the types of missing data and describes the techniques used to handle missing data in this dissertation.

### Types of Missing Data

Several methods have been developed to address missing data. Choosing the most appropriate method requires an understanding of the types of and/or reasons for missing data in order to minimize bias.<sup>144,145</sup> The three main types of missing data are: *missing completely at random* (MCAR), *missing at random* (MAR) and *missing not at random* (MNAR). When data are MCAR, there are no distinguishable patterns of variables leading the data to be missing.<sup>146–148</sup> For example, in a randomized controlled trial, data would be MCAR if participants in *both* the treatment and control arms drop out of the study because they had relocated. These data are MCAR because study arm assignment is unrelated to study participation and an individual's relocation. Data that are MCAR are considered “harmless” because they will not bias the mean or standard deviation estimated from the dataset, and will not impact the estimated relationships among other variables in the dataset given the fact that missingness occurs because of random events.<sup>144,149</sup>

While the extent of missing data and the way in which missing data are handled are not often explained in publications, when missing data are reported, they are most frequently described as *missing at random* (MAR).<sup>150</sup> When data are MAR, the probability that the data are missing is based on observable characteristics within a study population but are not related to the outcome of interest.<sup>147,148</sup> For example, if a larger proportion of Hispanics, as compared with other racial/ethnic groups, are less likely to report their income on a survey, their data are considered MAR as long as the Hispanics in the sample include sufficient representation of Hispanics in all income strata. In other words, the missing data are conditional on being Hispanic but not on the dependent variable of income. Therefore, when data that are MAR take into account the variable on which they are conditional (such as including the conditional variable in a regression equation), bias can be minimized.<sup>151</sup>

Despite the fact that researchers usually report missing data as MAR, some researchers argue that missing data are usually *missing not at random* (MNAR).<sup>150</sup> Data that are MNAR occur when the probability that an item is missing is dependent upon unobserved information among a subset of participants.<sup>147,148</sup> Utilizing the previous income example, data would be considered MNAR if low income Hispanics were less likely to report their income on a questionnaire. In this case, the reason for missingness is a characteristic of the outcome of interest and is therefore not a random event. This is particularly problematic because any estimates produced from such a sample will be biased, in this case producing an inflated overall income for the sample due to fewer responses among lower income Hispanics.<sup>144</sup> Data that are MNAR weaken the generalizability of the findings because the pattern of the missing data is systematic and therefore the associations are not likely to represent the general population.

## Missing Data Methods

This dissertation employed two techniques to address missing data: Listwise Deletion and Multiple Imputation. The following section provides an overview of each technique, as well as a discussion of other methods used to handle missing data.

### Listwise Deletion (LD)

The most common method for analyzing missing data is listwise deletion, or excluding cases from analysis if any item within that case is missing. The underlying assumption of listwise deletion is that the data are MCAR; therefore, utilizing listwise deletion with data that are MCAR would not introduce bias because the data that are deleted do not have a systematic pattern of missingness.<sup>152</sup> However, when listwise deletion is applied to data that are MAR or MNAR, bias is likely to be introduced due to a potential overestimation of the certainty of the results.<sup>153</sup> For instance, if a sample of Americans were asked about their annual household income, and low income participants were less likely to report their income, the resulting mean income would be larger than the true mean income had the lower income individuals responded to that question. The standard error would be smaller than is accurate because the assumption is that the sample was randomly selected. However, when data are MAR or MNAR, and are excluded via listwise deletion, the retained sample no longer reflects a random sample of the population and therefore selection bias may be introduced. Some researchers, however, argue that utilizing listwise deletion with data that are MAR, particularly when the missing data for predictor variables are independent of the dependent variable, will yield unbiased results because it is similar to stratified sampling.<sup>154</sup>

A general drawback of listwise deletion, regardless of the type of missing data, is the impact that listwise deletion can have on statistical power. Because listwise deletion removes all cases from the dataset that have any missing data, this method poses a threat to external validity, particularly in studies

with small sample sizes. However, in large sample surveys, such as the TEDS-A, particularly when data are MCAR, listwise deletion is not likely to impact results due to the large sample size.<sup>144</sup>

### *Pairwise Deletion*

Pairwise deletion is similar to listwise deletion, in that missing data are excluded from analysis; however, with pairwise deletion, only the missing item is excluded while the rest of the case is retained.<sup>152</sup> The ability to preserve a majority of the items for each case is advantageous because it results in a larger sample size (as compared with listwise deletion), thereby increasing statistical power.

Similar to listwise deletion, utilizing pairwise deletion for data that are MCAR will likely produce unbiased results because of the ability to retain the entire sample minus the missing items. However, when using pairwise deletion for data that are MAR or MNAR, it is difficult to produce accurate estimates of the standard error due to fluctuations in the sample size.<sup>155,156</sup>

For example, when assessing the relationship between several independent variables via a correlation matrix, utilizing a dataset in which pairwise deletion has been performed can be problematic because each correlation may include a different set of cases, making comparisons difficult and potentially prohibiting the use of these correlations in multivariate analyses.<sup>157</sup>

### *Imputation*

As a general category, imputation refers to the act of replacing missing values from a dataset with estimated values. Because imputation allows for the analysis of a complete dataset, threats to external validity may be minimized. There are several imputation methods, but the most widely utilized methods include: mean substitution, hot deck imputation, regression imputation, and multiple imputation. This section reviews each method, with a more in-depth description of MI, the imputation method used to handle missing data in this dissertation.

## Mean Substitution

Mean substitution is the process of substituting a missing value with the mean of non-missing values.<sup>158</sup> Similar to both listwise and pairwise deletion methods, the main assumption underlying mean substitution is that the data are MCAR and normally distributed. When this is the case, substituting the mean for this missing data will likely lead to unbiased results. However, when mean substitution is used with data that are not MAR, it can lead to an under- or over-estimation of the true value of the item because the reason the item is missing may be associated with the outcome. For example, individuals with higher incomes may be less willing to report their income than individuals with lower incomes; therefore, by replacing missing income with the mean income, the result will be an underestimate of the true value of income. Similarly, mean substitution may also weaken variance estimates because by substituting the mean, the true variability of the data are compromised.

## Hot Deck Imputation

Hot deck imputation is a useful tool for imputing missing data because this approach uses non-missing values from characteristically similar respondents, called donors, to impute missing values.<sup>159</sup> This imputation process is carried out through the creation of a matrix of variables that a researcher deems are related to the missing item to be imputed.<sup>160</sup> For example, if occupational status (unemployed, employed, etc.) is missing from a survey, a researcher with in-depth knowledge of the study can identify a set of variables that may be associated with occupational status, such as occupation and annual income. The data then form a *deck* where respondents with complete data on each of these variables are sorted.<sup>161</sup> Then, respondents who match the donee, or the respondent with missing data, then form a donor pool of potential imputes.<sup>152</sup> The donor may be randomly selected from the pool, called random hot deck methods, or the donor may be the “nearest neighbor” meaning that it most closely resembles the missing data characteristics (called deterministic hot deck methods).<sup>162</sup>

Hot deck imputation is widely utilized in the analysis of large surveys conducted by organizations such as the United States Census Bureau and the Substance Abuse and Mental Health Services Administration. National surveys with large sample sizes are most appropriate for hot deck procedures because of the increased likelihood of finding a similar donor due to the large sample size. Hot deck imputation is not as useful when it is applied to data sets with large amounts of missing data, or when used in the analysis of data sets with a small sample size. In these cases, the validity of hot deck imputation is threatened due to the need to identify matching donors for several respondents (in datasets with large amounts of missing data), or the need to find matching donors with a limited number of respondents (in small datasets that may yield few donors).<sup>158,163–165</sup> Finally, in order to accurately identify similar donors in the hot deck procedure, researchers must be able to determine a set of variables that are predictive of the missing data. The hot deck procedure hinges on this identification, yet it is subjective, and as such introduces the potential for bias.

#### Regression Based Single Imputation

Similar to hot deck imputation, single regression imputation draws on what is known about cases with missing data, as well as cases with non-missing data, and uses this information to predict a missing value via a regression equation.<sup>166</sup> Using the same example as above, if we wanted to impute missing values for occupational status, we would first calculate the correlation between variables that we think might be associated with occupational status, such as annual income, occupation and several others, and those variables with the highest correlations would then be used as predictors in a regression equation in which employment status was the outcome variable. Then, all of the variables (with complete data) that were associated with the outcome are used to predict the missing values for employment status.<sup>150</sup>

Single regression imputation affords researchers the ability to “recover” missing data through estimates, a benefit that can increase statistical power and generalizability of the findings. Additionally, the ability to include random error in the regression equation helps to account for the uncertainty of the imputation procedure. Despite these advantages, there are also some noted drawbacks. In particular, similar to hot deck imputation, special attention must be paid to the variables chosen as predictors for the imputation. If there is multicollinearity among these variables, the variance of the missing data variable may be artificially high.<sup>146</sup> Finally, single regression imputation assumes a linear relationship between variables; however, when this is not the case, the model may produce artificially low significance values, leading to a falsely conclusion of statistical significance.

#### Multiple Imputation (MI)

Multiple imputation (MI) is similar to hot deck and single regression imputation, in that this procedure also utilizes existing data to help inform imputed values. However, with MI, the process of creating imputed values for missing data is carried out several times.<sup>167</sup> More specifically, similar to single regression imputation, a predictive statistical model is developed based on a set of independent variables that are correlated with the missing variable, an error term is added and then an imputed value is computed.<sup>168</sup> This process is then repeated, usually between five and ten times, resulting in the creation of five to ten complete data sets. Once these data sets are created, analyses can then be performed (analyses are run separately on each dataset), and the results are then pooled in order to create a single set of statistics, including parameter estimates and standard errors.

The main advantage of MI is that through these multiple steps in the procedure, and the inclusion of an error term at each step, the uncertainty inherent in imputation is accounted for because the variability of the data is considered. The ability to account for the fluctuations in standard error across



each imputed data set can help reduce type I error, or the wrongful conclusion that there is an effect when none is present.<sup>152</sup>

The creation of several distinct data sets in the MI procedure is a critical strength to this technique. Because each data set is generated randomly, the potentially imputed values may vary slightly from one another. The randomness and repeated process of MI help to increase the likelihood of making valid inferences based on these imputed data by increasing the random variability that is inherent in non-imputed data.<sup>168</sup>

MI has been used to impute missing data in research on sensitive topics, such as substance use and sexually transmitted infection status. For example, MI was used in a study investigating the factors associated with severe liver disease among HCV-infected PWIDs.<sup>169</sup> The predictive model contained 8 variables, 6 of which had varying amounts of missing data. Researchers used both listwise deletion and MI to determine which of the eight factors were associated with severe liver disease. When comparing the two methods, listwise deletion found that male sex, age over 40, HCV infection of 18 years or more, excessive alcohol consumption and HCV genotype 3 were all associated with severe liver disease. The MI-enhanced model found the same five variables to be associated with severe liver disease, as well as the addition of HIV infection. Though the findings from the listwise deletion model are similar to the MI-enhanced model, the increase in power provided by MI allowed for additional associations, affirming the current evidence base regarding the role of HIV co-infection in advancing liver disease,<sup>170–173</sup>

MI and listwise deletion methods were also utilized in a study predicting factors associated with Chlamydia infection among teenage and young adult men.<sup>174</sup> Laboratory data confirming Chlamydia status were missing for 28% of the young adult sample and 18% of the teenage sample. Researchers first assessed whether missing data were due to a nonresponse bias and determined that males in both samples with missing Chlamydia status were not significantly different than males with complete data. Researchers then imputed missing Chlamydia status for both samples utilizing MI and compared the

results to those achieved through listwise deletion. There was little difference in the findings between the missing data methods so the researchers chose to report the listwise deletion model results in their paper. This study demonstrates that in certain circumstances, such as datasets with large sample sizes and when there is a lack of association between the missing data and the outcome of interest, listwise deletion can be as effective as multiple imputation.<sup>144</sup>

A main drawback of MI is the accurate specification of predictor variables.<sup>168,175</sup> Researchers using MI must have a distinct sense of the variables that predict missingness because these variables must be included in the imputation model in order to reduce bias and potentially invalid conclusions. For example, Hippisley-Cox developed an algorithm to predict cardiovascular risk among UK residents and, after using MI to account for missing data, found that cholesterol was not associated with cardiovascular risk.<sup>176</sup> This finding drew a fair amount of criticism given that it defied conventional wisdom about cardiovascular risk.<sup>177–179</sup> Due to these criticisms, the authors re-ran their analyses using listwise deletion, and found a strong association between cholesterol and cardiovascular risk.<sup>180</sup> The authors then developed new MI models that included additional predictor variables that might help to inform the missing values. When the revised MI-enhanced dataset was used to run the cardiovascular risk model, the researchers found an association between cholesterol and cardiovascular risk. Given this, the authors concluded that they had not used a sufficient number of independent variables in the initial MI model to accurately predict the imputed values, which then led to an underestimation of the association between cholesterol and cardiovascular risk.<sup>180</sup>

To explore missingness in this dissertation, cases that contained missing data were compared to those without missing data on all variables of interest in this study. The results of these comparisons indicate that for both Aims 2 and 3, the two samples were significantly different on nearly every study variable, indicating that the data are not likely MCAR.

Because this dissertation utilized very large datasets, concerns regarding a reduction in sample size when considering missing data methods were minimized. For this reason, and the fact that retaining the same sample size across analyses was preferable, LD was chosen as one method for handling missing data in this dissertation. However, given the large amount of missing data in both of the Aim 2 and 3 datasets, MI was also chosen so that complete case analyses could be performed, and any bias associated with excluding cases with missing data would be reduced. Both methods were performed for each Aim and study year and the findings across these methods were compared for the main outcomes in Aims 2 and 3. Due to the very large dataset for the combined year analyses, only LD was carried out.

Listwise Deletion was carried out by eliminating all cases from each dataset that contained at least one missing value. A dummy variable indicating missing data in any one of the variables of interest was created and the sample was then restricted based on those cases in which there were no missing data. Multiple imputation was performed using the ProcMI function and Markov Chain Monte Carlo method in SAS 9.3 (SAS Institute, Cary, NC). While there is some disagreement in the literature regarding the inclusion of outcome variables in MI procedures<sup>181–183</sup>, the dependent variable was included in all MI procedures. All study variables, including the dependent variables, were included in the imputation models. Each single year dataset in Aims 2 and 3 were imputed five times. Regression analyses were then performed on each dataset and the results were pooled using the ProcMIAnalyze function.

### **Validating Findings Derived from Large Samples**

The final samples used in the analyses for Aims 2 and 3 were very large, even after restricting them by study criteria and to those individuals with complete data. An important issue to consider when analyzing large datasets such as these is that the increased power due to the large size of the sample can result in an increase in the amount of significant associations.<sup>184</sup> These associations, while statistically significant, may have very small effect sizes, reducing the utility of the p-value as the sole

basis for interpreting study findings.<sup>185</sup> One way to address this limitation is to present the effect sizes and confidence intervals along with the p-value so that readers have a better understanding of the extent of the relationship between variables.<sup>184</sup> Another way to address this concern is to utilize a validation procedure to augment significance testing.<sup>143</sup> The most commonly used validation procedures are bootstrapping and jackknifing. The bootstrap and jackknife procedures are resampling techniques that can be used with non-normally distributed data to estimate parameters, standard errors and confidence intervals. These techniques are particularly useful when there is uncertainty regarding the generalizability of study findings. The following section provides a brief overview of each method.

#### Jackknife

As a resampling procedure, the jackknife technique, also known as the “leave one out” procedure, utilizes an entire sample, without replacement, to estimate a given parameter.<sup>186</sup> To do this, a single case is eliminated from the original sample one step at a time, and a “pseudo-value” is computed to estimate the parameter of interest at each step.<sup>185</sup> This procedure is repeated over a specified number of times as each observation is dropped from the sample. Once the iterative estimate process is complete, the “pseudo-values” are averaged to create an overall estimate of the parameter of interest.<sup>187</sup>

In addition to parameter estimates, the jackknife procedure can be used to create confidence intervals and estimate standard errors. Because observations or cases are removed from the original dataset one at a time, the jackknife procedure is particularly sensitive to outliers and can reduce bias given the ability to detect these observations.<sup>185</sup>

## Bootstrap

Similar to the jackknife procedure, bootstrapping involves the creation of a new set of samples via repeated resampling from an original, representative sample. Unlike the jackknife procedure, bootstrapping allows for random sampling with replacement, meaning that each time an observation is selected for bootstrapping, it is returned to the original dataset, allowing for it and all other observations to have an equal chance of being drawn at each selection step.<sup>188</sup> This procedure is repeated until a set number of cases is achieved for a set number of samples. The target sample size is determined prior to the start of the procedure and usually equals the size of the main sample, unless bootstrap subsampling is performed, in which case a fraction of the original sample is selected.<sup>189</sup> Bootstrap subsampling is often utilized with large datasets and when traditional bootstrapping procedures fail. The number of replications, or the number of times a new sample is created, is also determined a priori and usually ranges from 100-1000, or more.<sup>143,190</sup> Similar to MI, the bootstrap samples are pooled, which creates a sampling distribution and facilitates the computation of parameter estimates, standard errors and confidence intervals.<sup>191</sup>

Bootstrapping has been found to provide more stable estimates than the jackknife procedure.<sup>143,186,192</sup> While the jackknife procedure is particularly effective at reducing bias through the identification of outliers, bootstrapping can provide more comprehensive and accurate estimates for a given sample or set of samples. In Aims 2 and 3 of this dissertation bootstrapping was utilized as a validation technique to ensure that model results were consistent when performed on smaller and different samples.

## Chapter 4: Conceptual Framework

The first aim of this study is guided by a theoretical framework developed by Schneider and Jacoby that sought to explicate the impact of external influences on bureaucratic policy making.<sup>193</sup> The findings from this analysis provided a theoretical foundation for the selection of state-level factors utilized in the development of models for Aims 2 and 3 of this study.

Medicaid is a combined federal/state program, with the federal government and state governments sharing the costs of Medicaid services, depending upon the per capita income of the state, among other factors.<sup>128</sup> The federal government issues guidelines on “mandatory services” that states must cover, such as inpatient hospital stays, physician visits, as well as several other services; however, states can choose whether to cover “optional services”, which include prescription drugs and dental services, among other services.<sup>194</sup> The decision regarding what optional services state Medicaid programs will cover ultimately lies with state Medicaid administrators. Given the magnitude of this decision and the variability in coverage across states, Schneider and Jacoby sought to understand the factors that influence the number of optional services covered by states. To do this, Schneider and Jacoby developed and tested a theory that posited four levels of influence on Medicaid policy making: elected officials, interest groups, structural influences and state-level environmental conditions.<sup>193</sup> Schneider and Jacoby believed that elected officials have the potential to influence Medicaid decision-making due to the fact that governors and/or legislatures are responsible for appointing state Medicaid directors.<sup>195</sup> Because of this, Schneider and Jacoby tested the influence of two variables at the elected officials’ level that have been found to be influential in other relevant research: legislative partisanship, which they defined as the percent of Democrats in both the Senate and the House of Representatives or Assembly; and, the incumbent governor’s party affiliation.

At the interest group level, Schneider and Jacoby included four variables to assess the influence of interest groups on the inclusion of Medicaid optional services: the proportion of physicians, dentists,

hospital beds and nursing home beds within a state. These variables were chosen because they represented a wide cross-section of parties that might be interested in and lobby for specific optional services.

Structural influences, Schneider and Jacoby posited, may also play a significant role in influencing decisions regarding the coverage of Medicaid optional services. They operationalized these structural influences through the inclusion of the previous year's Medicaid expenditures, given that these expenses may impact decisions about future spending. Additionally, they believed the FMAP rate may also influence the extent to which states include optional services given that it is an indication of the payment contribution of the federal government. The final structural influence included in their model was whether Medicaid programs are controlled by state or local administrations. In some states, decision making regarding Medicaid lies solely at the state level, whereas in other states, Medicaid decision making has devolved to county officials as well. Schneider and Jacoby hypothesized that in states with local administration involved in the decision making, bureaucrats may have a better handle on the needs of their communities and therefore be more likely to include optional services that reflect the need of the population.

The final group of potential influences in their model was environmental factors. These factors were chosen to account for the conditions within a state that may influence Medicaid directors' decision making, including need, economics and ideology. Schneider and Jacoby operationalized need through the use of state infant mortality rate as an indicator of the overall health of the population. Per capita income was chosen to reflect the economic condition of the state, and the ideological leaning of the state was operationalized through the use of survey data measuring the extent to which state residents lean conservative or liberal.

Schneider and Jacoby assessed the strength of their framework by testing the extent to which the aforementioned independent variables explained the variability across states regarding the total

number of optional services adopted. Schneider and Jacoby found that per capita state income, FMAP rate, the proportion of physicians and dentists, state versus local Medicaid administrators and infant mortality rate were all significant factors that influenced the adoption of Medicaid optional services across states.<sup>193</sup>

Schneider and Jacoby were interested in understanding the influences on the volume of optional services states covered; however, this study is focused on the influences for two specific optional services, methadone and buprenorphine treatment. While some forms of substance use treatment are considered mandatory under federal Medicaid guidelines, such as inpatient detoxification, methadone and buprenorphine are optional. Given the fact that methadone and buprenorphine are the two most effective treatments for opioid dependence, it is unclear why only a portion of states provide coverage for these treatments.

Due to limitations on the availability of relevant factors, this study utilizes an adapted version of Schneider and Jacoby's framework to test the correlation of two levels of influence on Medicaid restrictions of methadone and buprenorphine coverage: economic and need. Economic factors will be operationalized through the use of the following state-level variables: FMAP rate, percent of residents receiving Medicaid, per capita income, annual state expenditures and the amount of federal block grant funding for substance use treatment. Finally, need factors will be operationalized through the following state-level indicator: the number of substance use treatment facilities in each state and the number of opioid dependent individuals in each state.



## **Chapter 5: State-level Analysis of Economic and Need Factors and Medicaid Coverage of Methadone and Buprenorphine Treatment in the United States (Aim 1 Analysis)**

### **Background**

#### Opioid Dependence

Substance use treatment admissions for opioid dependence have increased 71% between 1998 and 2012, due to a large increase in the nonmedical use of prescription opioids and heroin.<sup>1,126,196</sup> By 2013, 4.5 million Americans reported nonmedical use of prescription opioids within the previous month and close to 300,000 people reported heroin use within the previous month.<sup>16</sup> Both nonmedical prescription opioid use and heroin use have been associated with dramatic increases in the number of fatal drug overdose deaths in the United States. Between 2001 and 2013, fatal drug overdoses that were that result of nonmedical use of prescription opioids tripled and those associated with heroin increased by fivefold.<sup>197</sup>

Expanding access to evidence based treatments for opioid dependence, particularly methadone and buprenorphine, is a critical step in stemming the growing tide of opioid dependence and the negative health consequences associated with it.<sup>198</sup> While methadone and buprenorphine are considered to be the most effective forms of treatment for opioid dependence, public and private insurance programs are not required to cover these treatments. This study examines the association between two sets of factors, economic and need, and state Medicaid coverage of methadone and buprenorphine.

#### Medicaid Coverage of Methadone and Buprenorphine

Medicaid is a combined federal/state program that provides health insurance for low-income individuals and families. The federal government offers guidelines to states regarding the extent to

which medical services and medications should be covered under Medicaid. Ultimately, however, each state develops their own eligibility requirements, as well as coverage parameters for medical care and medications.<sup>124</sup> As a result of state autonomy, there is substantial variability in substance use treatment coverage across states, particularly for methadone and buprenorphine. In some states, for example, Medicaid covers either buprenorphine or methadone; however, in other states, Medicaid covers both medications as long as they are provided in specific settings or after physicians have obtained pre-approval. As of 2008, 19 states had some form of restriction on the coverage of buprenorphine and/or methadone.<sup>9</sup>

In 2014, substance use treatment became an Essential Health Benefit (EHB) under the Patient Protection and Affordable Care Act (PPACA). An EHB is a required set of health care services that every insurance plan sold in the Health Insurance Marketplace must cover. Additionally, new Medicaid beneficiaries now covered in states that have opted to expand their Medicaid programs will be entitled to receive substance use treatment as part of their essential benefits. This new EHB status provides significant hope for increased access to substance use treatment services; however, these changes are not likely to decrease the variability in Medicaid coverage of methadone and buprenorphine. State Medicaid programs will continue to have great latitude in choosing the types of substance use treatment services that will be covered. Additionally, while Medicaid expansion has the potential to increase access to substance use treatment, the expansion in services in some states will only apply to new Medicaid beneficiaries and not those that were receiving Medicaid prior to January 1, 2014.<sup>199,200</sup>

This study sought to gain a better understanding of Medicaid coverage variability for methadone and buprenorphine in the United States, focusing on two main categories of predictors: the need for treatment and the economic environment of the state. To guide the selection of relevant independent variables, we utilized an adapted framework from a study investigating factors associated with state coverage of Medicaid optional services.<sup>193</sup>

## Methods

An historical analysis of publicly available data was conducted using a variety of sources. An explanation of study variables and sources follow.

### Independent Variables

The independent variables chosen as economic predictors in this study include: state Federal Medical Assistance Percentages (FMAP) rate, percent of residents in each state receiving Medicaid, per capita income of each state, state expenditures and the amount of substance abuse block grant funding. The need predictor variables used in this study include: the rate of people seeking opioid treatment in each state and the rate of methadone and buprenorphine programs in each state. Each variable was examined separately to determine whether it was correlated with state Medicaid coverage of methadone in 1998, 2008 and 1998-2008 combined, and Medicaid coverage of buprenorphine in 2006, 2008 and 2006-2008 combined.

#### Federal Medical Assistance Percentages (FMAP)

The Federal Medical Assistance Percentage is the proportion of funds that the federal government contributes to each state's Medicaid program. The FMAP rate varies by state, however, the average FMAP rate is 57%, meaning that the federal government pays 57% of Medicaid costs. While the FMAP rate is never lower than 50%, in 2013 it was over 70% for Arkansas, the District of Columbia, Idaho, Kentucky, Mississippi, South Carolina and West Virginia.<sup>129</sup> FMAP rates for this study were obtained for fiscal years 1998, 2006 and 2008 from the Department of Health and Human Services.<sup>130</sup>

### Residents receiving Medicaid

Data regarding Medicaid beneficiaries were obtained from the Centers for Medicaid and Medicare (CMS), Medicaid Statistical Information System. The total number of beneficiaries was obtained for each state and then the proportion of residents receiving Medicaid was calculated using population totals obtained from the United States Census. Data were obtained for 1999 (1998 Medicaid beneficiary data were not available), 2006 and 2008.

### State Per Capita Income

Per capita income was obtained from the US Department of Commerce, Bureau of Economic Analysis for 1998, 2006 and 2008, and was based on the total personal income in each state, divided by the total midyear population.

### State Expenditures

State expenditure data include expenses paid by states for education, public assistance, Medicaid, corrections, transportation and capital expenses, among other categories. Expenditure data were obtained from the National Association of State Budget Officers for fiscal years 1998, 2006 and 2008.

### Substance Abuse Prevention and Treatment Block Grant (SABG) funding

SABG funds provide states with the opportunity to address their substance use prevention and treatment needs in ways that are unique to their communities. The services funded by SABG vary by state, as does the amount each state receives. SABG data were obtained from the Substance Abuse and Mental Health Services Administration for fiscal years 2006 and 2008 (1998 data were not available). Data used for this study was limited to substance use treatment block grant funds, and excluded the total amount awarded for substance use prevention.

### Rate of Individuals Seeking Opioid Treatment

The number of individuals seeking opioid treatment in 1998, 2006 and 2008 was obtained from the Treatment Episodes Data Set – Admission (TEDS-A). TEDS-A data include all drug treatment admissions from public and private substance use treatment programs that receive public funding. TEDS-A data are based on encounters in substance use treatment, rather than distinct individuals. For these analyses, TEDS-A data were limited to individuals seeking substance use treatment services with heroin or prescription opioids reported as their primary, secondary or tertiary substance of abuse. In order to standardize the number of opioid dependent individuals across states, a treatment rate of opioid dependent individuals per 10,000 population was calculated based on the number of opioid dependent individuals and population of each state.

### Rate of Methadone and Buprenorphine Programs

The number of opioid treatment programs were obtained from the Uniform Facility Data Set (UFDS) for 1998, and the National Survey of Substance Abuse Treatment Services (N-SSATS), formerly known as the UFDS, for 2006 and 2008. The UFDS and N-SSATS include all private and publicly funded substance use treatment programs in the United States. The UFDS and N-SSATS data used for this study were limited to the total number of programs providing methadone in 1998 or 2008 and buprenorphine in 2006 and 2008. In order to standardize the number of programs per state, a program rate of programs per one million population was calculated based on the number of methadone and buprenorphine programs (calculated separately) and the population of each state.

## Dependent variables

### Medicaid Coverage of Methadone and Buprenorphine

State Medicaid coverage of methadone for 1998 and 2008 was obtained from two sources. For 1998, data were obtained from McCarty et al's study, "Methadone Maintenance and State Medicaid Managed Care Programs".<sup>142</sup> For 2008, Medicaid coverage of methadone by state was obtained from the State Financing for Medication Assisted Treatment study.<sup>9</sup>

State Medicaid coverage of buprenorphine in 2006 was gathered from Ducharme et al's study, "State policy influence on the early diffusion of buprenorphine in community treatment programs".<sup>54</sup> Data for Medicaid coverage of buprenorphine in 2008 were obtained from the State Financing for Medication Assisted Treatment study.

## Analytic Approach

Bivariate logistic regression was used to assess the relationship between economic and need factors and Medicaid coverage of methadone in 1998, 2008 and 1998-2008 combined and buprenorphine in 2006, 2008 and 2006-2008 combined. The study timeframe was determined based on the availability of state-level Medicaid coverage of methadone and buprenorphine. The analyses included combined years for each treatment as well as analyses separated by study year in order to determine whether associations between the predictor variables and Medicaid coverage of each treatment remained significant when study years were assessed separately.

Predictor variables were standardized by dividing each mean score by the standard deviation in order to create a common scale. Economic and need factors were then assessed in separate bivariate analyses by predictor variable, year and type of treatment (methadone and buprenorphine). For all study years, Medicaid coverage of methadone and buprenorphine were dichotomized as yes/no. The

final sample for each analysis year was confined to only those states with data available for all of the independent and dependent variables in the given year. The analytic samples are depicted in Figure 1.3.

All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC). The study was determined exempt by the City University of New York's Human Research Protections Program Office due to the use of publicly available data.

## **Results**

Table 1.1 displays Medicaid coverage by state for methadone in 1998 and 2008 and buprenorphine in 2006 and 2008. In 1998, 25 states provided Medicaid coverage of methadone, as compared with 34 states in 2008. In 2006, 28 states provided coverage of buprenorphine for Medicaid beneficiaries, as compared with 38 states in 2008. A total of eleven states did not cover methadone for Medicaid beneficiaries in either 1998 or 2008 and six states did not cover buprenorphine for Medicaid beneficiaries in either 2006 or 2008. Finally, five states did not cover either methadone or buprenorphine for Medicaid beneficiaries in 2008.

The results of the bivariate logistic regression models for both treatments across study years are presented in Table 1.2.

### Economic Factors

State FMAP rate was negatively associated with Medicaid coverage of both methadone and buprenorphine across all study years. In 1998, for every one standard deviation increase (8.34%) in the FMAP rate, the odds of a state providing Medicaid coverage of methadone decreased by 64%. Comparable negative relationships were noted across all study years for methadone. Similarly, in 2006, for every one standard deviation increase (7.86%) in the FMAP rate, the odds of a state providing Medicaid coverage of buprenorphine decreased by 62%.

Per capita income was also significantly associated with Medicaid coverage of methadone and buprenorphine across all study periods. In 1998, the odds of a state providing Medicaid coverage of methadone increased by a factor of two for every one standard deviation (\$3,623) increase in per capita income, and in 2006, for every one standard deviation increase (\$5,261) in per capita income, the odds of a state providing coverage of buprenorphine more than doubled (OR=2.11).

The association between annual state expenditures and methadone and buprenorphine was inconsistent across study time periods for both methadone and buprenorphine. While state expenditures were associated with Medicaid coverage of methadone in 1998 ( $p=0.016$ ) and in 1998-2008 ( $p=0.001$ ), the relationship was not significant in 2008. For buprenorphine, annual state expenditures were associated with buprenorphine coverage in the combined 2006-2008 analysis ( $P=0.048$ ), but not in 2006 or 2008.

The relationship between Substance Abuse Block Grant funding (SABG) and Medicaid coverage of methadone and buprenorphine was assessed for 2006 and 2008 (1998 data were not available) but was not found to be significant in any of the analyses. Finally, the percent of residents receiving Medicaid was not associated with Medicaid coverage of methadone or buprenorphine in any study time period.

### Need Factors

The rate of individuals in opioid treatment was only associated Medicaid coverage of methadone in the 1998-2008 analysis. This finding suggests that for every 18 additional individuals/10,000 population being treated for opioid dependence, a state was 9.68 times more likely to cover methadone treatment for Medicaid beneficiaries.

Finally, the rate of methadone programs per one million population and Medicaid coverage of methadone were significantly associated in all three time periods (no associations were observed for buprenorphine). In 1998, for example, for every 2 additional methadone programs per one million



people in the population, a state was six times more likely to cover methadone treatment for Medicaid beneficiaries.

## **Discussion**

The main finding of this study is the significant associations observed between two measures of state wealth, FMAP rate and per capita income, and Medicaid coverage of methadone and buprenorphine. A negative relationship between FMAP rate and Medicaid coverage of methadone and buprenorphine was noted across all study time periods, demonstrating that states with greater financial need were less likely to provide Medicaid coverage of methadone and buprenorphine. Similarly, a positive association was found between per capita income across all study time periods, demonstrating that states with greater financial resources were more likely to cover methadone treatment than states with less financial resources.

The associations between annual state expenditures and Medicaid coverage of methadone and buprenorphine are difficult to interpret given their lack of consistency across study years and treatment type; however, the lack of association found for both percent of residents receiving Medicaid and the total amount of funding received from SABG have an interesting commonality. These two measures are both very specific; one regarding Medicaid itself and the other regarding substance use funding. Unlike per capita income and annual state expenditures, which are measures that include input from all members and sectors of the state, and the FMAP rate which is calculated in part based on per capita income, the percent of Medicaid recipients is not a broad based measure of a state's economy, but rather an economic indicator of a portion of a state's economy. As such, the percent of residents receiving Medicaid may not have a significant impact on the overall financial standing of the state. For instance, it is feasible for a state to have a large disparity in the wealth of its residents, which may result in a moderately large percentage of residents receiving Medicaid, but may not impact the overall

economy of the state if there is an equally sizeable segment of the state population with above average wealth. Similarly, the SABG funding proxy measure provides a very narrow measure of the wealth of a state, with its only use being for those programs and services that are specifically related to substance use treatment. Again, such a narrow economic indicator may not be broad enough to impact the overall financial standing of a state. Additionally, if a state receives an above average amount of SABG funding, this may actually serve as marker of a greater need for substance use treatment rather than an indicator of economic need. Given this possibility, future analyses may consider using SABG as an indicator of need rather than as an economic factor.

The findings regarding need factors were inconsistent both within and across treatments. While there was evidence of a significant relationship between the rate of methadone programs and Medicaid coverage of methadone, the confidence intervals associated with these odds ratios were large. Similarly, the confidence intervals regarding the rate of individuals in treatment for opioid dependence and Medicaid coverage of methadone, which may indicate that the relationship between these variables is weak. While the need factors and buprenorphine findings are somewhat consistent with those observed in the methadone analyses, the N-SSATS data did not include private physicians that are not affiliated with substance use treatment programs, which undoubtedly impacted the significance of these analyses. It is not known, however, whether these associations would become significant if the dataset were to include private physicians that prescribe buprenorphine. Future research in this area might utilize a dataset that provides a better indicator of the proportion of buprenorphine programs *and* providers.

Each annual analysis conducted in this paper (1998, 2006 and 2008) contained a sample of less than fifty states. The small sample size undoubtedly impacted the strength of the associations because when study years were combined, and therefore the sample size increased, nearly every association increased in significance. This may provide further evidence that a larger sample size could increase the strength

of the relationships between each of the economic variables, and reduce the confidence intervals; however, this limitation is inherent in state-level analyses.

While these analyses are historical, and do not include any time period since the PPACA was enacted, the findings of this study remain significant within the context of PPACA implementation. As mentioned previously, the PPACA has not changed the accessibility of methadone and buprenorphine directly. While substance use treatment has become an essential health benefit under the PPACA, states continue to choose the types of treatments their Medicaid programs will cover. Given this, it is very likely that the variability in Medicaid coverage of substance use treatment services that was observed in this study will persist post-PPACA implementation, resulting in inconsistent access to these evidence-based treatments.

Finally, this study investigated Medicaid coverage of methadone and buprenorphine as a dichotomous outcome. Other studies have investigated the accessibility of these treatments in terms of degrees.<sup>9</sup> For instance, in some states Medicaid coverage of methadone and buprenorphine is unrestricted, while in other states Medicaid programs put limits on the length of time a patient can be covered, require prior authorization for these treatments, and delay reimbursement to practitioners and programs by not putting these treatments on Medicaid formulary lists. Such restrictions are permissible under the PPACA, but may create additional barriers to both the provision and utilization of these treatments. Future research should investigate the extent to which environmental factors within a state are associated with different types of Medicaid restrictions of methadone and buprenorphine, and determine the extent to which these restrictions influence access to methadone and buprenorphine treatment.

## Limitations

Data regarding Medicaid coverage of methadone and buprenorphine by state were not available for consecutive years. This limited my ability to detect the direct impact when a policy changed. Given this limitation, particularly for need factors, it is not possible to determine whether Medicaid policy regarding coverage of methadone and buprenorphine led to an increase or decrease in the number of methadone and buprenorphine programs or individuals seeking treatment for opioid dependence. The findings presented in this paper simply indicate that some of the factors examined were associated. Future studies on this topic might investigate Medicaid coverage of methadone and buprenorphine over multiple, consecutive years in order to detect distinct changes in policy that could help to isolate causal factors.

This study utilized data from the TEDS-A, which includes only those individuals enrolled in substance use treatment, to investigate the association between the need for treatment and Medicaid coverage of these treatments. The number of people enrolled in treatment was used as one proxy measure for need, but the associations observed were weak. A better proxy measure for future research might include the rate of opioid dependence derived from a population-based sample so that individuals in and out of substance use treatment can be captured.

The majority of privately owned treatment facilities, which according to SAMHSA account for approximately twenty-nine percent of outpatient methadone programs in the United States, are not included in the TEDS data.<sup>201</sup> Additionally, individuals treated through private physicians that are not contained within a substance use treatment facility are not included in TEDS.<sup>202</sup> The exclusion of treatment programs not receiving public funds and private physicians may provide an under-representation of the rate of methadone and/or buprenorphine programs and therefore bias the results towards the null.

## Conclusion

Although methadone and buprenorphine are the two most effective treatments for opioid dependence, their use in the United States is limited. Previous research has investigated the influence of health insurance coverage, regulatory issues governing these treatments and physician training, among other factors, as potential reasons for the limited use of these treatments. This study expanded on previous research regarding the role of health insurance coverage by investigating the extent to which the economic condition of states and the significance of opioid dependence in states was associated with differences in Medicaid coverage of methadone and buprenorphine. This study provides evidence that states with increased wealth are more likely to provide Medicaid coverage of methadone and buprenorphine than states with less overall wealth. While the findings regarding the need for treatment were inconsistent, future research should investigate these associations utilizing additional variables that may serve as better proxy measures for the significance of opioid dependence in a state.

Finally, given the sustained increase in opioid use and associated mortality in the United States over the last decade, it is critical to ensure that evidence based treatments are accessible to all individuals in need. While passage of the PPACA and the inclusion of substance use treatment as an EHB provide hope for the expansion and increased accessibility of substance use treatment, states will continue to have the authority to choose the types of treatments covered under their Medicaid programs. Identifying the factors that are associated with states that cover these treatments, and those that do not, is an important step toward increasing the accessibility of these evidence based treatments.

## **Chapter 6: Medicaid Coverage of Methadone and Buprenorphine and Waiting Time to Enter Substance Use Treatment (Aim 2 Analysis)**

### **Background**

Opioid use has increased significantly over the last decade.<sup>3,203</sup> As of 2013, an estimated 2.4 million people were considered to be dependent on opioids; however, according to current estimates, only 20-25% of opioid dependent individuals receive some form of treatment.<sup>204</sup> Untreated opioid dependence is associated with significant health consequences, including HIV and hepatitis C infection, drug overdose, injection drug use, and unsafe sex and drug behaviors.<sup>24-31</sup> Medication assisted treatments (MAT), such as methadone and buprenorphine, are the most effective form of treatment for opioid dependence.<sup>4,5,47,48</sup> MAT have been associated with reductions in HIV infection, mortality, crime, injection drug use, heroin use, and syringe sharing.<sup>38-40,43,205,206</sup> In order to address the epidemic of opioid use and reduce the public health consequences associated with it, experts have called for an increase in access to MAT.<sup>198</sup>

Substance use treatment that is readily accessible can have a significant impact on both engagement and retention in treatment. When individuals are required to wait to enter treatment, they are at increased risk for treatment dropout,<sup>104</sup> mortality,<sup>106</sup> arrest,<sup>107</sup> untreated psychiatric problems,<sup>108</sup> new HIV infection,<sup>109</sup> and a return to or initiation in injection drug use (IDU).<sup>110</sup> Further, an inverse relationship between the time a person waits to enter treatment and treatment entry has been observed in several studies, such that the longer a person waits to enter treatment, the less likely they are to enroll in it.<sup>92,95,111-113</sup> Research suggests that the first twenty four hours following a client's initial contact with a substance use treatment program is the most critical period as it results in the largest decrease in program enrollment.<sup>92</sup>

## Factors Associated with Treatment Wait Time

Treatment wait time, which is defined here as the lag between when a person attempts to enter substance use treatment and actual treatment entry, is frequently cited as a primary barrier to initiating substance use treatment.<sup>90–93</sup> Factors contributing to treatment wait time may be the result of delays related to individuals, organizations or structural factors. Individual-level factors such as unemployment<sup>96</sup>, homelessness<sup>96</sup>, being African American<sup>103,116</sup>, cocaine use<sup>103,106</sup>, lack of insurance<sup>94</sup> and psychiatric problems<sup>103</sup> have all been associated with longer wait times for treatment entry. The associations between age<sup>96,106,117</sup> and gender<sup>100,102,105</sup> and treatment wait time have been inconsistent.

While individual-level factors may contribute to delays in treatment entry, they are not believed to have a significant impact on treatment wait time.<sup>90,98</sup> Rather, organizational factors, particularly regarding program inefficiencies, are believed to contribute most significantly to wait times.<sup>118–121</sup> Specific organizational factors associated with delays to treatment entry include larger client caseload<sup>96,123</sup>, staff shortages,<sup>92</sup> provision of methadone<sup>116</sup>, inefficient phone scheduling systems<sup>99</sup>, central intake units<sup>94</sup> and increased proportion of clients receiving public assistance<sup>123</sup>; whereas for-profit programs<sup>117</sup>, programs with an increased number of patients attending daily<sup>96</sup> and programs with performance contracting<sup>101</sup>, or financial incentives for improvement in patient outcomes or organizational efficiencies, have been associated with reduced treatment wait times.

There is scant literature regarding the influence of structural factors on treatment wait time. The only study that we found was an investigation of systems-level and individual-level characteristics by Carr et al.<sup>96</sup> This study found that bureaucratic delays related to processing court-ordered treatment resulted in increased wait times for substance use treatment entry.<sup>37</sup>

The main purpose of this study is to investigate the association between state Medicaid coverage of methadone and buprenorphine and the length of time individuals wait to enter substance use treatment. This study includes individual-level demographic variables and program-level characteristics

that have been observed in the literature. In addition, this study explores the contribution of several other structural factors in addition to Medicaid coverage of methadone and buprenorphine. Utilizing an adapted framework from a study investigating the factors associated with state coverage of Medicaid optional services, this study includes structural factors related to the economic environment and the need for treatment within states.<sup>193</sup> These variables include the percent of residents receiving Medicaid in each state, per capita income of each state, the rate of opioid dependent individuals enrolled in substance use treatment and the rate of methadone or buprenorphine programs in each state.

## **Methods**

The primary objective of this study is to provide an individual-level investigation of the association between Medicaid coverage of methadone and buprenorphine and treatment wait times. We hypothesize that individuals enrolled in substance use treatment programs in states with Medicaid coverage of methadone and buprenorphine will experience shorter wait times to enter treatment.

The main predictor of interest in this study is whether the state in which a person sought treatment provided Medicaid coverage for methadone or buprenorphine (examined separately) in 1998 and 2008 for the methadone analysis and 2006 and 2008 for the buprenorphine analysis. Additional independent variables include both individual-level demographic variables, program-level characteristics and structural variables. The structural variables served as state-level fixed effects estimators in order to help account for the unobserved heterogeneity of the state environment when examining the effect of state Medicaid policy. A detailed description of each of these variables is provided below. Finally, the dependent variable is the amount of time an individual waited to enter substance use treatment.



### Analytic Sample

Individual level data regarding admission to substance use treatment in 1998, 2006 and 2008 were obtained from the Treatment Episodes Data Set-Admissions (TEDS-A), an administrative data set containing annual admissions of individuals 12 years of age and older to licensed substance use treatment programs in the United States.<sup>126</sup> TEDS-A data are publicly available through the Substance Abuse and Mental Health Data Archive (SAMHDA).<sup>127</sup> The TEDS-A data represent annual encounters in substance use treatment, rather than individual clients, such that if a single individual had multiple episodes in substance use treatment programs in a given year, each treatment episode is counted separately.

Once TEDS-A data were obtained, separate methadone and buprenorphine datasets were created by matching structural variables with the state indicator variable representing the state in which a person sought substance use treatment. State matching was carried out for each study year and then merged into a final dataset for each treatment type containing both study years. The final methadone dataset contained data for 1998 and 2008 and the final buprenorphine dataset contained 2006 and 2008 data. The unit of analysis in each final dataset was person-year.

A description of the analytic sample is provided in Figure 2A.1. For the methadone analyses, the sample for each study year was restricted to individuals enrolled in any type of substance use treatment in 1998 and 2008 in the following fourteen states for which there were sufficient data available for the outcome of interest, main predictor variables and the combined year analyses: Arizona, Colorado, Florida, Hawaii, Idaho, Iowa, Kansas, Louisiana, Montana, New Hampshire, New Mexico, Ohio, South Carolina and Wyoming.

For the buprenorphine analyses, there were 24 states with sufficient data available for the outcome of interest, main predictor variables and the combined year analyses. The buprenorphine sample included individuals enrolled in any type of substance use treatment in 2006 and 2008 in Arizona,

Arkansas, California, Colorado, Florida, Hawaii, Idaho, Illinois, Iowa, Kansas, Louisiana, Maryland, Michigan, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Dakota, Ohio, South Dakota, Utah and Wyoming.

### Independent Variables

#### Individual and Program-Level Variables

Individual and program-level variables obtained from the TEDS-A for both the methadone and buprenorphine analyses included sex, age, race, gender, education, marital status, income, unstable housing, drug use, psychiatric problems, treatment type, provider type and insurance coverage.

#### Structural variables

Structural variables included the percent of residents in each state receiving Medicaid, per capita income of each state, rate of opioid dependent individuals enrolled in substance use treatment, rate of methadone or buprenorphine programs in each state and state Medicaid coverage of methadone and buprenorphine. Each continuous structural variable (percent of residents in receiving Medicaid, per capita income, rate of opioid dependent individuals enrolled in treatment and the rate of methadone or buprenorphine programs) was standardized by dividing the mean score by the standard deviation in order to create a common scale. A description of each structural variable follows.

#### Percent of Residents Receiving Medicaid

Data regarding Medicaid beneficiaries were obtained from the Centers for Medicaid and Medicare (CMS), Medicaid Statistical Information System. The total number of beneficiaries was obtained for each state and then the proportion of residents receiving Medicaid was calculated using population

totals obtained from the United States Census. Data were obtained for 1999 (1998 Medicaid beneficiary data were not available), 2006 and 2008.

#### State Per Capita Income

Per capita income was obtained from the US Department of Commerce, Bureau of Economic Analysis for 1998, 2006 and 2008, and was based on the total personal income in each state, divided by the total midyear population.

#### Rate of Opioid Dependent Individuals Enrolled in Substance Use Treatment

The number of opioid dependent individuals receiving substance use treatment was gathered from the TEDS-A data set for the years 1998, 2006 and 2008. In order to standardize the number of individuals per state, a treatment rate of individuals per 1 million population was calculated based on the number of opioid dependent individuals in any type of substance use treatment each year and the population of each state.

#### Rate of Methadone and Buprenorphine Programs

The number of opioid treatment programs was obtained from the Uniform Facility Data Set (UFDS) for 1998, and the National Survey of Substance Abuse Treatment Services (N-SSATS), formerly known as the UFDS, for 2006 and 2008. The UFDS and N-SSATS include all private and publicly funded substance use treatment programs in the United States. The UFDS and N-SSATS data used for this study were limited to the total number of programs providing methadone in 1998 or 2008 and buprenorphine in 2006 and 2008. In order to standardize the number of programs per state, a program rate of programs per 10,000 population was calculated based on the number of methadone and buprenorphine programs (calculated separately) and the population of each state.

## Medicaid Coverage of Methadone and Buprenorphine

State Medicaid coverage of methadone for 1998 and 2008 was obtained from two sources. For 1998, data were obtained from McCarty et al's study, "Methadone Maintenance and State Medicaid Managed Care Programs".<sup>142</sup> For 2008, Medicaid coverage of methadone by state was obtained from the State Financing for Medication Assisted Treatment study.<sup>9</sup> For both study years, Medicaid coverage of methadone was dichotomized as yes/no.

State Medicaid coverage of buprenorphine in 2006 was gathered from Ducharme et al's study, "State policy influence on the early diffusion of buprenorphine in community treatment programs".<sup>54</sup> Similar to the 2008 data used for methadone, data for Medicaid coverage of buprenorphine in 2008 were obtained from the State Financing for Medication Assisted Treatment study. Finally, similar to methadone, Medicaid coverage of buprenorphine was dichotomized as yes/no for both 2006 and 2008.

## Dependent variable

Wait time for entrance into substance use treatment was gathered from TEDS-A for 1998, 2006 and 2008. The TEDS-A defines wait time as the number of days a person waited to enter a treatment facility, based on the time of their initial request for treatment entry and the time that they were admitted to the program. The TEDS-A definition is based solely on delays due to treatment capacity, availability, or requirements due to admission or other programmatic factors. This wait time variable includes only successful admissions to treatment and does not reflect delays that were the result of individual factors, such as unavailability or failure to meet an obligation.

## Analytic Approach

Descriptive statistics were calculated to determine the distribution of the outcome variable, treatment wait time. Univariate analysis indicated that treatment wait time was heavily skewed towards

zero (range=0-996; mean=5.13, median=0, mode=0, variance=608). Poisson Regression (PR), Negative Binomial Regression (NBR) and Zero-Inflated Negative Binomial Regression (ZINBR) were all considered for modeling the relationship between the predictor variables and treatment wait time. Given the overdispersion of the treatment wait time variable, and the fact that PR could lead to false significance when overdispersion is evident, PR was ruled out.<sup>207,208</sup> While ZINBR can be utilized for models with an excess of zeros, it assumes that the zeros come from two sources, sampling (those that occur by randomly) and structural (those that occur through systematic error); thus, the zeros are modeled differently based on these assumptions.<sup>209</sup> The zeros reported for treatment wait time in the TEDS dataset are not believed to be subject to any systematic bias and therefore should not be modeled separately. Given the inappropriateness of both PR and ZINBR for these analyses, and the fact that NBR has more flexibility in handling overdispersion, NBR was selected.

Bivariate NBR was used to assess the unadjusted association between the main predictor of interest, Medicaid coverage of methadone and buprenorphine, and the amount of time individuals waited to enter substance use treatment. Multivariable NBR was then used to model the relationship between the remaining predictor variables and wait time for treatment entry in a stepwise fashion. Models were developed for each treatment type by single study year and combined study years (only the combined year analyses are presented here). An interaction term of Medicaid coverage and time (Medicaid coverage\*time) was added to each combined year model to account for the combined effects of these variables on treatment waiting times. To assist with the interpretation of the NBR estimates,  $\beta$  coefficients in each model were transformed using the formula:  $(e^{\beta}-1)(100)$  to provide the percent change in the number of days spent waiting to enter treatment, given a one unit difference in the predictor variable.

All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC). Associations were considered statistically significant at the  $p < .05$  level. The City University of New York's Human Research Protections Program Office approved this study.

### Missing Data

Missing data can be categorized in three ways: missing completely at random (MCAR), missing at random (MAR) and missing not at random (MNAR). When data are MCAR, there are no distinguishable patterns of variables leading the data to be missing; thus, these data will not bias the estimated relationships given the fact that missingness occurs because of random events.<sup>144,146–149</sup> When data are MAR, the probability that the data are missing is based on observable characteristics within a study population but are not related to the outcome of interest.<sup>147,148</sup> Finally, when data that are MNAR occur when the probability that an item is missing is dependent upon unobserved information among a subset of participants.<sup>147,148</sup>

To explore missingness in this study, cases containing missing data were compared to those without missing data on all variables for each study year. The results of these comparisons revealed that the samples were significantly different on nearly every study variable, indicating that the data are not likely MCAR (Tables 2A.1, 2A.2, 2B.1 and 2B.2). While there is no test to determine whether data are MAR or MNAR, most missing data are treated as MAR.<sup>150</sup> Data in this study were treated as MAR and two missing data techniques were employed prior to analyses: Listwise Deletion (LD) and Multiple Imputation (MI). An a priori cutoff of no more than 55% missing data on any one variable served as the criteria for the inclusion of cases in this study. This criteria was chosen in order to balance geographic representation, sufficient variability in Medicaid coverage of methadone and buprenorphine and the inclusion of relevant covariates.

Listwise Deletion was carried out by eliminating all cases from each dataset that contained at least one missing value for any study variable. A dummy variable indicating missing data for any one of the variables of interest was created and the sample was then restricted based on those cases in which there were no missing data. Multiple imputation was performed using the Markov Chain Monte Carlo method in SAS 9.3 (SAS Institute, Cary, NC). While there is some disagreement regarding the inclusion of outcome variables in MI<sup>181–183</sup>, the dependent variable, along with all other study variables, were included in the MI procedures in this study. Each single year dataset was imputed five times. LD and MI were performed for each single study year; however, only LD could be performed in the combined year analyses due to the very large sample size.

### Resampling

The samples used for the methadone and buprenorphine analyses were very large, even after restricting by study criteria and to those individuals with complete case data. With such large data sets, the number of significant associations are likely to increase.<sup>184</sup> These associations, while statistically significant, may have very small effect sizes, reducing the utility of the p-value as the sole basis for interpreting study findings.<sup>185</sup> To address this potential limitation, effect sizes and confidence intervals are presented alongside p-values in each model.<sup>184</sup>

Bootstrapping, a resampling technique used to validate non-normally distributed data, was performed on all LD samples to ensure that model results were consistent when performed on smaller and different samples. Bootstrapping was chosen because it is known to produce stable, unbiased estimates that demonstrate good internal validity, which is critical with large samples. Bootstrapping was employed using an unrestricted random sample of individuals from each single year and combined year LD dataset for each treatment type. Each sample was replicated in 100 separate datasets which were then combined to form a final sample for each study year and treatment.

The final models presented in this paper are from the combined year (1998-2008 for methadone and 2006-2008 for buprenorphine) bootstrapped LD analyses. The reader is referred to Tables 2A.6-2A.12 for the remaining combined year and single year methadone analyses, and Tables 2B.6-2B.12 for the remaining combined year and single year buprenorphine analyses.

## **Results**

Figures 2A.1 and 2B.1 describe how the final analytic samples for the methadone and buprenorphine analyses were obtained. The demographic characteristics of the final combined 1998-2008 methadone and 2006-2008 buprenorphine LD bootstrapped samples that are presented in this paper are displayed in Tables 2A.3 and 2B.3, respectively.

### Methadone Sample

A total of 26,100 people were included in the methadone sample. The sample was predominantly male (71%), white (73%) and non-Hispanic (88%). Almost two-thirds of the sample completed high school (63%), one-quarter were married, 40% were employed and 40% were living in an unstable housing situation at the time of treatment entry. The majority of the sample was attending outpatient treatment (64%), 1% were receiving medication assisted treatment and 9% reported some form opioid use at admission. Finally, slightly less than half of the sample (43%) was enrolled in substance use treatment in states that provided Medicaid coverage of methadone. As shown in Table 2A.4, individuals receiving treatment in states with Medicaid coverage of methadone were more likely to be older, male, white, Hispanic, have a high school education, unstably housed, enrolled in a detoxification program, utilizing MAT, using heroin, using one drug at the time of admission, have private insurance, a pension, and seeking treatment in a state with greater per capita income and an increased number of methadone programs per 10,000 population.



Table 2A.5 describes the findings from the unadjusted and adjusted NBR models investigating the association between Medicaid coverage of methadone and the number of days a person waited to enter substance use treatment. Given the large number of significant findings across the models, only the main predictor variable of interest, Medicaid coverage of methadone, and those significant predictors with a percent change of 50% or greater are explored in detail.

Model 1 describes the results of the bivariate association between Medicaid coverage of methadone and the number of days a person waited to enter substance use treatment. This unadjusted association indicated that Medicaid coverage of methadone was associated with an 11% decrease in the number of days that individuals waited to enter treatment ( $p < 0.001$ ).

Model 2 explored the relationship between Medicaid coverage of methadone and treatment wait time with the addition of demographic variables including sex, race, ethnicity, education, marital status, employment, unstable housing and age. Medicaid coverage of methadone was not significant in this model ( $p = 0.14$ ); however, both being Hispanic and less than 18 years of age, as compared with being over 45, were associated with treatment wait time. Hispanics experienced a 53% decrease in the mean number of days they waited to enter treatment, as compared with non-Hispanics ( $p < 0.0001$ ), and individuals that were less than 18 years of age experienced a 78% increase in the mean number of days they waited to enter treatment, as compared with individuals 45 years of age and over ( $p < 0.0001$ ).

Model 3 included all significant and non-significant variables from Model 2, as well as predictors related to substance use and treatment, including treatment program type, MAT use, psychological problems, the total number and type substances used at the time of treatment admission and whether the person was injecting drugs at the time of admission. The results of Model 3 indicate that, when controlling for demographic and drug-related variables, Medicaid coverage of methadone was negatively associated with treatment wait time, with individuals receiving treatment in states with Medicaid coverage of methadone experiencing a 15% decrease in the number of days they waited to

enter treatment, as compared with individuals in states without Medicaid coverage of methadone ( $p < 0.0001$ ). In addition to Medicaid coverage of methadone, Hispanic ethnicity remained negatively associated with treatment wait time (57% decrease in mean days;  $p < 0.0001$ ), and being less than 18 years of age, as compared to individuals aged 45 and older, continued to be associated with an increase in treatment wait time (58% increase in mean days;  $p < 0.0001$ ). Being enrolled in a detoxification program, as compared to a rehabilitation program, was associated with a 88% decrease in the mean number of days a person waited for treatment ( $p < 0.0001$ ), and individuals receiving MAT experienced a 68% decrease in treatment waiting time, as compared to individuals not using MAT ( $p < 0.0001$ ). Finally, individuals reporting benzodiazepine use experienced a 60% increase in the mean number of days they waited to enter treatment, as compared with non-benzodiazepine users ( $p < 0.001$ ).

Model 4 contained all of demographic and substance use variables from Models 2 and 3, in addition to health insurance coverage and primary source of income. Similar to Models 2 and 3, Medicaid coverage of methadone was associated with a 16% decrease in the mean number of days individuals waited to enter treatment, as compared to individuals in states without Medicaid coverage of methadone ( $p < 0.0001$ ). Hispanic ethnicity (56% decrease;  $p < 0.0001$ ), enrollment in detoxification, as compared to rehabilitation (89% decrease;  $p < 0.0001$ ), and MAT use (66% decrease;  $p < 0.0001$ ), all continued to be associated with a reduction in the mean number of days waiting to enter treatment wait time. Being less than 18 years of age, as compared with individuals 45 and over (61% increase;  $p < 0.0001$ ), using benzodiazepines (52% increase;  $p < 0.05$ ), having Medicaid, as compared to private insurance (63% increase;  $p < 0.0001$ ), and having a retirement or pension as the primary source, as compared with a salary (72% increase;  $p < 0.0001$ ), were all associated with increased wait time.

In Model 5, structural variables related to the state environment, including per capita income, rate of methadone programs, rate of opioid dependent individuals in substance use treatment and the percent of Medicaid beneficiaries were added as fixed effects estimators to the demographic, substance

use, health insurance and income variables included in Model 4. The addition of these state-level variables resulted in a change in the direction of the association between Medicaid coverage of methadone and treatment wait time. In Model 5, individuals receiving treatment in states with Medicaid coverage of methadone experienced a 90% increase in the mean number of days they waited to enter treatment, as compared with individuals receiving treatment in states without Medicaid coverage of methadone ( $p < 0.0001$ ). This was the only significant variable in which the direction of the association changed in Model 5. Enrollment in a detoxification program, as compared to rehabilitation (92% decrease,  $p < 0.0001$ ), and MAT use (67% decrease,  $p < 0.0001$ ) remained negatively associated with treatment wait times, and reporting zero substances of abuse at treatment entry, as compared to three substances, was also associated with a decrease in treatment wait time (55% decrease,  $p < 0.0001$ ). Finally, being under the age of 18, as compared to being 45 years of age or older (84% increase,  $p < 0.0001$ ), and having a retirement or pension, as compared to a salary as the primary source of income (57% increase,  $p < 0.0001$ ) were all associated with an increase in treatment wait time.

In Model 6, time was added to account for differences between 1998 and 2008. In this model, time was associated with an increase in treatment wait time, with individuals receiving treatment in 2008 experiencing a 239% increase in the mean number of days they waited for treatment, as compared with individuals in 1998 ( $p < 0.0001$ ). The addition of time also strengthened the association between Medicaid coverage of methadone (123% increase,  $p < 0.0001$ ), being under 18 years of age, as compared to being over 45 (99% increase,  $p < 0.0001$ ), enrollment in detoxification, as compared to rehabilitation (92% decrease,  $p < 0.0001$ ) and having no insurance, as compared to private insurance (60% increase,  $p < 0.0001$ ) and treatment wait time. The associations between enrollment in MAT (67% decrease,  $p < 0.0001$ ) and individuals whose primary source of income was retirement or pension, as compared to salary (57% increase,  $p < 0.0001$ ) remained similar to the associations observed in Model 5.

Model 7 included all of the predictor variables used in Model 6, as well as the addition of an interaction term for Medicaid coverage and time. The interaction term was negatively associated with treatment wait time in this model, suggesting that Medicaid coverage of methadone impacted treatment wait time differently in 1998 than in 2008 (50% decrease,  $p < 0.0001$ ). The addition of the interaction term to Model 7 increased the association between Medicaid coverage of methadone and treatment wait time, with individuals receiving treatment in states with Medicaid coverage experiencing a 219% increase in the amount of time they waited to enter treatment, as compared with individuals in states without Medicaid coverage of methadone ( $p < 0.0001$ ). The interaction term also strengthened the association between time and treatment wait time, with individuals in the 2008 sample experiencing a 410% increase in the amount of time they waited to enter treatment, as compared with individuals in 1998 ( $p < 0.0001$ ). Additionally, being under 18 years of age (92% increase, ( $p < 0.0001$ ) as compared with individuals 45 and over, having no insurance, as compared to having private insurance (57% increase,  $p < 0.0001$ ) and having a retirement or pension as your primary source of income, as compared with a salary (55% increase,  $p < 0.0001$ ), were all associated with increased treatment wait times. Finally, being enrolled in a detoxification program, as compared with rehabilitation (92% decrease,  $p < 0.0001$ ), utilizing MAT (67% decrease,  $p < 0.0001$ ), and reported no substances of abuse at treatment admission, as compared to individuals reporting three substances (51% decrease,  $p < 0.001$ ), were all associated with reduced treatment wait times.

### Buprenorphine Sample

As described in Table 2B.3, a total of 25,300 individuals were included in the buprenorphine sample. The sample was predominantly male (69%), white (66%) and non-Hispanic (89%). Almost two-thirds of the sample (64%) were high school educated and close to one-half (45%) reported an unstable housing situation at the time of treatment enrollment. Outpatient treatment was the most common form of

treatment (59%), 5% of the sample was receiving either methadone or buprenorphine, and 20% of the sample reported using some form of opioids at the time of treatment enrollment.

As detailed in 2B.4, individuals who attended treatment programs in states with Medicaid coverage of buprenorphine were more likely to be black, other race, unstably housed, less than 18 years of age and over 34 years of age, be enrolled in an outpatient treatment program, utilize MAT, use heroin, opioids and crack, report two or fewer substances of abuse at the time of treatment admission, be covered by Medicaid, Medicare and private insurance, report public assistance, retirement/pension, other income and salary as their primary source of income, wait longer to enter substance use treatment and seek treatment in states with higher per capita income, an increased number of buprenorphine programs and a higher rate of individuals in substance use treatment.

Table 2B.5 presents the results from the unadjusted and adjusted NBR models investigating the association between Medicaid coverage of buprenorphine and treatment wait time. Similar to the methadone results, only the main predictor variable of interest, Medicaid coverage of buprenorphine, and those significant predictors with a percent change of 50% or greater will be explored in detail.

In the unadjusted analysis presented in Model 1, individuals receiving treatment in states with Medicaid coverage of buprenorphine experienced a 75% increase in the mean number of days they waited to enter substance use treatment, as compared to individuals in states without Medicaid coverage of buprenorphine ( $p < 0.001$ ).

Model 2 contained Medicaid coverage of buprenorphine along with the addition of demographic variables, including sex, race, ethnicity, education, marital status, employment, unstable housing and age. Medicaid coverage of buprenorphine continued to be associated with an increase in treatment wait time, as compared to individuals in states without Medicaid coverage of buprenorphine (82% increase,  $p < 0.001$ ). In addition, being less than 18 (80% increase,  $p < 0.001$ ), 18-24 (65% increase,  $p < 0.001$ ) and

25-34 years of age (57% increase,  $p<0.001$ ) were all associated with an increase in the mean number of days individuals waited to enter substance use treatment, as compared to individuals over 44 years old.

Model 3 contained Medicaid coverage of buprenorphine and demographic variables that were included in Model 2, as well as variables related to substance use and treatment, including treatment program type, MAT use, psychological problems, the total number and type of substances used at the time of treatment admission and whether the person was injecting drugs at the time of admission. Medicaid coverage of buprenorphine remained associated with an increase in treatment wait time (67% increase,  $p<0.001$ ). Additionally, attending detoxification programs, as compared with rehabilitation, was associated with a 70% decrease in treatment wait time ( $p<0.001$ ).

Model 4 contained all of the demographic and substance use and treatment variables from Models 2 and 3, in addition to health insurance coverage and primary source of income. In Model 4, Medicaid coverage of buprenorphine was associated with a 63% increase in the mean number of days individuals waited to enter treatment, as compared with individuals in states without Medicaid coverage of buprenorphine ( $p<0.001$ ). Similar to Model 3, detoxification program enrollment was associated with a 70% decrease in the mean number of days individuals waited to enter treatment, as compared to rehabilitation programs ( $p<0.001$ ). Finally, having Medicare was associated with a 54% increase in treatment wait time ( $p<0.001$ ).

Model 5 contained all variables included in the previous models, with the addition of the following state fixed effects estimators: per capita income, rate of buprenorphine programs, rate of opioid dependent individuals in substance use treatment and the percent of Medicaid beneficiaries. The addition of the state-level fixed effects strengthened the association between Medicaid coverage of buprenorphine and treatment wait time, such that individuals receiving treatment in states with Medicaid coverage of buprenorphine experienced a 260% increase in the mean number of days they waited to enter substance use treatment, as compared with individuals in states without Medicaid

coverage of buprenorphine ( $p < 0.001$ ). In addition, the association between use of detoxification programs, as compared to rehabilitation programs, strengthened (82% decrease in wait time,  $p < 0.001$ ), and the positive association between Medicare coverage and treatment wait time also became stronger (79% increase in wait time,  $p < 0.001$ ). Finally heroin use was associated with a 67% increase in treatment wait time ( $p < 0.05$ ).

In Model 6, time was added to the variables used as predictors in Model 5. Unlike the methadone analysis, time was not significant. The association between Medicaid coverage of buprenorphine and wait time remained significant in Model 6, with individuals receiving treatment in states with Medicaid coverage of buprenorphine experiencing a 267% increase in the mean number of days they waited to enter treatment, as compared with individuals in states without Medicaid coverage of buprenorphine. Finally, detoxification, as compared with rehabilitation, remained associated with a reduction in treatment wait time (82% decrease,  $p < 0.001$ ) and heroin use (67% increase,  $p < 0.05$ ) and Medicare coverage (79% increase,  $p < 0.001$ ) were associated with an increase in treatment wait times.

In Model 7, the predictor variables used in Models 1-6 remained and an interaction term for Medicaid coverage and time was added. Unlike the methadone analysis, the interaction term was not associated with treatment wait time, suggesting that Medicaid coverage of buprenorphine did not have a differential impact on treatment wait time across study years. The addition of the interaction term did, however, increase the association between Medicaid coverage of buprenorphine and treatment wait time. When accounting for the interactive effect of Medicaid coverage of buprenorphine over the two study time periods, individuals receiving treatment in states with Medicaid coverage of buprenorphine experienced a 344% increase in the amount of time they waited to enter treatment, as compared with individuals in states without Medicaid coverage of buprenorphine ( $p < 0.0001$ ). Finally, similar to Models 5 and 6, detoxification, as compared with rehabilitation, was associated with decreased treatment wait time (82% decrease,  $p < 0.001$ ), and heroin use (72% increase,  $p < 0.05$ ) and Medicare (83% increase,

$p < 0.001$ ) were associated with an increase in the mean number of days individuals waited to enter substance use treatment.

## Discussion

This study tested the hypothesis that Medicaid coverage of methadone and buprenorphine would be associated with a reduction in the amount of time individuals waited to enter substance use treatment. The findings from the final models in this study do not support this hypothesis. For both methadone and buprenorphine treatment, state Medicaid coverage was associated with a significant increase in treatment wait time. The study hypothesis was driven by the expectation that Medicaid coverage of methadone and buprenorphine would increase the availability and accessibility of these treatments because more programs would offer these treatments and more individuals would utilize them. As described in Tables 2A.4 and 2B.4, in both the methadone and buprenorphine samples, there was an increased number of methadone and buprenorphine treatment programs per 10,000 population and an increased rate of opioid dependent individuals in substance use treatment in states with Medicaid coverage of methadone and buprenorphine. While the rate of opioid dependent individuals in each state was accounted for, the wait time variable was calculated for all individuals seeking substance use treatment, regardless of the type of substance of abuse. Limiting this control to *only* those individuals that were opioid dependent in each state might account for this unexpected association, particularly because in the methadone analysis, the direction of the association shifted from a decreased wait time among individuals receiving treatment in states with Medicaid coverage of methadone to an increased wait time when these state-level control variables were added to the model.

Several of the findings from this study are consistent with the literature, including the associations between unemployment<sup>96</sup>, unstable housing/homelessness<sup>96</sup>, and lack of health insurance<sup>94</sup> and increased treatment wait time. Unlike other studies, this study did not find an increase in treatment wait



times for blacks, cocaine users or individuals with psychological problems. Additionally, similar to previous studies in which findings regarding sex were mixed,<sup>100,102,105</sup> males in this study experienced increased wait times in the methadone analysis, but decreased wait times in the buprenorphine analysis. Similar to other studies, our findings regarding age were also inconsistent across the methadone and buprenorphine analyses.<sup>106,117</sup> In the methadone analysis, individuals less than 18 years of age experienced the longest treatment wait time, whereas individuals aged 25-34 experienced the longest wait time in the buprenorphine analysis. Finally, the strongest association found in this study was between time and treatment wait time in the methadone analysis, with individuals enrolled in substance treatment in 2008 waiting 410% longer to enter treatment than individuals enrolled in substance use treatment in 1998.

## **Limitations**

Multiyear data regarding Medicaid coverage of methadone and buprenorphine by state were not available for consecutive years. This limited my ability to detect the direct impact of this policy, particularly when the policy changed in some states. Given this limitation, it is not possible to determine whether Medicaid policy regarding coverage of methadone and buprenorphine led to an increase or decrease in the number of methadone and buprenorphine programs or individuals seeking treatment for opioid dependence. The findings presented in this paper simply indicate that some of the factors examined were associated.

This study utilized data from TEDS-A, which, for the most part, only includes individuals enrolled in publicly funded substance use treatment programs. The majority of privately owned treatment facilities, which according to SAMHSA accounts for approximately twenty-nine percent of outpatient methadone programs, are not included in the TEDS-A data.<sup>201</sup> Additionally, individuals treated through private physicians that are not contained within a substance use treatment facility, which is the case for the

majority of buprenorphine patients, are not included in TEDS-A.<sup>202</sup> The amount of time that individuals in private treatment programs and those being seen by individual doctors waited to enter a treatment program is unknown; therefore, the exclusion of these individuals may result in a skewed representation of treatment wait times for methadone and/or buprenorphine patients overall.

Finally, there was a significant amount of missing data for the outcome of interest in this study. Multiple imputation and listwise deletion were performed on each single year sample; however, only listwise deletion and bootstrapped listwise deletion could be performed on the combined year samples due to the very large sample size. For the 1998 methadone analyses, the association between Medicaid coverage of methadone and treatment wait time differed, with the bootstrapped LD (Table 2A.10) and LD (Table 2A.11) analyses indicating that Medicaid coverage of methadone was associated with a decrease in treatment wait time. The MI analysis (Table 2A.12), however, indicated that Medicaid coverage was significantly associated with an increase in treatment wait time, which was consistent with the findings of the 1998-2008 bootstrapped LD analysis presented in this paper. The 2008 bootstrapped LD (Table 2A.7), LD (Table 2A.8), and MI analyses (Table 2A.9) all indicated that Medicaid coverage of methadone was significantly associated with an increase in treatment wait time, which is also consistent with the findings presented in this paper, although the effect size in the 2008 MI methadone analysis is smaller than the effect size in the LD and bootstrapped LD analyses. For the single year buprenorphine analyses, the findings are consistent with the direction of the bootstrapped 2006-2008 LD analysis presented in this paper, in that they also indicate that Medicaid coverage of buprenorphine was associated with an increase in treatment wait time. Both single year buprenorphine MI analyses (Tables 2B.9 and 2B.12), however, produced more conservative effect sizes than the single year LD (Tables 2B.8 and 2B.11), single year bootstrapped LD (Tables 2B.7 and 2B.10) and the combined year bootstrapped LD (Table 2B.5) presented in this paper. While these associations were all significant, the variability in

the effect sizes across these analyses warrants a cautious interpretation of the extent of the combined year associations presented in this paper.

## **Conclusion**

Overall, the findings of this study highlight significant delays to substance use treatment entry. Individuals in the methadone sample waited an average of five days to enter treatment, and individuals in the buprenorphine sample waited an average of 6 days to enter treatment. In addition, several variables included in these analyses were associated with an even greater increase in average wait time, including Medicaid coverage of methadone and buprenorphine and younger age. Taken together, these findings indicate a significant gap in the demand versus availability of substance use treatment in the US. Further, given the fact that attrition for treatment entry is most significant within the first twenty-four hours after the initial contact is made with a program, these findings may provide insight into the low rate of treatment engagement among substance users in the US.

## **Chapter 7: Medicaid Coverage of Methadone and Utilization of Medication Assisted Treatment (Aim 3 Analysis)**

### **Background**

Between 2002 and 2012, substance use treatment admissions for opioid dependence increased steadily in the United States, from 18% to 26%, while treatment for alcohol, marijuana, cocaine and methamphetamines have either decreased or remained stable.<sup>1</sup> Several types of treatment are currently available for opioid dependence, but they fall into two main categories of modality: drug-free inpatient/outpatient treatment, which includes inpatient rehabilitation programs such as therapeutic communities, and outpatient support groups such as Narcotics Anonymous which are largely focused on abstinence; and medication-assisted treatment (MAT), which includes methadone, buprenorphine and naltrexone. Of these forms of treatment, MAT have been shown to be the most effective at reducing ongoing opioid use by suppressing withdrawal symptoms and blocking the effects for other opioids, such as heroin.<sup>4,5,35,36</sup> This quality is critical in treating opioid dependence because it can both reduce the likelihood of sustained or increased use of other opioids, as well as decrease the likelihood of overdose.

Despite overwhelming evidence supporting the effectiveness of MAT, these treatments are provided by a minority of substance use treatment programs and used by only 10% of opioid dependent individuals.<sup>3,68,210</sup> Further, a recent longitudinal analysis of substance use treatment data indicates that MAT utilization is declining, even in the face of a sustained increase in opioid use and dependence in the United States. Between 2002 and 2012, the use of MAT decreased from 35% to 28%.<sup>1</sup>

Previous research investigating potential explanations for limited uptake and provision of MAT has found individual level factors, such as cocaine injecting or crack smoking<sup>60,61</sup>, homelessness<sup>62</sup>, recent or previous incarceration<sup>61,62</sup>, injection drug use<sup>60-62</sup>, previous negative experiences with MAT<sup>63-65</sup>, perceived stigma associated with medication assisted treatments, particularly methadone,<sup>65-69</sup> and the

perceived punitive treatment structure of methadone programs,<sup>70</sup> to be associated with a decreased likelihood of MAT utilization. Factors previously found to be associated with an increased likelihood of MAT use include being female,<sup>61,62,71</sup> married<sup>71</sup>, having Medicaid coverage<sup>62</sup>, use of heroin<sup>60,62,64</sup>, older age<sup>61,62</sup> and having previously been in substance use treatment<sup>60,71</sup>. To date, we are unaware of any research investigating the relationship between structural factors such as Medicaid coverage of methadone, and the use of MAT by opioid dependent individuals, which is the primary objective of this study. In addition to Medicaid coverage of methadone, additional structural factors related to the economic environment and the need for substance use treatment within states were included in this study. The selection of these additional structural variables was guided by a framework developed by Schneider and Jacoby to investigate factors related to state coverage of Medicaid optional services. The structural factors utilized in this study include the percent of residents receiving Medicaid in each state, the rate of opioid dependent individuals enrolled in substance use treatment and the rate of methadone programs in each state.<sup>193</sup>

## **Methods**

This study hypothesized that individuals receiving substance use treatment in states with Medicaid coverage of methadone will be more likely to utilize MAT than individuals receiving substance use treatment in states with no Medicaid coverage of methadone. To test this hypothesis, an individual-level analysis was conducted with Medicaid coverage of methadone as the main predictor of interest. Additional predictor variables included a combination of individual-level demographic characteristics, program-level characteristics and structural variables which served as proxies for the state environment. An explanation of the variables and data sources is described below.

### Analytic Sample

Individual-level substance use treatment admission data were obtained from the Treatment Episodes Data Set-Admissions (TEDS-A) for the calendar years of 1998 and 2008. The TEDS-A is a publicly available administrative dataset comprised of new admissions to most publicly funded alcohol and substance use treatment facilities in the United States. TEDS-A data are available to the public by the Substance Abuse and Mental Health Services Administration (SAMHSA) and reflect all encounters in publicly funded substance use treatment programs in a given year.<sup>127</sup> The TEDS-A does not include an identifier to distinguish unique individuals; therefore, if the same person enters a treatment program three times in a given year, TEDS-A counts this as three distinct treatment episodes, rather than one.

Once the TEDS-A data were obtained from SAMHSA, they were matched with state-level variables based on an indicator variable representing the state. For instance, if the methadone treatment rate for NJ was 40.5, every individual receiving treatment in NJ would have 40.5 for the methadone treatment rate variable in the final dataset. This matching was done for each study year and the data were then merged into a final dataset that contained both study years. In the final combined dataset, the unit of analysis was person-year.

The analytic sample is described in Figure 3.1. Only opioid users were retained in the final dataset given that the outcome of this analysis is use of medication assisted treatment, and those treatments are only indicated for opioid users. The final sample was restricted to thirty eight states that had sufficient data for both study years on the main predictor variables of interest and the outcome variable. Individuals enrolled in substance use treatment in the following states were included in the final sample: Alaska, California, Colorado, Connecticut, Delaware, Florida, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon,

Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Vermont, Virginia, Wisconsin and Wyoming.

### Independent Variables

#### Individual and Program-Level Variables

Individual and program-level variables such as sex, age, race, ethnicity, gender, education, marital status, employment, income, housing, drug use, program type and insurance coverage were obtained from TEDS-A.

#### Structural Variables

Structural variables used in this study included the percent of residents in each state receiving Medicaid, the rate of methadone programs in each state, the rate of opioid dependent individuals enrolled in substance use treatment in each state and state Medicaid coverage of methadone. Each continuous variable (percent of residents in receiving Medicaid, rate of opioid dependent individuals enrolled in treatment and the rate of methadone programs) was standardized by dividing the mean score of that variable by the standard deviation in order to create a common scale. A description of each structural variable follows.

#### Percent of Residents Receiving Medicaid

Data regarding Medicaid beneficiaries were obtained from the Centers for Medicaid and Medicare (CMS), Medicaid Statistical Information System. The total number of beneficiaries was obtained for each state and then the proportion of residents receiving Medicaid was calculated using population totals obtained from the United States Census. Data were obtained for 1999 (1998 Medicaid beneficiary data were not available) and 2008.

### Rate of Opioid Dependent Individuals Enrolled in Substance Use Treatment

The number of opioid dependent individuals receiving substance use treatment was gathered from the TEDS-A data set for the years 1998 and 2008. In order to standardize the number of individuals per state, a treatment rate of individuals per 1 million population was calculated based on the number of opioid dependent individuals in any type of substance use treatment each year and the population of each state.

### Rate of Methadone Programs

The number of methadone programs was obtained from the Uniform Facility Data Set (UFDS) for 1998, and the National Survey of Substance Abuse Treatment Services (N-SSATS), formerly known as the UFDS, for 2008. The UFDS and N-SSATS include all private and publicly funded substance use treatment programs in the United States. The UFDS and N-SSATS data used for this study were limited to the total number of programs providing methadone in 1998 or 2008. In order to standardize the number of programs per state, a program rate of programs per 10,000 population was calculated based on the number of methadone programs and the population of each state.

### Medicaid Coverage of Methadone

State Medicaid coverage of methadone for 1998 and 2008 was obtained from two sources. For 1998, data were obtained from McCarty et al's study, "Methadone Maintenance and State Medicaid Managed Care Programs".<sup>142</sup> For 2008, Medicaid coverage of methadone by state was obtained from the State Financing for Medication Assisted Treatment study.<sup>9</sup> For both study years, Medicaid coverage of methadone was dichotomized as yes/no.



### Dependent variable

Data regarding MAT utilization was gathered from TEDS-A for 1998 and 2008. In the TEDS-A, MAT is a category of treatment that includes two types of treatment: methadone and buprenorphine. The TEDS-A question regarding MAT does not, however, distinguish between these two treatment types. In 1998, the only medication assisted treatment available in the United States was methadone; however, in 2008, buprenorphine was also available as a MAT option. This study utilizes both study years, but only examines the influence of Medicaid coverage of methadone on MAT use.

### Analytic Approach

Bivariate logistic regression was used to examine the unadjusted association between Medicaid coverage of methadone and the utilization of MAT. Multivariable logistic regression was then used to model the relationship between all predictor variables and MAT utilization in a stepwise manner. Models were tested for 1998, 2008 and the combined 1998-2008 years. The final combined year model included an interaction term to test for the combined effects of time and Medicaid coverage of methadone on the utilization of MAT.

All associations were considered statistically significant at the  $p < .05$  level. Statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC). The City University of New York's Human Research Protections Program Office approved this study.

### Missing Data

There was a significant amount of missing data in the 1998 and 2008 samples. Missing data can be missing completely at random (MCAR), missing at random (MAR) and missing not at random (MNAR). To explore the patterns of missing data in this study, comparisons were made between observations containing missing data and those with no missing data on all study variables for 1998 and 2008 (see

Tables 3.1 and 3.2). These comparisons indicated that cases with missing data were significantly different from cases with no missing data on nearly every study variable in 1998 and the majority in 2008, indicating that the data were not likely MCAR. Data in this study were treated as MAR and both Listwise Deletion (LD) and Multiple Imputation (MI) were used to handle these missing data. For LD, cases that contained at least one missing value for any study variable were eliminated from analyses. For MI, all study variables, including the outcome variable, were included in the imputation procedure. A series of five imputations was performed using the Markov Chain Monte Carlo method in SAS 9.3 (SAS Institute, Cary, NC). While LD and MI were performed for each single study year; only LD could be performed in the combined year analyses due to the very large sample size.

### Resampling

Even after restricting the final dataset based on study criteria, the remaining sample sizes were quite large, raising concern regarding misleading inferences about relatively small effects.<sup>184</sup> Bootstrapping is a resampling technique used to validate non-normally distributed data and produce unbiased estimates that demonstrate good internal validity, which is crucial in large sample sizes.<sup>143</sup> Bootstrapping was performed on the single year and combined year LD samples to ensure that study findings were consistent across smaller and different samples. Bootstrapping was carried out using an unrestricted random sample of individuals selected from the 1998, 2008 and combined 1998-2008 LD datasets. Each of these samples was replicated in 100 separate datasets and then combined to form a final sample for analysis of the single and combined study years.

The final stepwise models presented in this paper are from the combined year (1998-2008) bootstrapped LD analyses (see Table 3.5). The results of the 2008 bootstrapped LD analyses are contained in Table 3.7 and the 1998 bootstrapped LD analyses are presented in Table 3.10. For the results of the combined 1998-2008 LD analyses, the reader is referred to Table 3.6. The single year LD

results can be found in Tables 3.8 (2008) and 3.11 (1998). The results of the 2008 and 1998 MI analyses can be found in Tables 3.9 and 3.12, respectively.

## Results

Figure 3.1 depicts the various analytic sample sizes for each step of the analyses conducted, as well as for the overall sample and sample sub-sets. The demographic characteristics of the final combined 1998-2008 bootstrapped LD sample are described in Table 3.3. The sample was predominately male (60%), white (66%) and non-Hispanic (93%). The majority of the sample was high school educated (67%), one-fifth were employed (20%) and over one-third were unstably housed (41%). The age of the sample was evenly distributed across all categories. The overwhelming majority of the sample (81%) was enrolled in non-rehabilitation treatment programs, such as detoxification or outpatient programs. Less than one-fifth (19%) of the sample was receiving MAT, and just over one-quarter reported having a psychological problem. Heroin was the most commonly used drug (71%), followed by cocaine/crack (35%) and synthetic opioids (33%). Close to half of the sample (43%) reported current IDU at the time of admission. The majority of the sample (53%) was uninsured and had no reported income (43%). The overwhelming majority of the sample (85%) were enrolled in substance use treatment programs in states that provided Medicaid coverage of methadone. As detailed in Table 3.4, individuals receiving treatment in states with Medicaid coverage of methadone were more likely to be male, black, other race, high school educated, unstably housed, older, enrolled in outpatient or detoxifications programs, receiving MAT, reporting heroin and cocaine/crack use, using 1 or 2 substances, an IDU, have Medicaid coverage or private insurance, report public assistance, retirement/pension or other income as their primary source of income and receive substance use treatment in states with a higher rate of methadone programs and opioid dependent individuals in treatment.

Findings from the unadjusted bivariate and adjusted multivariate logistic regression analyses are displayed in Table 3.5. Given the large number of significant associations, only significant predictors with  $OR < 0.5$  or  $OR \geq 2.0$  will be explored in detail.

Model 1 tested the unadjusted association between the main predictor of interest, Medicaid coverage of methadone, and MAT utilization. This association was significant and indicated that being enrolled in substance use treatment programs in states with Medicaid coverage of methadone was associated with an increased odds of MAT utilization ( $OR=4.79$ ; 95% CI 4.14-5.54).

In Model 2, Medicaid coverage of methadone was examined along with the addition of demographic characteristics including sex, race, ethnicity, education, marital status, employment, unstable housing and age. Medicaid coverage of methadone remained a significant predictor of MAT use in this model ( $OR=4.48$ ; 95% CI 3.87-5.54). In addition, age was also significant, with individuals younger than 24 years old less likely to use MAT than individuals that were 45 years of age and older ( $OR=0.32$ ; 95% CI 0.28-0.36).

Model 3 examined Medicaid coverage of methadone along with the demographic variables in Model 2 and the addition of predictor variables related to substance use and treatment, including treatment program type, MAT use, psychological problems, the total number and type of substances used at the time of treatment admission and whether the person was injecting drugs at the time of admission. Medicaid coverage of methadone continued to be associated with an increased odds of MAT utilization ( $OR=3.03$ ; 95% CI 2.58-3.56). Individuals using heroin ( $OR=5.64$ ; 95% CI 4.77-6.62), non-prescription methadone ( $OR=8.94$ ; 95% CI 7.17-11.08), synthetic opioids ( $OR=3.94$ ; 95% CI 3.39-4.58) and reporting one drug of abuse at treatment entry, as compared to individuals reporting three drugs ( $OR=4.18$ ; 95% CI 3.65-4.77) also had an increased odds of using MAT. Attending a rehabilitation program, as compared with non-rehabilitation programs such as detoxification or outpatient ( $OR=0.17$ ; 95% CI 0.14-0.20), and

younger age, particularly individuals less than 24 years age, as compared to 45 and over (OR=0.33; 95% CI 0.29-0.38), were associated with a decrease in the odds of using MAT.

Model 4 included all of the predictor variables contained in the previous models, as well as the addition of health insurance coverage and primary source of income. In this model, Medicaid coverage of methadone (OR=3.16; 95% CI 2.69-3.73), heroin use (OR=5.75; 95% CI 4.88-6.8), non-prescription methadone use (OR=8.25; 95% CI 6.63-10.31), synthetic opioid use (OR=3.90; 95% CI 3.36-4.55) and reporting one (OR=4.44; 95% CI 3.88-5.09) or two (OR=2.03; 95% CI 1.83-2.24) drugs of abuse at treatment entry, as compared to reporting three drugs, were all associated with an increased likelihood of MAT use. Attending a rehabilitation program, as compared to detoxification or outpatient programs (p=0.16; 95% CI 0.14-0.19), and younger age, particularly being less than 24, as compared to individuals 45 and over (OR=0.33; 95% CI 0.29-0.38), continued to be associated with a decreased likelihood of MAT use in Model 4.

Model 5 contained all variables utilized in the previous four models as well as the addition of structural variables related to the state environment, including the rate of methadone treatment programs, rate of opioid dependent individuals in treatment and the percent of residents receiving Medicaid. The addition of these structural variables strengthened the association between Medicaid coverage of methadone and MAT use (OR=6.11; 95% CI 5.03-7.4). In addition, use of heroin (OR=6.44; 95% CI 5.41,7.66), non-prescription methadone (OR=7.17; 95% CI 5.70,8.98), synthetic opioids (OR=3.90; 95% CI 3.32-4.57) and benzodiazepines (OR=2.03; 95% CI 1.69-2.44), as well as reporting one drug of abuse at treatment entry (OR=4.35; 95% CI 3.77-4.96), as compared to three drugs, were all associated with increased odds of MAT use. Similar to Model 4, attending a rehabilitation program, as compared to detoxification or outpatient programs (OR=0.16; 95% CI 0.14-0.19), and younger age, specifically being less than 24 years age, as compared to individuals 45 and over (OR=0.37; 95% CI 0.32-0.42), continued to be associated with decreased odds of MAT use.

Model 6 included the variables used as predictors in Model 5, as well as the addition of the variable time to account for any differences in the two time periods. In this model, Medicaid coverage of methadone continued to be associated with an increased likelihood of MAT use (OR=6.42; 95% CI 5.26-7.78), as did heroin use (OR=6.42; 95% CI 5.37-7.61), non-prescription methadone use (OR=7.17; 95% CI 5.74-9.05), synthetic opioid use (OR=3.94; 95% CI 3.36-4.63), benzodiazepine use (OR=2.01; 95% CI 1.68-2.43) and reporting one drug of abuse at treatment entry (OR=4.35; 95% CI 3.81-5.01), as compared reporting three drugs. Enrollment in a rehabilitation program, as compared to detoxification or outpatient programs ( $p=0.16$ ; 95% CI 0.14-0.19), and being less than 24 years age, as compared to 45 and over (OR=0.37; 95% CI 0.32-0.42), continued to be associated with a decreased likelihood of MAT use.

Model 7 included all of the predictor variables from Models 1-6 as well as the addition of an interaction term for Medicaid coverage and time. The interaction term was not significant in this model; however, Medicaid coverage (OR=5.37; 95% CI 3.72-7.76), use of heroin (OR=6.36; 95% CI 5.39-7.63), non-prescription methadone (OR=7.24; 95% CI 5.69-8.98), synthetic opioids (OR=3.97; 95% CI 3.34-4.6) and benzodiazepines (OR=2.03; 95% CI 1.67-2.42), as well as reporting one drug of abuse at treatment entry (OR=4.39; 95% CI 3.79-4.99), as compared to three drugs, all continued to be associated with an increased odds of MAT use. Finally, utilizing a rehabilitation program, as compared to detoxification or outpatient programs ( $p=0.16$ ; 95% CI 0.14-0.19), and being less than 24 years age, as compared to 45 and over (OR=0.37; 95% CI 0.32-0.42), continued to be associated with a decreased odds of MAT use.

## **Discussion**

This study tested the hypothesis that receiving substance use treatment in a state with Medicaid coverage of methadone would increase the likelihood of MAT use among opioid dependent individuals.

The findings from this study support this hypothesis. Across all seven models, Medicaid coverage of methadone was significantly associated with higher odds of using MAT for treatment.

In addition to Medicaid coverage of MAT, several variables remained significantly associated with higher odds of MAT utilization across models, but did not have an  $OR \geq 2.0$ . These variables included being Hispanic, married, employed, cocaine use, benzodiazepine use, reporting two substances of abuse at admission, as compared to three, having no health insurance, receiving substance use treatment in states with an increased number of methadone programs and receiving treatment in a state with an increased percentage of Medicaid beneficiaries. Significant variables that were associated with reduced odds of MAT use across all study models, but did not have an  $OR < 0.5$ , included being male, identifying as other race, as compared to white, being between 25-34 years old and 35-44 years old, as compared to being over 44 years old, reporting psychological problems, having a retirement/pension or no income as the primary source of income, receiving substance use treatment in a state with fewer opioid dependent individuals and receiving substance use treatment in 1998 as compared to 2008.

The significant factors associated with increased odds of MAT use in the final model of this study that are consistent with the literature include older age<sup>61,62</sup>, being married<sup>71</sup>, using heroin<sup>60,64</sup>, crack/cocaine use<sup>61</sup>, and having Medicaid coverage<sup>62</sup>. Factors in this study that were associated with reduced odds of MAT use that are consistent with the literature include being male<sup>61,62,71</sup> and black<sup>62</sup>. Contrary to previous findings, this study found increased odds of MAT utilization among IDUs<sup>62</sup> and no association between unstable housing and MAT use<sup>62,64</sup>.

The positive association between age and increased odds of MAT use that was found in this study, and has been observed in other studies, is particularly noteworthy given the current opioid epidemic. While the average age of individuals attending substance use treatment in the United States is 35 years old, recent trend data from TEDS-A indicate that between 2002 and 2012, the largest increase in treatment admissions due to heroin use was among 20-34 year old non-Hispanic whites.<sup>1</sup> Given the

steady increase in the number of young opioid users over the last decade, and the importance of providing the most effective treatments to opioid dependent individuals as early on in their drug using careers as possible, it is critical that medication assisted treatments are available and accessible to young opioid users. Given this finding, and the precipitous increase in the use of opioids by young people in the United States, future research investigating the reasons for low MAT utilization among this population is critical.

### **Limitations**

This study is subject to several limitations. The primary purpose of this study was to test the association between state Medicaid coverage of methadone and the use of methadone treatment by opioid dependent individuals. However, the TEDS-A does not distinguish between methadone and buprenorphine use; rather, these treatments are lumped together in one question about MAT use. In 1998, methadone was the only approved MAT available for the treatment of opioid dependence in the United States; however, in 2008 buprenorphine was also available. An affirmative response to MAT use in the 2008 TEDS-A could indicate either methadone or buprenorphine treatment. In the 1998 analysis (Table 2A.10), Medicaid coverage of methadone was associated with an increased likelihood of MAT utilization (OR=2.33; 95% CI 2.06-2.62). In the 2008 analysis (Table 2A.8), this association was also significant, but stronger (OR=8.16; 95% CI 6.51-10.22). The strengthening of this association could be the result of several factors; however, it is possible that the increased association between study years is due to the inclusion of buprenorphine in the MAT question. Given this, this study may be subject to response bias due to the double-barreled question regarding MAT use in the 2008 TEDS-A.

Another limitation of the TEDS-A data is that they do not represent the universe of treatment admissions in the United States. Rather, the majority of TEDS-A data come from publicly funded substance use treatment programs. Most privately owned treatment facilities, which account for



approximately twenty-nine percent of outpatient methadone programs in the United States, are not included in TEDS-A.<sup>201</sup> The exclusion of privately funded substance use treatment programs may reduce the external validity of the findings in this study.

Finally, missing data was a significant issue in this study. In order to address this limitation, MI and LD were performed on each single year sample. Additionally, bootstrapping was conducted on the LD samples to validate these findings. Due to the large sample size in the combined year analyses, MI could not be performed. In comparing the results across the three 1998 analyses, the associations between Medicaid coverage of methadone and MAT utilization were consistent, with the bootstrapped LD (Table 3.10), LD (Table 3.11) and MI analyses (Table 3.12) indicating that individuals receiving treatment in states with Medicaid coverage of methadone had approximately twice the odds of using MAT, as compared with individuals in states with no Medicaid coverage of methadone. The findings across the 2008 analyses were also consistent regarding the significant association between Medicaid coverage of methadone and MAT utilization; however, in the 2008 MI analysis (Table 3.9), the odds ratio was 2.59 (95% CI 2.54-2.65), compared to 8.00 (95% CI 7.08-8.99) in the LD analysis (Table 3.8) and 8.16 (95% CI 6.51-10.22) in the bootstrapped LD analysis (Table 3.7). In light of the variability in effect sizes across the 2008 analyses, combined year analyses presented in this paper should be interpreted with caution.

Despite the limitations of the TEDS-A, it is the only national data set containing substance use treatment admissions. These data are widely used by researchers and federal agencies to gain a better understanding of the characteristics of individuals enrolled in substance use treatment in the United States. The findings presented here, while subject to limitations, utilized TEDS-A data to provide a novel investigation of the association between structural factors and MAT utilization.

## **Conclusion**

Despite strong evidence supporting the effectiveness of MAT for treating opioid dependence, MAT utilization has decreased over the last decade. During the same time period, opioid use and dependence have increased significantly, particularly among non-Hispanic whites between the ages of 20-34. In this study, MAT use was negatively associated with age, such that individuals younger than 44 years old were less likely to utilize MAT as compared with individuals 45 and older. Understanding the factors associated with decreased utilization of MAT may help increase the availability and accessibility of these treatments, which may help to reduce the public health consequences of opioid dependence.

## **Chapter 8: Discussion and Conclusion**

The purpose of this dissertation was twofold: (1) to provide a state-level examination of the influence of factors related to the need for substance use treatment, and the extent to which the economic environment of states are correlated with Medicaid coverage of methadone and buprenorphine; and, (2) to investigate the impact that Medicaid coverage of these treatments has on individuals seeking substance use treatment in the United States, in terms of the amount of time a person waits to enter substance use treatment and the extent to which opioid dependent individuals utilize MAT.

This chapter provides an overview of the study findings presented in Chapter 5, 6 and 7, policy recommendations related to these findings, limitations to this dissertation and a discussion of future research directions based on this work.

### **Discussion of Results**

Is the economic situation of a state correlated with Medicaid coverage of methadone or buprenorphine? The findings of these analyses were mixed. Two measures, FMAP and per capita income, were significant across all study years for both methadone and buprenorphine, indicating that states with greater wealth were more likely to cover methadone or buprenorphine for Medicaid beneficiaries. The correlation between substance use treatment block grant funding, annual state expenditures and Medicaid coverage of methadone or buprenorphine were not consistent, varying in the year-to-year analyses, as well as across measures. The final measure of state wealth, the percent of residents receiving Medicaid, was not correlated with Medicaid coverage of methadone or buprenorphine in any study year. The lack of consistent findings across the remaining three economic variables and respective treatment types may provide evidence for a weak relationship between these

variables, or they may indicate that they are poor proxy variables for state wealth. The percent of residents receiving Medicaid and amount of substance abuse block grant funding states receive only capture the wealth, or lack thereof, of a portion of a state's population; whereas, per capita income and FMAP rate serve as more general indicators of population wealth. Further research using these and other novel proxy measures for state wealth can provide additional evidence as to the extent of the relationship between state wealth and Medicaid coverage of methadone or buprenorphine.

Is the need for opioid treatment correlated with Medicaid coverage of methadone and buprenorphine? The results regarding need for treatment, particularly for methadone, were also inconsistent. For methadone, the rate of opioid dependent individuals was correlated with an increased likelihood of Medicaid coverage in 1998 and the combined year analysis; however, the confidence intervals in these analyses were quite large and as such indicate a weak relationship. Similarly, while there was a consistent correlation between the rate of methadone programs and Medicaid coverage of methadone across all study years, the confidence intervals associated with each of these analyses were also very large. Finally, there was no relationship between either need factor and Medicaid coverage of buprenorphine.

Is Medicaid coverage of methadone or buprenorphine associated with shorter wait times for substance use treatment entry? For both methadone and buprenorphine, Medicaid coverage was associated with a significantly longer wait time. Individuals enrolled in substance use treatment in states with Medicaid coverage of methadone waited 219% longer than individuals in states without Medicaid coverage. For buprenorphine, the wait time was 344% longer for individuals enrolled in substance use treatment programs in states with Medicaid coverage, as compared to individuals in states without Medicaid coverage. While these findings do not confirm the study hypothesis, additional research is warranted and should include the proportion of all individuals in substance use treatment in each state, rather than a subset of in-treatment individuals.

Other factors associated with increased wait times for the methadone analysis include being male, other race, as compared to white, employed, unstably housed, less than 18 years old or between 25-44 years old, as compared to individuals over 44, reporting one substance of abuse, as compared to three, having Medicaid, Medicare or no insurance, as compared to private insurance, having retirement/pension or other income as the primary income source, as compared with a salary and receiving treatment in 2008, as compared to 1998. Factors that were associated with a decrease in the mean number of days individuals waited to enter treatment in the methadone analysis included being Hispanic, attending outpatient or detoxification programs, as compared to rehabilitation, utilizing MAT, reporting no substances of abuse at the time of treatment, as compared to three and having no income, as compared to having a salary as the primary source of income.

Variables that were associated with increased treatment wait time in the buprenorphine analysis, include younger age, reported psychological problems, heroin use, synthetic opioid use and Medicare and no health insurance (as compared with private insurance). Factors that were associated with a decrease in the mean number of days individuals waited to enter treatment included being male, black (as compared to white), Hispanic, being employed, use of MAT, detoxification and outpatient program enrollment, as compared to enrollment in a rehabilitation program, opioid use, reporting one substance of abuse, as compared to three and reporting public assistance, retirement/pension, other income source or no income, as compared to salary as the primary source of income.

Is Medicaid coverage of methadone associated with an increase in the utilization of MAT? The results of this analysis indicate that Medicaid coverage of methadone is associated with increased odds of MAT utilization. Other factors that were associated with increased odds of MAT utilization include being Hispanic, married, employed, using heroin, non-prescription methadone, cocaine, synthetic opioids, benzodiazepines, reporting one or two drugs of abuse, as compared with three, and having Medicaid or no insurance, as compared with private insurance. Factors associated with decreased odds

of MAT use include being male, black or other race, as compared to white, less than 44 years of age, attending a rehabilitation program versus a non-rehabilitation program (detoxification and outpatient), reporting psychological problems, having retirement/pension or no income as the primary source of income, as compared to salary and receiving treatment in 2008, as compared to 1998.

### **Policy Recommendations**

Based on the main findings of this dissertation, the following policy recommendations are proposed:

#### **Finding: State wealth is correlated with Medicaid coverage of MAT**

The results from Aim 1 (Chapter 5) indicate a significant relationship between increased state wealth and Medicaid coverage of MAT. This finding was consistent across both the methadone and buprenorphine analyses and all study years. In addition to these findings, recent data regarding prescribing patterns for opioids demonstrate that states with the highest levels of opioid prescribing, which serves as a proxy for prescription opioid use, also have some of the lowest per capita incomes and highest FMAP rates in the country.<sup>211</sup> Further, two of the five states with the highest rates of opioid prescribing did not cover either methadone or buprenorphine and three of the five states only provided Medicaid coverage of methadone or buprenorphine, but did not cover both.<sup>9</sup>

#### **Recommendation:**

- 1. Increase reimbursement incentives for Medicaid coverage of MAT in states with less overall wealth in order to increase access to evidence based treatments for opioid dependence.**

#### **Finding: Substance use treatment entry wait time averaged between 5-6 days**

One of the most important findings from the Aim 2 analysis (Chapter 6) was the fact that individuals waited, on average, 5-6 days to enter substance use treatment. Prior research has found that the first 24 hours following a person's initial contact with a treatment program is the most critical in order to

engage and maintain an individual in substance use treatment.<sup>92</sup> Given the increase in opioid use and dependence, novel approaches are needed to increase treatment capacity and continuity in order to reduce the amount of time that individuals wait to enter substance use treatment. The following two regulatory issues serve as impediments to expeditious entry into MAT programs.

MAT pre-authorization: The majority of state Medicaid programs require that pre-authorization of buprenorphine treatment must be obtained prior to a person initiating treatment as well as when they renew their prescription. Physicians and treatment programs have argued that this policy is unnecessarily onerous and contributes significantly to both delays to treatment entry, as well as interruptions in the continuity of MAT.<sup>212,213</sup> These pre-authorization requirements may prevent individuals from initiating treatment altogether, and may also expose individuals that are already maintained on buprenorphine treatment to interruptions in their treatment regimen, which in turn could increase their risk of relapse.

**Recommendation:**

- 1. Streamline or remove pre-authorization requirements for preferred providers or Medicaid beneficiaries with existing prescriptions in order to reduce delays to initiating or continuing buprenorphine treatment.**

Lack of integration of opioid treatment into the primary medical care system: Prior to the passage of the DATA 2000 and approval of buprenorphine in 2002, MAT in the United States was limited only to methadone, which was administered at opioid treatment programs (OTPs) that were typically segregated from other types of medical care. Many experts believe that this segregation increased the stigmatization of opioid users and created additional barriers to treatment accessibility.<sup>51–53,214</sup> While DATA 2000 and the approval of buprenorphine have helped to integrate substance use treatment into

more mainstream medical settings, the restrictions on the administration of methadone remain in place. Additionally, the waiver requirements that doctors must complete in order to become buprenorphine prescribers have been identified as a barrier to becoming a buprenorphine provider.<sup>79–81,84–86</sup> Both the restrictions on methadone provision and requirements for buprenorphine provision likely contribute to the lack of available programs and providers, as well as the low utilization of MAT, which in turn contributes to longer waiting times across substance use treatment services.

**Recommendations:**

- 1. Allow for the administration of all forms of MAT in primary care settings.**
- 2. Provide incentives and/or subsidies to physicians in areas with limited MAT availability to prescribe buprenorphine.**

**Finding: Younger age is associated with both an increase in treatment wait time and decreased odds of MAT use**

The Aim 2 analysis (Chapter 6) indicated that individuals under the age of 18 experienced a 92% increase in treatment wait time, as compared to individuals over 44 years of age. In the Aim 3 analysis, as age decreased, so did the odds that an opioid dependent individual would use MAT. These findings, coupled with the fact that TEDS-A data from 2002-2012 show the largest increase in treatment admissions due to heroin use among 20-34 year olds<sup>1</sup>, suggest that increased efforts are required in order to reach and engage younger opioid users in substance use treatment. Such efforts could include an increased use of outreach services that specifically target younger opioid users, with an emphasis on educating young opioid users about their options for substance use treatment services, including accurate information regarding the effectiveness of each modality. Additionally, substance use treatment



**Recommendations:**

1. **Amend state and federal budget policies so that substance use treatment programs can be reimbursed for outreach services that target hard-to-reach groups who are disproportionately impacted by substance use.**
2. **Provide incentives for substance use treatment programs to expand their programming capacity to provide specialized services to younger substance users.**

**Finding: Enrollment in a substance use treatment program in a state with Medicaid coverage of methadone is associated with an increased odds of MAT use**

Findings from the Aim 3 analysis (Chapter 7) demonstrated that for an individual enrolled in a substance use treatment program in a state with Medicaid coverage of methadone, the odds of them enrolling in MAT was 5 times greater than for an individual receiving treatment in a state without Medicaid coverage of methadone (OR=5.37). This finding suggests that the coverage options offered by insurance companies influence the types of treatments that opioid users utilize.

As of 2013, buprenorphine was covered in all 50 states for Medicaid beneficiaries; however, methadone was only covered in 30 states. Such policies that limit coverage options employ a “one size fits all” model, despite the fact that the appropriateness and satisfaction of each treatment varies across individuals. Limitations to the types of substance use treatment may lead to an increased likelihood of relapse if the treatments that are covered by Medicaid do not work for particular individuals.

**Recommendation:**

1. **Require that at least two MAT options are available to Medicaid beneficiaries.**

## Limitations

This dissertation project served as an initial exploration of state-level influences on Medicaid coverage of methadone and buprenorphine treatment, and the impact of this coverage on the utilization of substance use treatment. While novel, this study is subject to several limitations.

The design of this study was constructed based on the availability of the primary variable of interest, Medicaid coverage of methadone and buprenorphine. Longitudinal Medicaid coverage data across multiple years were not publicly available. Because of this, the analyses for all three aims of this dissertation were limited to the two time periods that state Medicaid coverage data were publicly available for each treatment type (1998 and 2008 for methadone, and 2006 and 2008 for buprenorphine).<sup>9,54,142</sup> This limitation reduced my ability to detect causality and the immediate and direct effects of changes in Medicaid coverage of each treatment, given that I was unable to determine the exact timing of any changes in Medicaid coverage.

The Treatment Episodes Data Set-Admissions served as my primary data source for this study, and there are noteworthy limitations to the TEDS-A. First, the TEDS-A consists of data reported primarily by publicly funded substance use treatment facilities to the SAMHSA, as per state requirement.<sup>122</sup> Most privately owned treatment facilities, of which approximately 29% of outpatient methadone programs are in the United States, are not required to report their treatment data as per state regulations, and are therefore not likely to be included in the TEDS-A.<sup>201</sup> This limitation may have introduced selection bias into both the methadone and buprenorphine analyses given that only a portion of private programs are required to report their admission data.<sup>122</sup> Further, the TEDS-A does not contain treatment episodes from private practice physicians or those physicians operating outside of licensed substance use treatment programs. In 2012, only 19% of buprenorphine clients received their treatment from an opioid treatment program (OTP); therefore, the overwhelming majority of buprenorphine clients are not included in the TEDS-A.<sup>215</sup> Given this, it is conceivable that the individuals contained within the TEDS-A

that received buprenorphine treatment are different from the overall population of buprenorphine patients in the US. This may limit the generalizability of the analyses presented in Chapter 6 and 7.

When data collection began for the TEDS-A, methadone was the primary MAT provided in the United States. When buprenorphine was introduced in 2002, the TEDS included buprenorphine within an existing question regarding MAT, rather than differentiating between methadone and buprenorphine. Including a double-barreled question is likely to result in response bias, particularly for analyses such as these that seek to differentiate between the two treatment types.<sup>216</sup> The TEDS-A response structure for MAT limited my ability to explore the utilization of each treatment separately in the Chapter 7 analyses. Because of this, the findings regarding methadone utilization in 2008 and the combined 1998-2008 analyses may be overestimated given that the outcome variable, MAT use, likely included some individuals utilizing buprenorphine treatment.

The TEDS-A contains a combination of patient self-reported responses as well as program-reported responses. (Justin Gaertner, SAMHDA User Support, personal communication, April 7, 2015). Variables that are self-reported may be subject to social desirability bias, given the sensitive nature of many of the items, including self-reported psychological problems. Additionally, some variables in the TEDS-A may also be subject to recall bias given that some questions refer to past behavior. Variables that may be impacted by recall bias include self-report of substance use at admission and number of prior treatment episodes.

A final limitation of the TEDS-A is that a significant amount of data were missing, particularly for the treatment wait time and health insurance coverage variables. These missing data may introduce bias, particularly when performing analyses using listwise deletion. Both listwise deletion and multiple imputation were employed prior to analyses to handle missing data in the analyses presented in Chapter 6 and 7; however, the sample was first limited to individuals receiving substance use treatment in states with ~50% missing data on any one variable included in the analyses. Sub-setting the sample to

individuals in a select number of states may have introduced a threat to external validity given that individuals residing in states that were excluded based on significant missing data may be different from the individuals residing in states with ~50% or less missing data for any one variable.

Despite the limitations associated with the TEDS-A, it serves as the most comprehensive source of individual-level data regarding substance use treatment admissions in the United States. Additionally, the TEDS-A is the only dataset that provides individual-level data on treatment wait times across the United States.

A final limitation associated with the datasets utilized in this study comes from the UFDS and N-SSATS. Similar to the TEDS-A, there is a known bias associated with the substance use treatment programs included in the UFDS and N-SSATS datasets. The UFDS and N-SSATS datasets were used to calculate the rate of methadone and buprenorphine programs per state. The response rate for these surveys was significant (88% in 1998; 97% in 2006; and, 94% in 2008); however, similar to the TEDS-A, the UFDS and N-SSATS do not include private physicians that are not contained within or affiliated with a substance use treatment program. Given this, the association between the rate of buprenorphine programs and Medicaid coverage is likely to be underestimated.

While this dissertation is subject to several limitations, it provides an important contribution to the literature regarding the impact of Medicaid coverage on opioid dependent individuals. While prior research has documented the ways in which Medicaid coverage restrictions of methadone and buprenorphine impact substance use treatment facilities, to date we are not aware of any study investigating the impact of Medicaid coverage of these treatments on substance users engaged in treatment.

## **Future Directions**

Previous research has investigated individual and program-level factors that are associated with wait time to enter substance use treatment and MAT utilization. This dissertation adds to that literature by both confirming and refuting some of the previous findings. This dissertation also provides a novel contribution to the literature through the investigation of Medicaid coverage of methadone and buprenorphine, the wait time associated with substance use treatment entry and MAT utilization. While the analyses conducted for this dissertation are historical, they reflect a time when opioid use and substance use treatment admissions were increasing, but MAT utilization was decreasing. This is particularly important given the public health significance of opioid use in the United States and the relatively low utilization of the most evidence-based approaches to treating opioid dependence.

The analyses in this dissertation were preliminary and were subject to several limitations. The lack of publicly available secondary data regarding Medicaid coverage of methadone and buprenorphine treatment was a significant limiting factor in the design of this study. Future research might include primary data collection with State Medicaid administrators regarding Medicaid coverage patterns over repeated years in order to conduct a more rigorous analysis of the impact of Medicaid coverage of methadone and buprenorphine on individuals seeking substance use treatment.

This dissertation did not include any analyses since the passage of the PPACA, most specifically since 2014 when substance use treatment became an Essential Health Benefit. Future analyses should explore the availability of methadone and buprenorphine post-PPACA implementation for Medicaid beneficiaries as well as privately insured individuals. There is significant hope that the passage of the PPACA will improve access to and utilization of substance use treatment; however, the variability in the availability of treatment modalities will undoubtedly persist. Future research should investigate changes to the availability of methadone and buprenorphine treatments, potentially comparing the utilization of these evidence based treatments before and after PPACA implementation.

Finally, while this dissertation investigated Medicaid coverage of methadone and buprenorphine as a dichotomous variable, future research might include a more nuanced definition of this variable. In some states Medicaid programs cover methadone and/or buprenorphine treatments, but the use of them is limited by pre-authorization requirements for treatment initiation or restrictions to the length of time that individuals can use them.<sup>213</sup> These restrictions could have a significant impact on treatment engagement, utilization of MAT and treatment outcomes. Future studies might define Medicaid coverage as a polytomous variable, including categories such as full coverage, no coverage, restricted coverage, or even more specifically, restricted coverage based on lifetime limits and restricted coverage based on pre-authorization. Creating a more specific definition of the ways in which Medicaid coverage is restricted might result in an increased ability to detect the specific impact of these restrictions.

## **Conclusion**

This dissertation provided an historical analysis of the availability of the two most effective treatments for opioid dependence during a time when both nonmedical use of prescription opioids and heroin use increased significantly in the United States. The impetus for this study was to better understand why some states provided coverage of methadone and buprenorphine for Medicaid beneficiaries while others did not, and how Medicaid coverage of these treatment impacted opioid dependent individuals' access to treatment. While this study had limitations, particularly based on the availability of complete and multi-year data, it addressed a significant gap in the literature by examining factors related to Medicaid coverage at the state-level and the impact of this coverage on individuals enrolled in substance use treatment.

Since 2008, significant progress has been made with respect to substance use treatment and Medicaid coverage. In 2008, the Paul Wellstone and Pete Domenici Mental Health Parity and Addiction Equity Act of 2008 (MHPAEA) was passed, paving the way for elimination of differential benefits for

substance use treatment as compared to those placed on medical/surgical benefits. Additionally, in 2010, the PPACA was passed, paving the way for the expansion of Medicaid coverage to an increased number of individuals in thirty one states and the prioritization of substance use treatment as an essential health benefit. These policy changes have been considered unprecedented by substance use treatment experts<sup>217</sup> because of their potential to significantly increase access to substance treatment services. However, while these policies provide incredible opportunities for reducing barriers to treatment, it is critical that we remain cautiously optimistic because an expansion of coverage does not necessarily equal an increase in accessibility or utilization. In Massachusetts, for example, where universal health insurance was provided to nearly all state residents prior to the passage of the PPACA, admissions to substance use treatment programs, which had been expected to increase significantly, remained flat.<sup>218</sup> Since the early 2000s, substance use treatment admissions for opioids have increased steadily, yet since the passage of PPACA, the total number of substance use treatment facilities has decreased, from 17,204 in 2010 to 14,630 in 2013, as has the utilization of MAT.<sup>219,220</sup> In order to keep pace with an expansion in the population of individuals with health insurance that are in need of substance use treatment, there must be a concurrent expansion in services in order to ensure that substance use treatment is accessible. Future research should monitor the impact of the expansion in Medicaid coverage, the prioritization of substance use treatment as an EHB and the extent to which the passage of the Parity Act are impacting substance use treatment access.

## Appendices



Figure 1.1: Factors Influencing State Adoption of Medicaid Optional Services, Schneider & Jacoby

**Influential Factors**

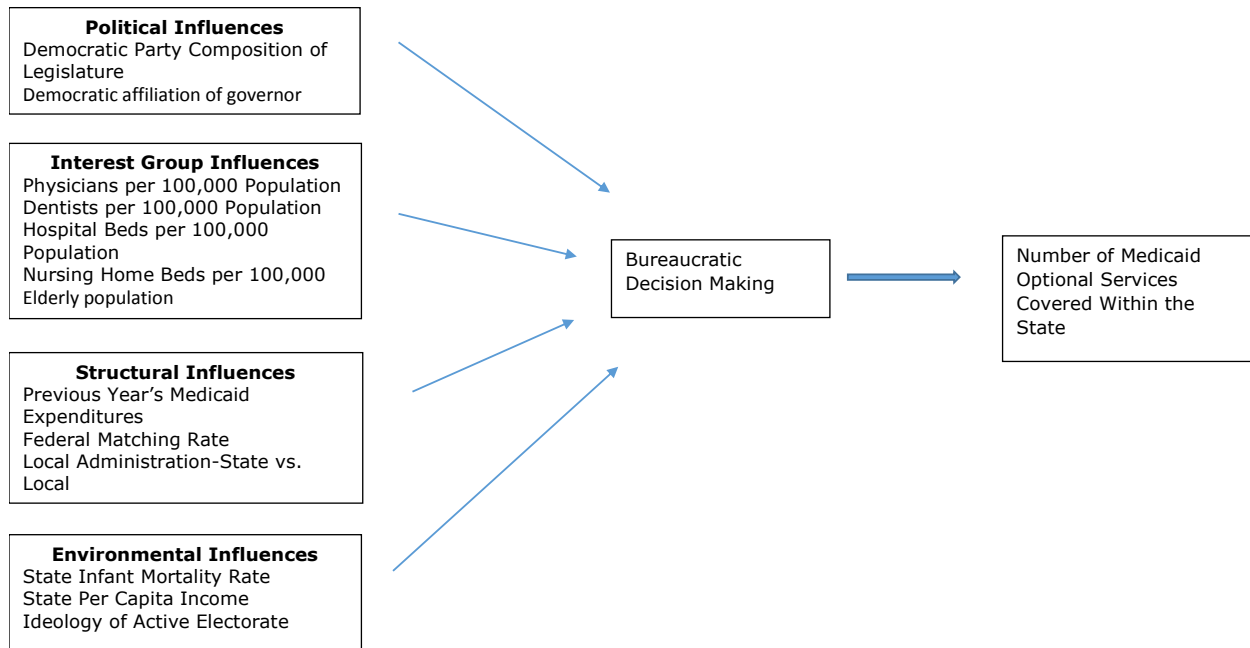


Figure 1.2: Factors Influencing State Medicaid Coverage of Methadone and Buprenorphine, Utilizing an Adapted Version of the Schneider & Jacoby Framework

**Influential Factors**

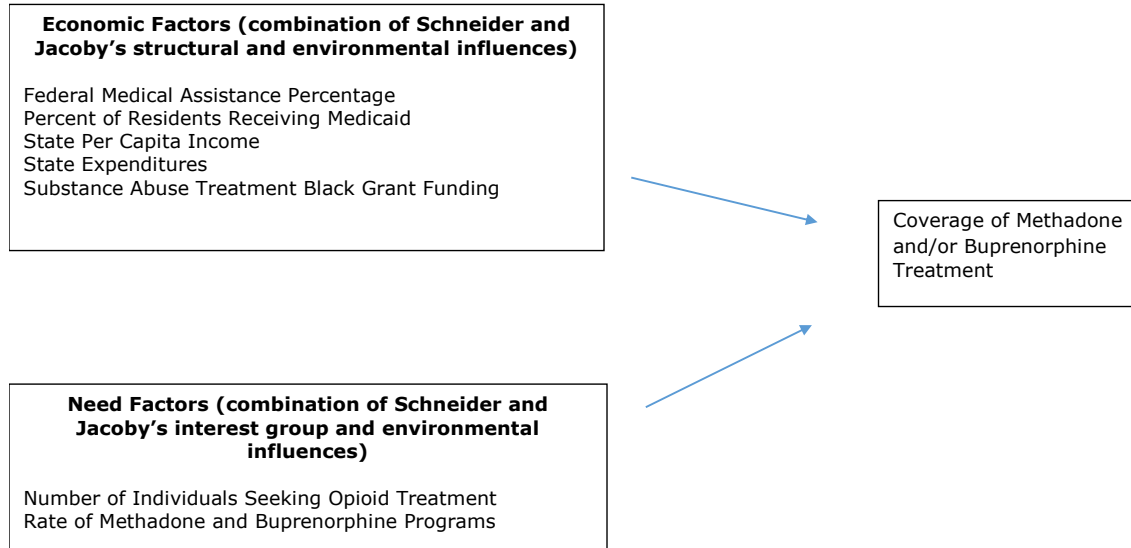


Figure 1.3: Analytic Sample for Aim 1, State-Level Analysis of Economic and Need Factors and Medicaid Coverage of Methadone and Buprenorphine

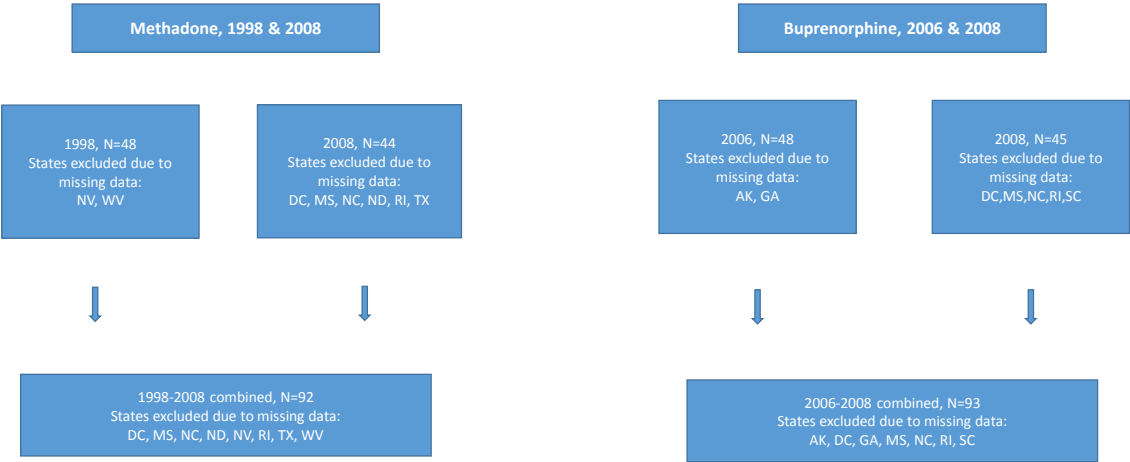
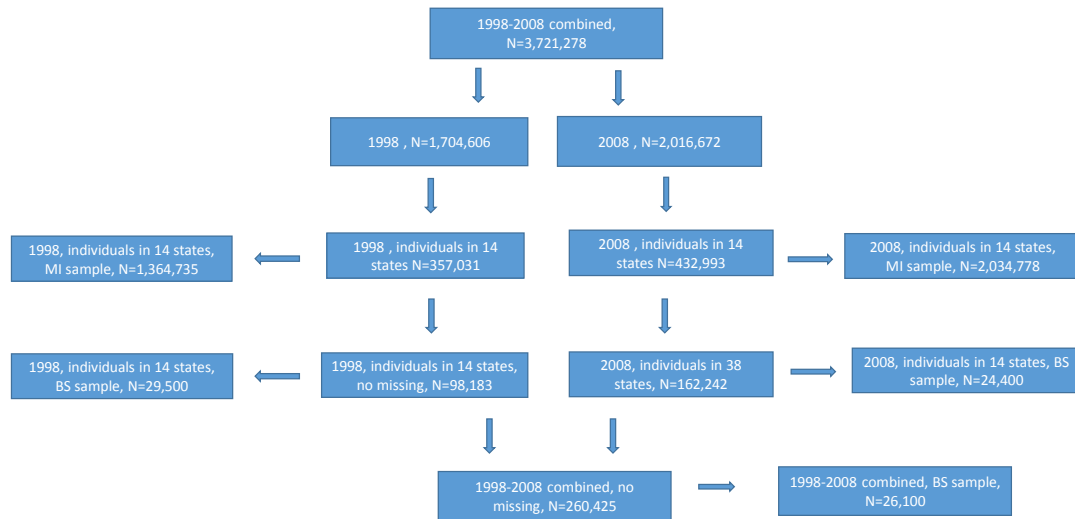


Table 1.1: Medicaid Coverage of Methadone (1998, 2008) and Buprenorphine (2006, 2008)

State	Medicaid Coverage of Methadone		Change in Methadone Coverage	Medicaid Coverage of Buprenorphine		Change in Buprenorphine Coverage	
	1998	2008	Began Covering	2006	2008	Began Covering	Stopped Covering
AL	1	1		0	0		
AK	0	1	x	1	1		
AZ	1	1		1	1		
AR	0	0		0	0		
CA	1	1		1	1		
CO	0	1	x	0	1	x	
CT	1	1		0	1	x	
DE	1	1		1	1		
DC	1	—		0	—		
FL	1	1		1	1		
GA	1	1		0	1	x	
HI	1	1		1	1		
ID	0	0		0	0		
IL	0	1	x	1	1		
IN	0	0		0	1	x	
IA	0	1	x	0	1	x	
KS	0	0		0	1	x	
KY	0	0		0	0		
LA	0	0		0	0		
ME	1	1		0	1	x	
MD	1	1		1	1		
MA	1	1		1	1		
MI	1	1		1	1		
MN	1	1		1	0		x
MS	0	—		0	—		
MO	0	1	x	0	1	x	
MT	0	0		0	1	x	
NE	0	1	x	1	1		
NV	1	1		0	1	x	
NH	0	1	x	0	1	x	
NJ	1	1		1	1		
NM	0	0		1	1		
NY	1	1		1	1		
NC	1	—		1	—		
ND	0	—		1	1		
OH	1	1		1	1		
OK	0	1	x	0	1	x	
OR	1	1		0	1	x	
PA	1	1		1	1		
RI	1	—		1	—		
SC	0	0		0	—		
SD	0	1	x	1	1		
TN	0	1	x	1	1		
TX	0	—		0	1	x	
UT	1	1		0	0		
VT	0	1	x	1	1		
VA	0	1	x	1	1		
WA	1	1		1	1		
WV	0	0		1	0		x
WI	1	1		1	1		
WY	0	0		1	1		
Total	25	34	12	28	38	14	2

Table 1.2: Results of Bivariate Logistic Regression Analyses for Medicaid Coverage and Economic and Need Factors																		
	Medicaid Coverage of Methadone									Medicaid Coverage of Buprenorphine								
	1998, n=48			2008, n=44			1998-2008 Combined, n=92			2006, n=48			2008, n=45			2006-2008 Combined, n=93		
	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p
<b>Economic Factors</b>																		
FMAP	0.36	(0.18-0.72)	0.004	0.17	(0.06-0.51)	0.002	0.3	(0.17-0.51)	<0.0001	0.38	(0.18-0.75)	0.006	0.12	(0.03-0.50)	0.004	0.30	(0.17-0.52)	<0.0001
% of Res Rec'v Medicaid	1.09	(0.61-1.93)	0.777	0.82	(0.42-1.59)	0.553	1.25	(0.81-1.94)	0.309	1.24	(0.69-2.24)	0.471	0.79	(0.37-1.69)	0.536	1.10	(0.70-1.72)	0.678
Per Capita Income	2.00	(1.42-7.57)	0.005	5.16	(1.45-18.30)	0.011	3.45	(1.87-6.35)	<0.0001	2.11	(1.03-4.31)	0.04	13.12	(1.92-89.79)	0.009	3.97	(1.92-8.21)	0.0002
SABG	////////////////////			11.73	(0.99-137.66)	0.05	////////////////////			1.92	(0.74-4.96)	0.177	5.42	(0.52-56.41)	0.157	2.24	(0.94-5.36)	0.071
State expenditures	4.74	(1.34-16.71)	0.016	6.03	(0.88-41.57)	0.068	7.9	(2.39-26.14)	0.001	2.79	(0.91-8.53)	0.073	1.75	(0.46-6.59)	0.411	2.38	(1.01-5.61)	0.048
<b>Need factors</b>																		
Rate indiv in opioid tx/10,000 pop	114.2	(2.32->999.99)	0.017	2.57	(0.73-9.00)	0.14	9.68	(2.52-37.18)	0.001	1.44	(0.76-2.70)	0.215	1.42	(0.55-3.69)	0.472	1.55	(0.90-2.67)	0.118
Rate of meth progs/1M pop	6.11	(1.58-23.58)	0.009	5.89	(1.22-28.38)	0.027	6.5	(2.42-17.44)	0.0002	////////////////////			////////////////////			////////////////////		
Rate of bupe progs/1M pop	////////////////////			////////////////////			////////////////////			1.52	(0.78-2.95)	0.264	1.57	(0.53-4.70)	0.417	1.69	(0.92-3.11)	0.094

Figure 2A.1: Analytic Sample, Treatment Wait Time and Medicaid Coverage of Methadone



**Table 2A.1 Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Methadone Analysis, 2008**

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
	N=270,751 n ( %)	N=162,242 n ( %)
Medicaid Coverage of Methadone*** missing	260197 (96%) n=0	72749 (45%) n=0
Male*** missing	175226 (65%) n=71	113360 (70%) n=0
<b>Race</b>		
White***	182659 (77%)	122257 (75%)
Black***	42224 (18%)	26327 (16%)
Other Race*** missing	13853 (6%) n=32015	13658 (8%) n=0
Hispanic*** missing	30456 (13%) n=30074	21725 (13%) n=0
HS Education*** missing	164153 (62%) n=7505	105755 (65%) n=0
Married*** missing	42376 (19%) n=46685	37988 (23%) n=0
Employed*** missing	76133 (29%) n=5325	62813 (29%) n=0
Unstably housed*** missing	81587 (31%) n=9355	66890 (41%) n=0
<b>Age</b>		
<18*	30396 (11%)	14646 (9%)
18-24***	54197 (20%)	31165 (19%)
25-34	71340 (26%)	42935 (26%)
35-44***	57560 (21%)	35959 (22%)
≥45*** missing	57258 (21%) n=0	37537 (23%) n=0
<b>Program Type</b>		
Outpatient***	196290 (73%)	99686 (61%)
Detox***	42731 (16%)	42280 (26%)
Rehab*** missing	31706 (12%) n=24	20276 (13%) n=0
Patient receiving MAT*** missing	5901 (2%) n=24875	2232 (1%) n=0
Psych Problems*** missing	98042 (45%) n=52097	40914 (25%) n=0
<b>Drug use reported at admit</b>		
Heroin*** missing	20136 (7%) n=0	4219 (3%) n=0
Non prescription Methadone*** missing	1857 (1%) n=0	952 (1%) n=0
Synthetic opioids*** missing	42859 (16%) n=0	17263 (11%) n=0

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
Any opiates***	16673 (6%)	5694 (6%)
missing	n=0	n=0
Cocaine/Crack***	65011 (24%)	33899 (21%)
missing	n=0	n=0
Benzodiazepine***	8713 (3%)	4045 (2%)
missing	n=0	n=0
<b># of subs reported at admit</b>		
0***	22340 (8%)	439 (<1%)
1***	127338 (47%)	78996 (49%)
2***	74163 (27%)	47490 (29%)
3***	46910 (17%)	35317 (22%)
missing	n=0	n=0
IDU***	20205 (7%)	10765 (7%)
missing	n=22771	n=0
<b>Client Insurance Type</b>		
Medicaid	12495 (18%)	16997 (10%)
Medicare***	3958 (6%)	11115 (7%)
No insurance***	42205 (61%)	110369 (68%)
Private Insurance***	11008 (16%)	23761 (15%)
missing	n=201085	n=0
<b>Primary Source of Income</b>		
Public Assistance***	7783 (3%)	7231 (4%)
Retirement/Pension***	20073 (9%)	11092 (7%)
Other Income***	38016 (16%)	17640 (11%)
No income***	95252 (41%)	52664 (32%)
Salary***	72101 (31%)	73615 (45%)
missing	n=113201	n=0
<b>Continuous variables</b>		
Days Waiting to Enter Treatment***	15.71 (105.5)	5.18 (18.07)
Per capita Income***	\$38,753 (\$3,057)	\$39,302 (\$4,464)
Rate of methadone programs/10K pop*	2.51 (1.49)	1.94 (1.01)
Rate of individuals in tx/1M pop***	12.89 (4.71)	9.45 (3.47)
Percent of residents rec'v Medicaid***	17.84 (3.73)	16.98 (5.65)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05



**Table 2A.2 Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Methadone Analysis, 1998**

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
	N=258,848	N=98,183
	n ( %)	n ( %)
Medicaid Coverage of Methadone***	134191 (52%)	40577 (41%)
missing	n=0	n=0
Male***	183654 (72%)	69830 (71%)
missing	n=4646	n=0
<b>Race</b>		
White***	157958 (64%)	68747 (70%)
Black***	55657 (22%)	20832 (21%)
Other Race***	35064 (14%)	8604 (9%)
missing	n=10169	n=0
Hispanic***	27462 (11%)	9054 (9%)
missing	n=12213	n=0
HS Education**	136410 (59%)	58507 (60%)
missing	n=27435	n=0
Married***	59240 (25%)	26383 (27%)
missing	n=19467	n=0
Employed***	92304 (39%)	41054 (42%)
missing	n=22935	n=0
Unstably housed***	60828 (28%)	36317 (37%)
missing	n=38811	n=0
<b>Age</b>		
<18*	30417 (12%)	11897 (12%)
18-24***	40139 (16%)	17034 (17%)
25-34***	71268 (28%)	28282 (29%)
35-44***	78759 (30%)	28737 (29%)
≥45***	38265 (15%)	12233 (12%)
missing	n=0	n=0
<b>Program Type</b>		
Outpatient***	159847 (62%)	65471 (67%)
Detox***	75266 (29%)	15227 (16%)
Rehab***	23702 (9%)	17485 (18%)
missing	n=33	n=0
Patient receiving MAT	3348 (1%)	1325 (1%)
missing	n=17473	n=0
Psych Problems***	33719 (20%)	16671 (17%)
missing	n=92145	n=0
<b>Drug use reported at admit</b>		
Heroin***	12029 (5%)	3812 (4%)
missing	n=0	n=0
Non prescription Methadone	357 (<1%)	155 (<1%)
missing	n=0	n=0
Synthetic opioids***	5116 (2%)	2211 (2%)
missing	n=0	n=0

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
Any opiates***	16673 (6%)	5694 (6%)
missing	n=0	n=0
Cocaine/Crack***	63023 (24%)	31240 (32%)
missing	n=0	n=0
Benzodiazepine***	2109 (1%)	1000 (1%)
missing	n=0	n=0
<b># of subs reported at admit</b>		
0***	17460 (7%)	1710 (2%)
1***	127932 (49%)	43679 (44%)
2***	73909 (29%)	31115 (32%)
3***	39547 (15%)	21679 (22%)
missing	n=0	n=0
IDU***	14765 (6%)	6956 (7%)
missing	n=19081	n=0
<b>Client Insurance Type</b>		
Medicaid	9091 (9%)	8522 (9%)
Medicare***	6494 (6%)	16368 (17%)
No insurance***	78817 (74%)	64433 (66%)
Private Insurance***	12169 (11%)	8860 (9%)
missing	n=152277	n=0
<b>Primary Source of Income</b>		
Public Assistance***	9588 (7%)	5244 (5%)
Retirement/Pension***	6220 (4%)	6803 (7%)
Other Income***	25521 (18%)	10001 (10%)
No income***	42658 (29%)	31226 (32%)
Salary***	61633 (42%)	44909 (46%)
missing	n=113201	n=0
<b>Continuous variables</b>		
Days Waiting to Enter Treatment***	3.38 (28.3)	6.03 (45.0)
Per capita Income***	\$26,246 (\$2,400)	\$24,952 (\$1,797)
Rate of methadone programs/10K pop*	1.82 (1.02)	1.43 (0.87)
Rate of individuals in tx/1M pop***	5.61 (2.34)	2.71 (0.98)
Percent of residents rec'v Medicaid***	12.00 (2.91)	13.90 (3.02)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

**Table 2A.3: Descriptive Characteristics of Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, Combined 1998-2008**

	N=26,100
	n ( % )
Individuals in States with Medicaid Coverage of Methadone	11235 (43%)
Male	18429 (71%)
<b>Race</b>	
White	19177 (73%)
Black	4680 (18%)
Other Race	2243 (9%)
Hispanic	3118 (12%)
HS Education	16455 (63%)
Married	6423 (25%)
Employed	10462 (40%)
Unstably housed	10435 (40%)
<b>Age</b>	
<18	2722 (10%)
18-24	4800 (19%)
25-34	7033 (27%)
35-44	6708 (26%)
≥45	4837 (19%)
<b>Program Type</b>	
Outpatient	16649 (64%)
Detox	5706 (22%)
Rehab	3745 (14%)
Patient receiving MAT	324 (1%)
Psych Problems	5738 (22%)
<b>Drug use reported at admit</b>	
Heroin	789 (3%)
Non prescription Methadone	120 (<1%)
Synthetic opioids	1534 (6%)
Any opioids	2270 (9%)
Cocaine/Crack	6628 (25%)
Benzodiazepine	511 (2%)
<b># of subs reported at admit</b>	
0	245 (1%)
1	12306 (47%)
2	7858 (30%)
3	5691 (22%)
<b>IDU</b>	1792 (7%)
<b>Client Insurance Type</b>	
Medicaid	2515 (10%)
Medicare	2789 (11%)
No insurance	17568 (67%)
Private Insurance	3228 (12%)
<b>Primary Source of Income</b>	
Public Assistance	1223 (5%)
Retirement/Pension	1762 (7%)
Other Income	2749 (11%)
No income	8464 (32%)
Salary	11902 (46%)
<b>Continuous variables</b>	<b>Mean (SD)</b>
Days Waiting to Enter Treatment	5.14 (24.66)
Per Capita Income	\$33,740 (\$7,838)
Rate of methadone programs/10K pop	1.74 (1.00)
Rate of individuals in tx/1M pop	6.82 (4.30)
Percent of residents rec'v Medicaid	15.81 (5.05)

**Table 2A.4: Comparison of Characteristics of Bootstrapped Listwise Deletion Sample by Medicaid Coverage of Methadone, Combined 1998-2008**

	Medicaid Coverage	No Medicaid Coverage
	N=11,265	N=14,835
	n ( % )	n ( % )
Male ***	8117 (72%)	10312 (70%)
<b>Race</b>		
White***	8674 (77%)	10503 (71%)
Black***	1522 (14%)	3158 (21%)
Other Race***	1069 (9%)	1174 (8%)
Hispanic***	1976 (18%)	1142 (8%)
HS Education***	7466 (66%)	8989 (61%)
Married***	2502 (22%)	3921 (26%)
Employed	4566 (41%)	5896 (40%)
Unstably housed***	5182 (46%)	5253 (35%)
<b>Age</b>		
≤24***	3005 (27%)	4517 (30%)
25-34*	2933 (26%)	4100 (28%)
35-44*	2965 (26%)	3743 (25%)
≥45***	2362 (21%)	2475 (17%)
<b>Program Type</b>		
Outpatient***	6149 (55%)	10500 (71%)
Detox***	3448 (31%)	2258 (15%)
Rehab	1668 (15%)	2077 (14%)
Patient receiving MAT***	212 (2%)	112 (1%)
Psych Problems	2522 (22%)	3216 (22%)
<b>Drug use reported at admit</b>		
Heroin***	425 (4%)	364 (2%)
Non prescription Methadone***	15 (<1%)	105 (1%)
Any opiates***	811 (7%)	1459 (10%)
Cocaine/Crack	2797 (25%)	3831 (26%)
Synthetic opioids***	439 (4%)	1095 (7%)
Benzodiazepine***	135 (1%)	376 (3%)
<b># of subs reported at admit</b>		
0***	168 (1%)	77 (1%)
1***	5894 (52%)	6412 (43%)
2*	3307 (29%)	4551 (31%)
3***	1896 (17%)	3795 (26%)
IDU***	591 (5%)	1201 (8%)
<b>Client Insurance Type</b>		
Medicaid***	952 (8%)	1563 (11%)
Medicare***	746 (7%)	2043 (14%)
No insurance***	7421 (66%)	10147 (68%)
Private Insurance***	2146 (19%)	1082 (7%)
<b>Primary Source of Income</b>		
Public Assistance	539 (5%)	684 (5%)
Retirement/Pension***	849 (8%)	913 (6%)
Other Income***	1384 (12%)	1365 (9%)
No income	3588 (32%)	4876 (33%)
Salary***	4905 (44%)	6997 (47%)
<b>Continuous variables</b>		
Days Waiting to Enter Treatment	4.8 (31.7)	5.4 (17.5)
Per capita Income***	\$36,453 (\$7,967)	\$31,681 (\$7,075)
Rate of methadone programs/10K pop***	1.95 (0.37)	1.58 (1.27)
Rate of individuals in tx/1M pop***	7.3 (3.8)	6.5 (4.6)
Percent of residents rec'v Medicaid***	14.2 (2.2)	17.0 (6.1)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone covered	-0.12 (-0.19, -0.04)**	-11.31	-0.06 (-0.14, 0.02)	-5.82	-0.16 (-0.24, -0.08)**	-14.79	-0.18 (-0.26, -0.1)**	-16.47	0.64 (0.55, 0.73)**	89.65	0.8 (0.7, 0.89)**	122.55	1.16 (1.03, 1.29)**	218.99
Male			0.06 (-0.02, 0.14)	6.18	0.16 (0.07, 0.24)**	17.35	0.15 (0.07, 0.23)**	16.18	0.11 (0.02, 0.19)*	11.63	0.14 (0.06, 0.22)**	15.03	0.14 (0.06, 0.22)**	15.03
Race														
Black			0.34 (0.24, 0.44)**	40.49	0.21 (0.1, 0.31)**	23.37	0.2 (0.1, 0.3)**	22.14	-0.03 (-0.13, 0.07)	-2.96	-0.03 (-0.13, 0.07)	-2.96	-0.4 (-0.14, 0.06)	-3.92
Other Race			0.15 (0.02, 0.29)*	16.18	0.26 (0.13, 0.4)**	29.69	0.29 (0.15, 0.42)**	33.64	0.16 (0.03, 0.29)*	17.35	0.18 (0.05, 0.31)*	19.72	0.13 (0.0, 0.26)*	13.88
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.75 (-0.87, -0.63)**	-52.76	-0.85 (-0.97, -0.72)**	-57.26	-0.83 (-0.95, -0.71)**	-56.40	-0.43 (-0.55, -0.31)**	-34.95	-0.34 (-0.46, -0.22)**	-28.82	-0.31 (-0.43, -0.19)**	-26.66
HS Education			-0.14 (-0.23, -0.06)**	-13.06	-0.09 (-0.18, -0.01)*	-8.61	-0.08 (-0.16, 0.01)	-7.69	-0.01 (-0.09, 0.07)	-1.00	0 (-0.08, 0.08)	0.00	0 (-0.08, 0.08)	0.00
Marijuana			0.08 (-0.01, 0.17)	8.33	-0.03 (-0.12, 0.06)	-2.96	-0.01 (-0.09, 0.08)	-1.00	-0.02 (-0.11, 0.07)	-1.98	-0.06 (-0.14, 0.03)	-5.82	-0.03 (-0.11, 0.06)	-2.96
Employed			0.27 (0.19, 0.35)**	31.00	0.24 (0.16, 0.33)**	27.12	0.43 (0.31, 0.54)**	53.73	0.28 (0.17, 0.39)**	32.31	0.23 (0.12, 0.35)**	25.86	0.22 (0.1, 0.33)**	24.61
Unstably Housed			0.07 (-0.01, 0.16)	7.25	0.13 (0.04, 0.21)*	13.88	0.15 (0.07, 0.24)**	16.18	0.25 (0.16, 0.33)**	28.40	0.24 (0.15, 0.32)**	27.12	0.26 (0.17, 0.34)**	29.69
Age														
<18			0.58 (0.42, 0.75)**	78.60	0.46 (0.3, 0.63)**	58.41	0.48 (0.31, 0.65)**	61.61	0.61 (0.45, 0.78)**	84.04	0.69 (0.52, 0.85)**	99.37	0.65 (0.49, 0.82)**	91.55
18-24			0.36 (0.24, 0.49)**	43.33	0.2 (0.07, 0.32)*	22.14	0.22 (0.09, 0.35)**	24.61	0.18 (0.06, 0.31)*	19.72	0.21 (0.08, 0.33)*	23.37	0.2 (0.08, 0.33)*	22.14
25-34			0.32 (0.21, 0.43)**	37.71	0.23 (0.12, 0.34)**	25.86	0.24 (0.13, 0.35)**	27.12	0.2 (0.09, 0.31)*	22.14	0.24 (0.13, 0.35)**	27.12	0.23 (0.12, 0.34)**	25.86
35-44			0.24 (0.13, 0.35)**	27.12	0.34 (0.23, 0.45)**	40.49	0.33 (0.21, 0.44)**	39.10	0.28 (0.17, 0.39)**	32.31	0.35 (0.24, 0.46)**	41.91	0.34 (0.23, 0.45)**	40.49
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type														
Outpatient					-0.26 (-0.37, -0.15)**	-22.89	-0.28 (-0.4, -0.17)**	-24.42	-0.55 (-0.66, -0.44)**	-42.31	-0.65 (-0.77, -0.54)**	-47.80	-0.66 (-0.78, -0.55)**	-48.31
Detox					-2.15 (-2.28, -2.02)**	-88.35	-2.19 (-2.32, -2.06)**	-88.81	-2.47 (-2.6, -2.34)**	-91.54	-2.56 (-2.69, -2.42)**	-92.27	-2.63 (-2.77, -2.5)**	-92.79
Rehab (														

\*= $p<0.05$

Table 2A.6: Model Building Summary Using Ustwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, Combined 1998-2008, N=260,425

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone covered	-0.03 (-0.06, -0.10)**	-2.96	0.02 (-0.01, 0.04)	2.02	-0.14 (-0.16, -0.11)***	-13.06	-0.13 (-0.15, -0.11)***	-12.19	-0.72 (-0.69, 0.75)***	105.44	0.9 (0.87, 0.93)***	145.96	1.42 (1.38, 1.46)***	313.71
Male			-0.01 (-0.04, 0.01)	-1.00	0.07 (0.04, 0.1)***	7.25	0.08 (0.06, 0.11)***	8.33	0.04 (0.02, 0.07)**	4.08	0.05 (0.02, 0.07)**	5.13	0.06 (0.03, 0.08)***	6.18
Race														
Black			0.22 (0.19, 0.26)***	24.61	0.17 (0.14, 0.2)***	18.53	0.16 (0.13, 0.19)***	17.35	-0.05 (-0.08, -0.02)**	-4.88	-0.05 (-0.08, -0.02)*	-4.88	-0.04 (-0.07, -0.01)*	-3.92
Other Race			0.01 (-0.03, 0.06)	1.01	0.2 (0.15, 0.24)***	22.14	0.23 (0.18, 0.27)***	25.86	0.09 (0.05, 0.13)***	9.42	0.09 (0.04, 0.13)***	9.42	0.02 (-0.02, 0.06)	2.02
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.61 (-0.65, -0.57)***	-45.66	-0.7 (-0.74, -0.66)***	-50.34	-0.7 (-0.74, -0.66)***	-50.34	-0.25 (-0.29, -0.21)***	-22.12	-0.15 (-0.19, -0.11)***	-13.93	-0.11 (-0.15, -0.07)**	-10.42
HS Education			-0.14 (-0.17, -0.11)***	-13.06	-0.14 (-0.16, -0.11)***	-13.06	-0.12 (-0.15, -0.1)***	-11.31	-0.07 (-0.1, -0.04)***	-6.76	-0.06 (-0.09, -0.03)***	-5.82	-0.05 (-0.08, -0.03)***	-4.88
Married			0.02 (-0.01, 0.05)	2.02	-0.07 (-0.1, -0.04)***	-6.76	-0.05 (-0.08, -0.02)**	-4.88	-0.04 (-0.07, -0.01)*	-3.92	-0.06 (-0.08, -0.03)***	-5.82	-0.01 (-0.04, 0.02)	-1.00
Employed			0.19 (0.17, 0.22)***	20.92	0.15 (0.12, 0.18)***	16.18	0.17 (0.14, 0.21)***	18.53	0.05 (0.02, 0.09)*	5.13	0.01 (-0.03, 0.04)	1.01	0.01 (-0.03, 0.05)	1.01
Unstably Housed			0 (-0.03, 0.03)	0.00	-0.02 (-0.05, 0)	-1.98	-0.01 (-0.04, 0.02)	-1.00	0.11 (0.08, 0.13)***	11.63	0.08 (0.05, 0.1)***	8.33	0.12 (0.1, 0.15)***	12.75
Age														
<18			0.47 (0.42, 0.52)***	60.00	0.27 (0.22, 0.32)***	31.00	0.33 (0.28, 0.39)***	39.10	0.39 (0.33, 0.44)***	47.70	0.47 (0.42, 0.52)***	60.00	0.44 (0.39, 0.49)***	55.27
18-24			0.3 (0.26, 0.34)***	34.99	0.15 (0.11, 0.18)***	16.18	0.16 (0.12, 0.2)***	17.35	0.1 (0.06, 0.13)***	10.52	0.11 (0.07, 0.15)***	11.63	0.1 (0.06, 0.13)***	10.52
25-34			0.25 (0.22, 0.29)***	28.40	0.21 (0.17, 0.24)***	23.37	0.2 (0.17, 0.24)***	22.14	0.14 (0.11, 0.18)***	15.03	0.17 (0.13, 0.21)***	18.53	0.16 (0.12, 0.19)***	17.35
35-44			0.19 (0.15, 0.22)***	20.92	0.17 (0.13, 0.2)***	18.53	0.16 (0.12, 0.19)***	17.35	0.09 (0.05, 0.12)***	9.42	0.13 (0.09, 0.16)***	13.88	0.12 (0.09, 0.16)***	12.75
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type														
Outpatient					-0.3 (-0.33, -0.26)***	-25.92	-0.3 (-0.34, -0.26)***	-25.92	-0.62 (-0.65, -0.58)***	-46.21	-0.74 (-0.78, -0.7)***	-52.29	-0.76 (-0.8, -0.73)***	-53.23
Detox					-2.26 (-2.3, -2.22)***	-89.56	-2.26 (-2.3, -2.21)***	-89.56	-2.52 (-2.56, -2.47)***	-91.95	-2.62 (-2.66, -2.58)***	-92.72	-2.68 (-2.72, -2.64)***	-93.14
Rehab (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.82 (-0.93, -0.71)***	-55.96	-0.85 (-0.96, -0.75)***	-57.26	-0.85 (-0.96, -0.74)***	-57.26	-0.78 (-0.88, -0.67)***	-54.16	-0.72 (-0.83, -0.62)***	-51.32
Psych problems					0.25 (0.22, 0.28)***	28.40	0.24 (0.21, 0.27)***	27.12	0.19 (0.16, 0.22)***	20.92	0.15 (0.13, 0.18)***	16.18	0.14 (0.11, 0.17)***	15.03
Drug Use														
Heroin					-0.12 (-0.29, 0.04)	-11.31	-0.14 (-0.31, 0.03)	-13.06	-0.28 (-0.44, -0.12)**	-24.42	-0.18 (-0.34, -0.02)*	-16.47	-0.18 (-0.34, -0.01)*	-16.47
Non-rx Methadone					-0.19 (-0.39, 0.01)	-17.30	-0.17 (-0.37, 0.03)	-15.63	-0.5 (-0.7, -0.3)***	-39.35	-0.49 (-0.68, -0.29)***	-38.74	-0.48 (-0.67, -0.29)***	-38.12
Cocaine					0.16 (0.13, 0.19)***	17.35	0.15 (0.12, 0.18)***	16.18	-0.05 (-0.08, -0.03)**	-4.88	-0.02 (-0.05, 0.01)	-1.98	-0.06 (-0.09, -0.03)**	-5.82
Synthetic Opioids					-0.06 (-0.22, 0.11)	-5.82	-0.08 (-0.25, 0.09)	-7.69	-0.29 (-0.45, -0.13)**	-25.17	-0.25 (-0.41, -0.09)*	-22.12	-0.29 (-0.45, -0.13)**	-25.17
Benzodiazepines					0.13 (0.04, 0.21)*	13.88	0.13 (0.04, 0.21)*	13.88	-0.31 (-0.4, -0.23)***	-26.66	-0.26 (-0.35, -0.18)***	-22.89	-0.25 (-0.33, -0.17)**	-22.12
Any Opioids					0.39 (0.21, 0.56)***	47.70	0.4 (0.22, 0.57)***	49.18	0.34 (0.17, 0.51)***	40.49	0.28 (0.12, 0.45)**	32.31	0.27 (0.1, 0.44)*	31.00
Ttl # of Drugs Used														
0					0.56 (0.43, 0.69)***	75.07	0.58 (0.45, 0.7)***	78.60	-0.18 (-0.3, -0.06)*	-16.47	-0.02 (-0.14, 0.11)	-1.98	-0.26 (-0.39, -0.14)***	-22.89
1					0.29 (0.25, 0.32)***	33.64	0.28 (0.24, 0.32)***	32.31	0.13 (0.1, 0.16)***	13.88	0.16 (0.13, 0.2)***	17.35	0.13 (0.1, 0.17)***	13.88
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
2					0.13 (0.09, 0.16)***	13.88	0.12 (0.08, 0.15)***	12.75	0.09 (0.06, 0.12)***	9.42	0.08 (0.05, 0.12)***	8.33	0.08 (0.05, 0.11)***	8.33
3 (ref)					ref	ref	ref	ref	ref	ref	0 (0.0)	0.00	0 (0.0)	0.00
IDU					0.01 (-0.05, 0.06)	1.01	0.02 (-0.04, 0.07)	2.02	0.23 (0.18, 0.28)***	25.86	0.22 (0.17, 0.27)***	24.61	0.23 (0.18, 0.28)***	25.86
Health Insurance Type														
Medicaid							0.33 (0.28, 0.38)***	39.10	0.19 (0.14, 0.24)***	20.92	0.19 (0.14, 0.24)***	20.92	0.08 (0.02, 0.13)*	8.33
Medicare							0.09 (0.04, 0.14)***	9.42	0.35 (0.3, 0.4)***	41.91	0.36 (0.31, 0.41)***	43.33	0.34 (0.29, 0.39)***	40.49
No insurance							0.32 (0.29, 0.36)***	37.71	0.29 (0.25, 0.32)***	33.64	0.32 (0.29, 0.36)***	37.71	0.29 (0.26, 0.33)***	33.64
Private Insurance (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Primary Income														
Public Assistance							0.04 (-0.02, 0.11)	4.08	-0.07 (-0.13, -0.01)*	-6.76	-0.06 (-0.12, 0)	-5.82	0.01 (-0.05, 0.07)	1.01
Retirement/Pension							0.13 (0.07, 0.19)***	13.88	0.03 (-0.02, 0.09)	3.05	0 (-0.05, 0.06)	0.00	0.02 (-0.04, 0.07)	2.02
Other Income Source							0.11 (0.06, 0.15)***	11.63	0.01 (-0.04, 0.05)	1.01	-0.12 (-0.17, -0.08)***	-11.31	-0.09 (-0.14, -0.05)***	-8.61
No Income							-0.09 (-0.12, -0.05)***	-8.61	-0.3 (-0.34, -0.27)***	-25.92	-0.36 (-0.39, -0.32)***	-30.23	-0.32 (-0.35, -0.28)***	-27.39
Salary (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
State Level Variables														
Per Capita Income									-0.0001 (-0.0001, -0.0001)***	-0.01	-0.0001 (-0.0001, -0.0001)***	-0.01	-0.0001 (-0.0001, -0.0001)***	-0.01
Methadone Prog Rate									-0.53 (-0.54, -0.51)***	-41.14	-0.57 (-0.58, -0.55)***	-43.45	-0.51 (-0.52, -0.49)***	-39.95
Rate of Indiv in Tx									0.09 (0.08, 0.09)***	9.42	0.05 (0.04, 0.05)***	5.13	0.02 (0.02, 0.03)***	2.02
% of res w/Medicaid									0.2 (0.2, 0.2)***	22.14	0.17 (0.17, 0.17)***	18.53	0.14 (0.13, 0.14)***	15.03
Time											1.22 (1.15, 1.28)***	238.72	1.86 (1.79, 1.92)***	542.37
Medicaid Cov * Time													-1.05 (-1.1, -0.99)***	-65.01

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

Model 6: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level variables and time

Model 7: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level variables, time and interaction term

\*\*\*p&lt;0.0001

\*\*p&lt;0.001

\*p&lt;0.05

Table 2A.7: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 2008, N=24,400

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone Covered	-0.68 (-0.75,-0.60)***	-49.09	-0.61 (-0.69,-0.53)***	-45.66	-0.96 (-1.04,-0.88)***	-61.71	-0.98 (-1.06,-0.9)***	-62.47	1.34 (1.19,1.49)***	281.90
Male			-0.07 (-0.15,0.01)	-6.76	-0.04 (-0.12,0.04)	-3.92	-0.03 (-0.1,0.05)	-2.96	-0.11 (-0.19,-0.04)*	-10.42
Race										
Black			0.17 (0.07,0.27)**	18.53	0.06 (-0.03,0.16)	6.18	0.07 (-0.03,0.17)	7.25	0.1 (0.004,0.2)*	10.52
Other Race			-0.24 (-0.38,-0.11)**	-21.34	0 (-0.12,0.13)	0.00	-0.13 (-0.26,0.005)*	-12.19	-0.61 (-0.74,-0.48)***	-45.66
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.62 (-0.73,-0.51)***	-46.21	-0.65 (-0.76,-0.54)***	-47.80	-0.65 (-0.75,-0.54)***	-47.80	-0.1 (-0.22,0.01)	-9.52
HS Education			-0.07 (-0.15,0.02)	-6.76	-0.1 (-0.18,-0.03)*	-9.52	-0.1 (-0.17,-0.02)*	-9.52	-0.14 (-0.22,-0.07)**	-13.06
Married			0.1 (0.01,0.19)*	10.52	0.1 (0.01,0.18)*	10.52	0.12 (0.03,0.2)*	12.75	0.06 (-0.02,0.15)	6.18
Employed			0.19 (0.11,0.27)***	20.92	0.13 (0.05,0.2)*	13.88	0.16 (0.05,0.28)*	17.35	-0.02 (-0.13,0.09)	-1.98
Unstably Housed			0.15 (0.07,0.24)**	16.18	0.18 (0.1,0.26)***	19.72	0.19 (0.11,0.27)***	20.92	0.2 (0.12,0.28)***	22.14
Age										
<18			0.27 (0.11,0.43)*	31.00	-0.15 (-0.31,0.01)	-13.93	-0.16 (-0.32,0.01)	-14.79	-0.16 (-0.33,0)*	-14.79
18-24			0.25 (0.14,0.37)***	28.40	0.09 (-0.02,0.2)	9.42	0.1 (-0.01,0.21)	10.52	0.02 (-0.09,0.13)	2.02
25-34			0.2 (0.1,0.3)**	22.14	0.1 (-0.001,0.2)*	10.52	0.1 (0.001,0.21)*	10.52	0.16 (0.06,0.26)*	17.35
35-44			0.17 (0.06,0.27)*	18.53	0.1 (-0.01,0.2)	10.52	0.1 (-0.001,0.2)*	10.52	0.15 (0.05,0.25)*	16.18
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.27 (-0.38,-0.16)***	-23.66	-0.33 (-0.44,-0.22)***	-28.11	-1.12 (-1.23,-1)***	-67.37
Detox					-2.75 (-2.87,-2.62)***	-93.61	-2.78 (-2.91,-2.66)***	-93.80	-3.43 (-3.56,-3.3)***	-96.76
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.73 (-1.02,-0.44)***	-51.81	-0.8 (-1.1,-0.51)***	-55.07	-0.71 (-1.01,-0.41)***	-50.84
Psych Problems					0.33 (0.25,0.42)***	39.10	0.31 (0.23,0.4)***	36.34	0.01 (-0.07,0.09)	1.01
Drug Use										
Heroin					-0.79 (-1.37,-0.22)*	-54.62	-0.76 (-1.32,-0.19)*	-53.23	-0.19 (-0.75,0.36)	-17.30
Non-rx Methadone					-0.62 (-1.11,-0.12)*	-46.21	-0.58 (-1.08,-0.07)*	-44.01	-0.41 (-0.91,0.08)	-33.63
Cocaine					0.11 (0.01,0.2)*	11.63	0.09 (-0.01,0.18)	9.42	0.18 (0.09,0.27)***	19.72
Synthetic Opioids					-0.71 (-1.28,-0.15)*	-50.84	-0.66 (-1.22,-0.1)*	-48.31	-0.51 (-1.06,0.04)	-39.95
Benzodiazepines					0.01 (-0.21,0.23)	1.01	0.04 (-0.18,0.26)	4.08	0.07 (-0.14,0.29)	7.25
Any Opioids					0.56 (-0.02,1.14)	75.07	0.52 (-0.05,1.1)	68.20	0.34 (-0.22,0.91)	40.49
Ttl # of Drugs Used										
0					0.71 (-0.01,1.43)*	103.40	0.65 (-0.06,1.37)	91.55	0.8 (0.12,1.48)*	122.55
1					-0.07 (-0.18,0.03)	-6.76	-0.12 (-0.23,-0.02)*	-11.31	0.22 (0.12,0.32)***	24.61
2					0.06 (-0.04,0.16)	6.18	0.01 (-0.09,0.11)	1.01	0.25 (0.15,0.35)***	28.40
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.29 (0.13,0.45)**	33.64	0.3 (0.14,0.46)**	34.99	0.23 (0.08,0.38)*	25.86
Health Insurance Type										
Medicaid							0.11 (-0.04,0.26)	11.63	-0.03 (-0.18,0.11)	-2.96
Medicare							0.82 (0.67,0.98)***	127.05	0.54 (0.39,0.69)***	71.60
No Insurance							0.27 (0.17,0.38)***	31.00	0.16 (0.06,0.26)*	17.35
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							0.14 (-0.05,0.34)	15.03	-0.2 (-0.38,-0.01)*	-18.13
Retirement/Pension							0.03 (-0.14,0.21)	3.05	-0.3 (-0.46,-0.13)**	-25.92
Other Income Source							0.28 (0.15,0.42)***	32.31	-0.24 (-0.38,-0.1)**	-21.34
No Income							-0.09 (-0.21,0.02)	-8.61	-0.52 (-0.64,-0.4)***	-40.55
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0002 (-0.0002,-0.0001)***	-0.02
Methadone Prog Rate									-0.04 (-0.11,0.03)	-3.92
Rate of Indiv in Tx									0.22 (0.2,0.25)***	24.61
% of res w/Medicaid									0.08 (0.07,0.09)***	8.33
SABG									-0.08 (-0.08,-0.07)***	-7.69

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2A.8: Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 2008, N=162,242

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone Covered	-0.64 (-0.67,-0.61)***	-47.32	-0.62 (-0.65,-0.59)***	-46.21	-0.94 (-0.97,-0.91)***	-60.94	-0.95 (-0.98,-0.92)***	-61.33	1.27 (1.22,1.33)***	256.09
Male			-0.03 (-0.06,-0.005)*	-2.96	0.04 (0.01,0.07)*	4.08	0.05 (0.02,0.07)*	5.13	-0.03 (-0.06,-0.001)*	-2.96
Race										
Black			0.09 (0.06,0.13)***	9.42	0.04 (0,0.08)*	4.08	0.05 (0.02,0.09)*	5.13	0.09 (0.05,0.12)***	9.42
Other Race			-0.06 (-0.11,-0.01)*	-5.82	0.16 (0.11,0.21)***	17.35	0.05 (0.001,0.1)*	5.13	-0.39 (-0.44,-0.34)***	-32.29
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.77 (-0.81,-0.73)***	-53.70	-0.78 (-0.82,-0.74)***	-54.16	-0.76 (-0.8,-0.72)***	-53.23	-0.16 (-0.2,-0.12)***	-14.79
HS Education			-0.13 (-0.16,-0.1)***	-12.19	-0.14 (-0.17,-0.11)***	-13.06	-0.14 (-0.17,-0.11)***	-13.06	-0.14 (-0.16,-0.11)***	-13.06
Married			0.16 (0.13,0.2)***	17.35	0.09 (0.05,0.12)***	9.42	0.08 (0.05,0.11)***	8.33	0.04 (0.01,0.07)*	4.08
Employed			0.18 (0.15,0.21)***	19.72	0.1 (0.07,0.13)***	10.52	0.09 (0.04,0.13)**	9.42	-0.16 (-0.2,-0.11)***	-14.79
Unstably Housed			0.19 (0.15,0.22)***	20.92	0.14 (0.11,0.17)***	15.03	0.16 (0.13,0.19)***	17.35	0.16 (0.13,0.19)***	17.35
Age										
<18			0.26 (0.2,0.32)***	29.69	-0.15 (-0.21,-0.09)***	-13.93	-0.2 (-0.26,-0.14)***	-18.13	-0.18 (-0.24,-0.12)***	-16.47
18-24			0.38 (0.33,0.42)***	46.23	0.15 (0.11,0.19)***	16.18	0.14 (0.1,0.19)***	15.03	0.04 (0,0.08)*	4.08
25-34			0.31 (0.28,0.35)***	36.34	0.14 (0.1,0.18)***	15.03	0.14 (0.1,0.18)***	15.03	0.13 (0.09,0.17)***	13.88
35-44			0.2 (0.16,0.24)***	22.14	0.1 (0.07,0.14)***	10.52	0.1 (0.06,0.14)***	10.52	0.09 (0.05,0.12)***	9.42
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.33 (-0.37,-0.29)***	-28.11	-0.38 (-0.42,-0.34)***	-31.61	-1.07 (-1.11,-1.02)***	-65.70
Detox					-2.75 (-2.8,-2.7)***	-93.61	-2.79 (-2.84,-2.74)***	-93.86	-3.36 (-3.41,-3.31)***	-96.53
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.75 (-0.87,-0.64)***	-52.76	-0.76 (-0.88,-0.65)***	-53.23	-0.61 (-0.72,-0.49)***	-45.66
Psych Problems					0.33 (0.3,0.36)***	39.10	0.32 (0.29,0.35)***	37.71	0.04 (0.01,0.07)*	4.08
Drug Use										
Heroin					-0.44 (-0.62,-0.26)***	-35.60	-0.44 (-0.62,-0.27)***	-35.60	-0.13 (-0.3,0.04)	-12.19
Non-rx Methadone					-0.23 (-0.43,-0.04)*	-20.55	-0.23 (-0.42,-0.03)*	-20.55	-0.26 (-0.45,-0.07)*	-22.89
Cocaine					-0.04 (-0.08,0)*	-3.92	-0.04 (-0.08,-0.01)*	-3.92	0.13 (0.09,0.16)***	13.88
Synthetic Opioids					-0.28 (-0.46,-0.1)*	-24.42	-0.32 (-0.5,-0.14)**	-27.39	-0.21 (-0.39,-0.04)*	-18.94
Benzodiazepines					-0.08 (-0.17,0)	-7.69	-0.04 (-0.12,0.05)	-3.92	0.06 (-0.02,0.14)	6.18
Any Opioids					0.25 (0.06,0.44)	28.40	0.29 (0.1,0.47)*	33.64	0.14 (-0.04,0.32)	15.03
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
0					-0.38 (-0.62,-0.14)*	-31.61	-0.33 (-0.57,-0.09)*	-28.11	-0.3 (-0.53,-0.07)*	-25.92
1					-0.16 (-0.2,-0.12)***	-14.79	-0.17 (-0.21,-0.13)***	-15.63	0.11 (0.07,0.15)***	11.63
2					0.02 (-0.02,0.05)	2.02	0 (-0.04,0.04)	0.00	0.11 (0.08,0.15)***	11.63
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.25 (0.19,0.31)***	28.40	0.25 (0.19,0.31)***	28.40	0.27 (0.21,0.32)***	31.00
Health Insurance Type										
Medicaid							0.2 (0.14,0.26)***	22.14	0.12 (0.07,0.18)***	12.75
Medicare							0.76 (0.7,0.82)***	113.83	0.57 (0.51,0.62)***	76.83
No Insurance							0.31 (0.27,0.35)***	36.34	0.28 (0.24,0.32)***	32.31
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							0 (-0.07,0.07)	0.00	-0.34 (-0.41,-0.27)***	-28.82
Retirement/Pension							-0.08 (-0.15,-0.01)*	-7.69	-0.38 (-0.44,-0.32)***	-31.61
Other Income Source							0.22 (0.17,0.28)***	24.61	-0.24 (-0.29,-0.19)***	-21.34
No Income							-0.17 (-0.22,-0.13)***	-15.63	-0.58 (-0.63,-0.54)***	-44.01
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									<sup>1</sup> -0.0002 (-0.0002,-0.0002)***	-0.02
Methadone Prog Rate									-0.07 (-0.1,-0.05)***	-6.76
Rate of Indiv in Tx									0.21 (0.2,0.22)***	23.37
% of res w/Medicaid									0.08 (0.07,0.08)***	8.33
SABG									-0.07 (-0.08,-0.07)***	-6.76

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05



Table 2A.9: Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 2008, N=2,034,778

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone Covered	1.03 (1.02,1.04)***	179.13	0.94 (0.93,0.95)***	156.00	0.72 (0.71,0.74)***	105.44	0.7 (0.69,0.71)***	101.38	0.41 (0.39,0.42)***	50.68
Male			-0.04 (-0.05,-0.03)***	-3.92	0.08 (0.07,0.1)***	8.33	0.03 (0.02,0.04)***	3.05	0.05 (0.04,0.06)***	5.13
Race										
Black			0.16 (0.15,0.18)***	17.35	0.13 (0.11,0.14)***	13.88	0.11 (0.09,0.12)***	11.63	-0.03 (-0.04,-0.01)**	-2.96
Other Race			-0.19 (-0.21,-0.17)***	-17.30	-0.17 (-0.2,-0.15)***	-15.63	-0.23 (-0.25,-0.21)***	-20.55	-0.09 (-0.11,-0.07)***	-8.61
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.31 (-0.32,-0.29)***	-26.66	-0.33 (-0.35,-0.31)***	-28.11	-0.4 (-0.42,-0.39)***	-32.97	-0.28 (-0.29,-0.26)***	-24.42
HS Education			-0.08 (-0.09,-0.07)***	-7.69	-0.07 (-0.08,-0.06)***	-6.76	-0.02 (-0.04,-0.01)***	-1.98	0.003 (-0.01,0.01)	0.30
Married			0.02 (0.004,0.03)*	2.02	-0.01 (-0.02,0.01)	-1.00	0.02 (0.01,0.04)**	2.02	0.08 (0.07,0.09)***	8.33
Employed			-0.01 (-0.02,0.003)	-1.00	0.04 (0.02,0.05)***	4.08	0.08 (0.06,0.1)***	8.33	0.07 (0.05,0.09)***	7.25
Unstably Housed			-0.16 (-0.17,-0.14)	-14.79	-0.18 (-0.19,-0.17)***	-16.47	-0.22 (-0.24,-0.21)***	-19.75	-0.03 (-0.04,-0.01)***	-2.96
Age										
<18			0.77 (0.75,0.79)***	115.98	0.54 (0.51,0.56)***	71.60	0.72 (0.7,0.74)***	105.44	0.6 (0.58,0.63)***	82.21
18-24			0.21 (0.19,0.23)***	23.37	0.18 (0.16,0.2)***	19.72	0.19 (0.18,0.21)***	20.92	0.17 (0.15,0.18)***	18.53
25-34			0.1 (0.09,0.12)***	10.52	0.08 (0.07,0.1)***	8.33	0.07 (0.05,0.08)***	7.25	0.05 (0.04,0.07)***	5.13
35-44			0.04 (0.02,0.05)***	4.08	0.01 (0.0,0.03)	1.01	0.01 (-0.004,0.03)	1.01	-0.01 (-0.02,0.01)	-1.00
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.01 (-0.02,0.01)	-1.00	0.005 (-0.01,0.02)	0.50	-0.2 (-0.22,-0.19)***	-18.13
Detox					-0.32 (-0.34,-0.31)***	-27.39	-0.24 (-0.26,-0.22)***	-21.34	-0.18 (-0.2,-0.16)***	-16.47
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.99 (-1.03,-0.96)***	-62.84	-0.89 (-0.93,-0.86)***	-58.93	-0.75 (-0.79,-0.71)***	-52.76
Psych Problems					0.73 (0.72,0.74)***	107.51	0.5 (0.49,0.51)***	64.87	0.48 (0.47,0.49)***	61.61
Drug Use										
Heroin					0.19 (0.13,0.24)***	20.92	0.12 (0.06,0.17)***	12.75	0.01 (-0.04,0.06)	1.01
Non-rx Methadone					0.3 (0.24,0.37)***	34.99	0.19 (0.12,0.25)***	20.92	0.08 (0.01,0.14)*	8.33
Cocaine					0.12 (0.11,0.14)***	12.75	0.08 (0.06,0.09)***	8.33	-0.06 (-0.07,-0.04)***	-5.82
Synthetic Opioids					0.15 (0.1,0.2)***	16.18	0.03 (-0.03,0.08)	3.05	0.02 (-0.03,0.07)	2.02
Benzodiazepines					0.08 (0.05,0.11)***	8.33	0.06 (0.03,0.08)**	6.18	-0.03 (-0.06,-0.01)*	-2.96
Any Opioids					-0.03 (-0.08,0.03)	-2.96	0.09 (0.03,0.14)*	9.42	-0.04 (-0.09,0.02)	-3.92
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
0					0.25 (0.22,0.28)***	28.40	0.21 (0.18,0.24)***	23.37	0.03 (-0.002,0.06)	3.05
1					0.25 (0.24,0.27)***	28.40	0.23 (0.22,0.25)***	25.86	0.16 (0.14,0.18)***	17.35
2					0.06 (0.04,0.07)***	6.18	0.07 (0.05,0.08)***	7.25	0.01 (-0.003,0.03)	1.01
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					-0.05 (-0.07,-0.02)**	-4.88	-0.07 (-0.09,-0.04)***	-6.76	-0.01 (-0.04,0.01)	-1.00
Health Insurance Type										
Medicaid							0.78 (0.76,0.8)***	118.15	0.8 (0.78,0.82)***	122.55
Medicare							1.18 (1.15,1.2)***	225.44	1.17 (1.15,1.19)***	222.20
No Insurance							1.15 (1.14,1.16)***	215.82	1.18 (1.17,1.2)***	225.44
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.1 (-0.13,-0.07)***	-9.52	-0.09 (-0.12,-0.06)***	-8.61
Retirement/Pension							0.01 (-0.01,0.04)	1.01	-0.07 (-0.1,-0.05)***	-6.76
Other Income Source							-0.03 (-0.05,-0.01)*	-2.96	-0.13 (-0.15,-0.11)***	-12.19
No Income							-0.06 (-0.08,-0.04)***	-5.82	-0.24 (-0.25,-0.22)***	-21.34
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0001 (0.0001,0.0001)***	-0.01
Methadone Prog Rate									-0.04 (-0.04,-0.03)***	-3.92
Rate of Indiv in Tx									0.06 (0.06,0.06)***	6.18
% of res w/Medicaid									-0.01 (-0.01,-0.01)***	-1.00
SABG									0.01 (0.01,0.01)***	1.01

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2A.10: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 1998, N=29,500

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone Covered	0.8 (0.72,0.88)***	123.36	0.86 (0.78,0.94)***	136.32	0.78 (0.7,0.869)***	118.15	0.72 (0.63,0.81)***	105.44	-0.91 (-1.23,-0.59)***	-59.75
Male			0.03 (-0.06,0.12)	3.05	0.1 (0.01,0.1903)*	10.52	0.19 (0.1,0.28)***	20.92	0.1 (0.01,0.19)*	10.52
Race										
Black			0.23 (0.13,0.33)***	25.86	0.37 (0.27,0.4749)***	44.77	0.36 (0.26,0.47)***	43.33	0.02 (-0.08,0.12)	2.02
Other Race			-0.41 (-0.57,-0.25)***	-33.63	-0.43 (-0.59,-0.2737)***	-34.95	-0.44 (-0.61,-0.28)***	-35.60	-0.51 (-0.68,-0.35)***	-39.95
White (ref)			ref	ref	ref	ref	ref	ref	0 (0,0)	0.00
Hispanic			-0.34 (-0.5,-0.18)***	-28.82	-0.39 (-0.55,-0.2383)***	-32.29	-0.34 (-0.49,-0.18)***	-28.82	-0.16 (-0.33,0)*	-14.79
HS Education			-0.18 (-0.27,-0.09)**	-16.47	-0.21 (-0.3,-0.1222)***	-18.94	-0.18 (-0.27,-0.09)***	-16.47	-0.18 (-0.27,-0.09)***	-16.47
Married			0.01 (-0.08,0.11)	1.01	0.01 (-0.08,0.1089)	1.01	0.05 (-0.05,0.14)	5.13	0.08 (-0.01,0.17)	8.33
Employed			0.33 (0.24,0.42)***	39.10	0.23 (0.13,0.3188)***	25.86	0.43 (0.3,0.56)***	53.73	0.37 (0.24,0.49)***	44.77
Unstably Housed			-0.05 (-0.14,0.04)	-4.88	-0.13 (-0.22,-0.035)*	-12.19	-0.11 (-0.2,-0.01)***	-10.42	0.04 (-0.06,0.13)	4.08
Age										
<18			0.79 (0.61,0.97)***	120.34	0.85 (0.67,1.0403)***	133.96	0.99 (0.79,1.19)***	169.12	1.63 (1.43,1.82)***	410.39
18-24			0.08 (-0.08,0.23)	8.33	0.03 (-0.13,0.1855)	3.05	0.11 (-0.05,0.27)	11.63	0.34 (0.19,0.5)***	40.49
25-34			0.15 (0.01,0.29)*	16.18	0.13 (-0.01,0.2728)	13.88	0.17 (0.03,0.31)*	18.53	0.21 (0.07,0.35)*	23.37
35-44			0.18 (0.05,0.32)*	19.72	0.17 (0.03,0.3031)*	18.53	0.19 (0.06,0.33)*	20.92	0.24 (0.11,0.37)**	27.12
>44 (ref)			ref	ref	ref	ref	ref	ref	0 (0,0)	0.00
Tx Program Type										
Outpatient					-0.43 (-0.55,-0.315)***	-34.95	-0.42 (-0.54,-0.3)***	-34.30	-0.55 (-0.66,-0.43)***	-42.31
Detox					-2.2 (-2.35,-2.0486)***	-88.92	-2.18 (-2.33,-2.03)***	-88.70	-2.31 (-2.46,-2.16)***	-90.07
Rehab (ref)					ref	ref	ref	ref	0 (0,0)	0.00
Enrolled in MAT					-1.06 (-1.48,-0.6426)***	-65.35	-1.06 (-1.48,-0.65)***	-65.35	-0.84 (-1.23,-0.45)***	-56.83
Psych Problems					-0.08 (-0.19,0.0266)	-7.69	-0.16 (-0.27,-0.04)*	-14.79	-0.03 (-0.14,0.08)	-2.96
Drug Use										
Heroin					-0.61 (-1.36,0.1459)	-45.66	-0.56 (-1.3,0.19)	-42.88	-1.12 (-1.85,-0.39)*	-67.37
Non-rx Methadone					-0.17 (-1.23,0.9006)	-15.63	-0.21 (-1.27,0.84)	-18.94	-0.2 (-1.21,0.81)	-18.13
Cocaine					0.14 (0.04,0.2525)*	15.03	0.2 (0.09,0.31)**	22.14	-0.1 (-0.2,0)	-9.52
Synthetic Opioids					-0.32 (-1.02,0.381)	-27.39	-0.25 (-0.95,0.44)	-22.12	-0.35 (-1.03,0.32)	-29.53
Benzodiazepines					-0.06 (-0.46,0.3368)	-5.82	-0.05 (-0.44,0.34)	-4.88	-0.43 (-0.81,-0.04)*	-34.95
Any Opioids					1.17 (0.42,1.9265)*	222.20	1.05 (0.3,1.79)*	185.77	1.06 (0.33,1.79)*	188.64
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
0					-0.85 (-1.18,-0.5224)***	-57.26	-0.72 (-1.05,-0.39)***	-51.32	-1.06 (-1.38,-0.74)***	-65.35
1					0.68 (0.56,0.807)***	97.39	0.71 (0.58,0.83)***	103.40	0.2 (0.07,0.32)*	22.14
2					0.22 (0.1,0.3327)**	24.61	0.24 (0.13,0.36)***	27.12	0.09 (-0.02,0.2)	9.42
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					-0.53 (-0.73,-0.3384)***	-41.14	-0.54 (-0.74,-0.34)***	-41.73	-0.34 (-0.53,-0.15)**	-28.82
Health Insurance Type										
Medicaid							0.08 (-0.12,0.29)	8.33	0.07 (-0.13,0.27)	7.25
Medicare							-0.79 (-0.96,-0.63)***	-54.62	-0.09 (-0.28,0.1)	-8.61
No Insurance							0.06 (-0.08,0.2)	6.18	0.5 (0.36,0.64)***	64.87
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							0.45 (0.24,0.67)***	56.83	0.43 (0.22,0.63)***	53.73
Retirement/Pension							0.57 (0.36,0.78)***	76.83	0.8 (0.59,1)***	122.55
Other Income Source							0.37 (0.21,0.53)***	44.77	0.43 (0.28,0.59)***	53.73
No Income							0.23 (0.1,0.37)**	25.86	0.27 (0.14,0.4)***	31.00
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									0.0005 (0.0004,0.0006)***	0.05
Methadone Prog Rate									-0.75 (-0.85,-0.66)***	-52.76
Rate of Indiv in Tx									0.13 (0.01,0.25)*	13.88
% of res w/Medicaid									0.61 (0.57,0.64)***	84.04

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2A.11: Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 1998, N=98,183

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone Covered	0.79 (0.74,0.83)***	119.66	0.87 (0.82,0.92)***	138.69	0.84 (0.79,0.89)***	131.64	0.81 (0.76,0.86)***	124.79	-0.26 (-0.43,-0.08)*	-22.89
Male			0.09 (0.04,0.14)**	9.42	0.15 (0.1,0.2)***	16.18	0.22 (0.17,0.27)***	24.61	0.13 (0.08,0.18)***	13.88
Race										
Black			0.24 (0.18,0.29)***	27.12	0.2 (0.14,0.25)***	22.14	0.2 (0.14,0.25)***	22.14	-0.09 (-0.14,-0.03)*	-8.61
Other Race			-0.17 (-0.26,-0.09)***	-15.63	-0.25 (-0.34,-0.16)***	-22.12	-0.23 (-0.32,-0.15)***	-20.55	-0.31 (-0.4,-0.22)***	-26.66
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.16 (-0.24,-0.07)**	-14.79	-0.14 (-0.23,-0.06)**	-13.06	-0.09 (-0.18,-0.01)*	-8.61	0.16 (0.07,0.25)**	17.35
HS Education			-0.08 (-0.13,-0.03)*	-7.69	-0.06 (-0.11,-0.01)*	-5.82	-0.03 (-0.08,0.02)	-2.96	-0.01 (-0.06,0.04)	-1.00
Married			0.02 (-0.03,0.08)	2.02	-0.04 (-0.09,0.01)	-3.92	-0.01 (-0.06,0.04)	-1.00	-0.03 (-0.08,0.02)	-2.96
Employed			0.27 (0.22,0.32)***	31.00	0.15 (0.1,0.2)***	16.18	0.21 (0.14,0.28)***	23.37	0.19 (0.12,0.26)***	20.92
Unstably Housed			0 (-0.05,0.05)	0.00	0.04 (-0.01,0.09)	4.08	0.06 (0.01,0.11)*	6.18	0.14 (0.09,0.2)***	15.03
Age										
<18			0.6 (0.5,0.7)***	82.21	0.67 (0.56,0.77)***	95.42	0.77 (0.66,0.88)***	115.98	1.52 (1.42,1.63)***	357.22
18-24			0.07 (-0.02,0.15)	7.25	0.07 (-0.02,0.15)	7.25	0.13 (0.04,0.21)*	13.88	0.51 (0.42,0.59)***	66.53
25-34			0.03 (-0.05,0.11)	3.05	0.15 (0.07,0.23)**	16.18	0.15 (0.08,0.23)***	16.18	0.39 (0.32,0.47)***	47.70
35-44			0.01 (-0.06,0.09)	1.01	0.1 (0.02,0.17)*	10.52	0.08 (0.01,0.16)*	8.33	0.3 (0.22,0.37)***	34.99
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.28 (-0.35,-0.22)***	-24.42	-0.22 (-0.29,-0.16)***	-19.75	-0.39 (-0.45,-0.33)***	-32.29
Detox					-1.87 (-1.95,-1.79)***	-84.59	-1.79 (-1.87,-1.71)***	-83.30	-1.73 (-1.81,-1.65)***	-82.27
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.87 (-1.09,-0.65)***	-58.10	-0.97 (-1.19,-0.76)***	-62.09	-0.77 (-0.98,-0.57)***	-53.70
Psych Problems					-0.18 (-0.24,-0.12)***	-16.47	-0.23 (-0.29,-0.17)***	-20.55	-0.14 (-0.2,-0.08)***	-13.06
Drug Use										
Heroin					0.44 (0.07,0.81)*	55.27	0.57 (0.2,0.94)*	76.83	0.29 (-0.07,0.64)	33.64
Non-rx Methadone					-0.11 (-0.67,0.45)	-10.42	-0.11 (-0.67,0.45)	-10.42	-0.33 (-0.87,0.21)	-28.11
Cocaine					0.11 (0.05,0.16)**	11.63	0.11 (0.05,0.17)**	11.63	-0.18 (-0.24,-0.12)***	-16.47
Synthetic Opioids					0.1 (-0.25,0.45)	10.52	0.13 (-0.22,0.48)	13.88	0.08 (-0.26,0.42)	8.33
Benzodiazepines					0.25 (0.03,0.48)	28.40	0.19 (-0.03,0.41)	20.92	-0.18 (-0.4,0.03)	-16.47
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Any Opioids					0.32 (-0.05,0.7)	37.71	0.21 (-0.16,0.58)	23.37	0.01 (-0.35,0.37)	1.01
Ttl # of Drugs Used										
0					0.25 (0.08,0.43)*	28.40	0.32 (0.15,0.5)**	37.71	-0.21 (-0.38,-0.04)*	-18.94
1					0.79 (0.72,0.86)***	120.34	0.79 (0.72,0.86)***	120.34	0.26 (0.2,0.33)***	29.69
2					0.31 (0.25,0.37)***	36.34	0.32 (0.26,0.39)***	37.71	0.13 (0.06,0.19)***	13.88
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					-0.6 (-0.71,-0.49)***	-45.12	-0.61 (-0.72,-0.5)***	-45.66	-0.28 (-0.39,-0.18)***	-24.42
Health Insurance Type										
Medicaid							0.08 (-0.04,0.19)	8.33	0.06 (-0.05,0.16)	6.18
Medicare							-0.71 (-0.81,-0.62)***	-50.84	0.02 (-0.09,0.13)	2.02
No Insurance							0.15 (0.07,0.23)**	16.18	0.52 (0.44,0.59)***	68.20
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							0.24 (0.12,0.36)***	27.12	0.32 (0.2,0.43)***	37.71
Retirement/Pension							0.51 (0.4,0.62)***	66.53	0.68 (0.57,0.79)***	97.39
Other Income Source							0.14 (0.05,0.23)	15.03	0.21 (0.12,0.29)***	23.37
No Income							0.09 (0.01,0.16)*	9.42	0.2 (0.13,0.27)***	22.14
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									0.0003 (0.0003,0.0004)***	0.03
Methadone Prog Rate									-0.8 (-0.85,-0.75)***	-55.07
Rate of Indiv in Tx									0.16 (0.09,0.22)***	17.35
% of res w/Medicaid									0.51 (0.49,0.53)***	66.53

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2A.12: Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Methadone, 1998, N=1,364,735

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Methadone Covered	0.70 (0.69,0.71)***	101.23	0.7 (0.69,0.72)***	101.38	0.51 (0.5,0.52)***	66.53	0.45 (0.44,0.47)***	56.83	0.35 (0.33,0.37)***	41.91
Male			0.15 (0.13,0.16)***	16.18	0.19 (0.18,0.21)***	20.92	0.17 (0.16,0.19)***	18.53	0.21 (0.2,0.23)***	23.37
Race										
Black			0.04 (0.02,0.06)***	4.08	0.01 (-0.01,0.02)	1.01	-0.03 (-0.04,-0.01)**	-2.96	-0.14 (-0.16,-0.13)***	-13.06
Other Race			-0.33 (-0.35,-0.31)***	-28.11	-0.14 (-0.16,-0.12)***	-13.06	-0.15 (-0.17,-0.13)***	-13.93	0.08 (0.06,0.1)***	8.33
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.17 (-0.2,-0.15)***	-15.63	-0.36 (-0.39,-0.34)***	-30.23	-0.36 (-0.38,-0.34)***	-30.23	-0.39 (-0.41,-0.36)***	-32.29
HS Education			-0.08 (-0.09,-0.07)***	-7.69	-0.09 (-0.1,-0.08)***	-8.61	-0.09 (-0.1,-0.07)***	-8.61	-0.06 (-0.08,-0.05)***	-5.82
Married			0.09 (0.08,0.11)***	9.42	0.02 (0.01,0.04)*	2.02	0.02 (0.03)*	2.02	-0.06 (-0.07,-0.04)***	-5.82
Employed			0.11 (0.1,0.13)***	11.63	0.1 (0.09,0.12)***	10.52	0.22 (0.2,0.24)***	24.61	0.14 (0.12,0.16)***	15.03
Unstably Housed			0.13 (0.12,0.15)***	13.88	0.04 (0.02,0.05)***	4.08	0.01 (-0.01,0.02)	1.01	-0.03 (-0.05,-0.02)***	-2.96
Age										
<18			0.65 (0.63,0.68)***	91.55	0.57 (0.54,0.6)***	76.83	0.62 (0.59,0.65)***	85.89	0.53 (0.51,0.56)***	69.89
18-24			0.43 (0.41,0.45)***	53.73	0.37 (0.34,0.39)***	44.77	0.4 (0.38,0.42)***	49.18	0.4 (0.37,0.42)***	49.18
25-34			0.38 (0.36,0.4)***	46.23	0.38 (0.36,0.4)***	46.23	0.41 (0.39,0.43)***	50.68	0.38 (0.36,0.4)***	46.23
35-44			0.22 (0.2,0.24)***	24.61	0.23 (0.21,0.25)***	25.86	0.26 (0.24,0.28)***	29.69	0.23 (0.21,0.25)***	25.86
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.64 (-0.66,-0.62)***	-47.27	-0.69 (-0.71,-0.67)***	-49.84	-0.99 (-1.01,-0.97)***	-62.84
Detox					-1.84 (-1.86,-1.82)***	-84.12	-1.9 (-1.93,-1.88)***	-85.04	-2.03 (-2.05,-2.01)***	-86.87
Rehab (ref)					0 (0,0)	0.00	0 (0,0)	0.00	0 (0,0)	0.00
Enrolled in MAT					-0.1 (-0.15,-0.05)**	-9.52	-0.09 (-0.14,-0.03)*	-8.61	-0.1 (-0.16,-0.05)**	-9.52
Psych Problems					-0.13 (-0.15,-0.12)***	-12.19	-0.18 (-0.2,-0.16)***	-16.47	-0.02 (-0.04,-0.01)*	-1.98
Drug Use										
Heroin					-0.14 (-0.25,-0.03)*	-13.06	-0.03 (-0.13,0.08)	-2.96	0.11 (0.0,0.22)*	11.63
Non-rx Methadone					-0.14 (-0.31,0.04)	-13.06	-0.08 (-0.25,0.09)	-7.69	-0.2 (-0.38,-0.03)*	-18.13
Cocaine					0.09 (0.07,0.11)***	9.42	0.08 (0.07,0.1)***	8.33	-0.03 (-0.05,-0.02)**	-2.96
Synthetic Opioids					0.21 (0.1,0.31)***	23.37	0.25 (0.15,0.35)***	28.40	0.14 (0.04,0.24)*	15.03
Benzodiazepines					0.12 (0.05,0.18)**	12.75	0.09 (0.03,0.16)*	9.42	-0.14 (-0.2,-0.07)***	-13.06
Any Opioids					0.13 (0.02,0.24)*	13.88	0.02 (-0.09,0.13)	2.02	-0.01 (-0.12,0.1)	-1.00
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
0					0.07 (0.04,0.11)**	7.25	0.05 (0.02,0.09)*	5.13	0.08 (0.04,0.12)***	8.33
1					0.16 (0.14,0.18)***	17.35	0.17 (0.15,0.19)***	18.53	0.09 (0.07,0.11)***	9.42
2					-0.03 (-0.05,-0.02)**	-2.96	-0.03 (-0.05,-0.02)**	-2.96	-0.06 (-0.07,-0.04)***	-5.82
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.12 (0.09,0.15)***	12.75	0.11 (0.08,0.14)***	11.63	0.17 (0.14,0.2)***	18.53
Health Insurance Type										
Medicaid							0.27 (0.24,0.3)***	31.00	0.02 (-0.01,0.05)	2.02
Medicare							0.25 (0.22,0.28)***	28.40	-0.07 (-0.1,-0.04)***	-6.76
No Insurance							0.04 (0.02,0.06)***	4.08	-0.01 (-0.03,0.01)	-1.00
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.25 (-0.28,-0.22)***	-22.12	0.09 (0.06,0.12)***	9.42
Retirement/Pension							0.36 (0.33,0.39)***	43.33	0.11 (0.08,0.15)***	11.63
Other Income Source							-0.13 (-0.15,-0.1)***	-12.19	0.08 (0.05,0.1)***	8.33
No Income							0.21 (0.19,0.23)***	23.37	-0.06 (-0.08,-0.03)***	-5.82
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0001 (-0.0001,-0.0001)*	-0.01
Methadone Prog Rate									-0.13 (-0.13,-0.12)***	-12.19
Rate of Indiv in Tx									-0.13 (-0.14,-0.13)***	-12.19
% of res w/Medicaid									0.11 (0.11,0.12)***	11.63

Model 1: Unadjusted association between Medicaid coverage of methadone and wait time for substance use treatment

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

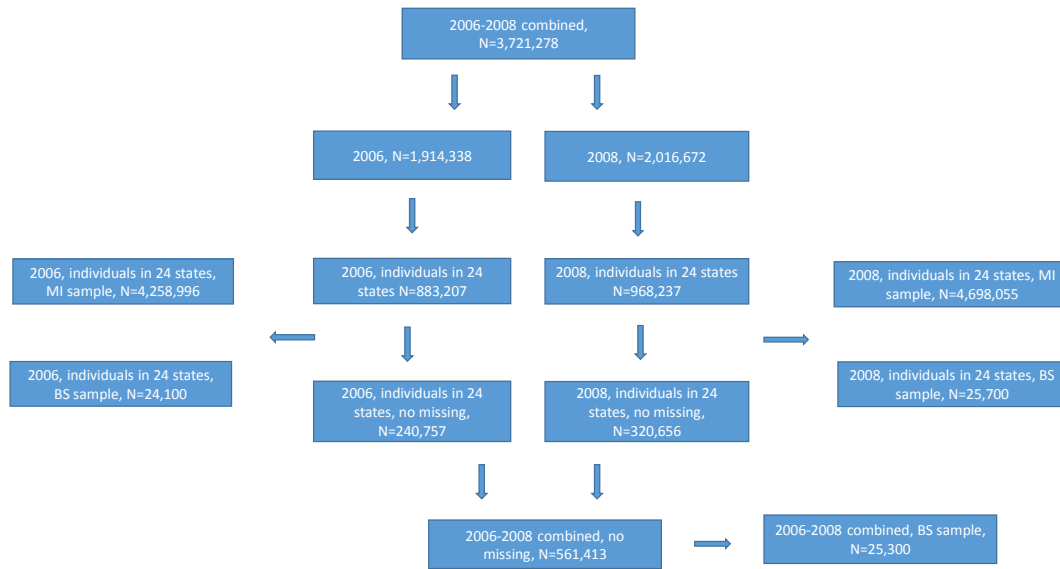
Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Figure 2B.1: Analytic Sample, Treatment Wait Time and Medicaid Coverage of Buprenorphine



**Table 2B.1 Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Buprenorphine Analysis, 2008**

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
	N=649,612 n ( %)	N=320,694 n ( %)
Medicaid Coverage of Buprenorphine**	644921 (99%)	250675 (78%)
missing	n=0	n=0
Male***	422089 (65%)	219679 (69%)
missing	n=203	n=0
<b>Race</b>		
White***	396201 (64%)	215265 (67%)
Black***	124540 (20%)	72914 (23%)
Other Race***	95713 (16%)	32515 (10%)
missing	n=33158	n=0
Hispanic***	117021 (19%)	34008 (11%)
missing	n=31598	n=0
HS Education***	389981 (61%)	210126 (66%)
missing	n=11805	n=0
Married***	73956 (19%)	67037 (21%)
missing	n=253124	n=0
Employed***	155065 (24%)	104298 (33%)
missing	n=8980	n=0
Unstably housed***	259992 (41%)	143422 (45%)
missing	n=11604	n=0
<b>Age</b>		
<18***	67587 (10%)	26259 (8%)
18-24***	120578 (19%)	62089 (19%)
25-34	166420 (26%)	81816 (26%)
35-44***	147584 (23%)	74996 (23%)
≥45***	147442 (23%)	75534 (24%)
missing	n=1	n=0
<b>Program Type</b>		
Outpatient***	439175 (68%)	188000 (59%)
Detox***	108337 (17%)	77886 (24%)
Rehab***	102008 (16%)	54808 (17%)
missing	n=92	n=0
Patient receiving MAT***	46070 (7%)	16254 (5%)
missing	n=31758	n=0
Psych Problems***	146690 (26%)	73249 (23%)
missing	n=91483	n=0
<b>Drug use reported at admit</b>		
Heroin***	101536 (16%)	40347 (13%)
missing	n=0	n=0
Non prescription Methadone***	4684 (1%)	1836 (1%)
missing	n=0	n=0
Synthetic opioids***	56031 (9%)	28286 (8%)
missing	n=0	n=0

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
Any opiates***	148021 (23%)	63890 (20%)
missing	n=0	n=0
Cocaine/Crack***	151756 (23%)	78415 (24%)
missing	n=0	n=0
Benzodiazepine	16211 (3%)	7947 (2%)
missing	n=0	n=0
<b># of subs reported at admit</b>		
1***	292681 (45%)	152040 (47%)
2***	249214 (38%)	103316 (32%)
3***	83256 (13%)	65336 (20%)
missing	n=0	n=0
IDU***	85288 (14%)	32155 (10%)
missing	n=24452	n=0
<b>Client Insurance Type</b>		
Medicaid	27822 (17%)	47002 (15%)
Medicare***	8401 (5%)	19701 (6%)
No insurance***	103905 (62%)	213149 (66%)
Private Insurance***	27331 (16%)	40842 (13%)
missing	n=201085	n=0
<b>Primary Source of Income</b>		
Public Assistance***	8645 (3%)	17863 (6%)
Retirement/Pension*	21426 (8%)	26258 (8%)
Other Income***	41029 (16%)	31787 (10%)
No income***	102646 (40%)	118490 (37%)
Salary***	81587 (32%)	126296 (39%)
missing	n=394279	n=0
<b>Continuous variables</b>		
Days Waiting to Enter Treatment***	8.74 (65.48)	6.29 (22.66)
Per capita Income***	\$41,746 (\$5,144)	\$41,470 (\$4,853)
Rate of bupe programs/10K pop***	7.22 (3.08)	7.57 (6.26)
Rate of individuals in tx/1M pop***	17.55 (10.65)	18.94 (14.91)
Percent of residents rec'v Medicaid***	21.17 (6.53)	17.8 (5.24)
SABG***	141.1 (111.2)	42.36 (29.73)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

**Table 2B.2 Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Treatment Wait Time and Medicaid Coverage of Buprenorphine Analysis, 2006**

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
	N=643,460 n ( %)	N=240,769 n ( %)
Medicaid Coverage of Buprenorphine**	562599 (87%)	120297 (50%)
missing	n=0	n=0
Male***	421756 (66%)	165786 (69%)
missing	n=247	n=0
<b>Race</b>		
White***	410625 (65%)	157930 (66%)
Black***	125140 (20%)	60977 (25%)
Other Race***	100594 (16%)	21862 (9%)
missing	n=7101	n=0
Hispanic***	110260 (17%)	28788 (12%)
missing	n=31598	n=0
HS Education***	387201 (61%)	154228 (64%)
missing	n=11152	n=0
Married***	81091 (20%)	53924 (22%)
missing	n=241524	n=0
Employed***	176582 (28%)	86187 (36%)
missing	n=9344	n=0
Unstably housed***	258626 (42%)	108643 (45%)
missing	n=21471	n=0
<b>Age</b>		
<18***	60925 (9%)	18416 (8%)
18-24***	122551 (19%)	44871 (19%)
25-34**	161976 (25%)	59751 (25%)
35-44***	164008 (25%)	62825 (26%)
≥45***	134000 (21%)	54906 (23%)
missing	n=0	n=0
<b>Program Type</b>		
Outpatient***	431927 (67%)	140729 (58%)
Detox***	108712 (17%)	60553 (25%)
Rehab***	102765 (16%)	39487 (16%)
missing	n=92	n=0
Patient receiving MAT***	40406 (7%)	14459 (6%)
missing	n=46243	n=0
Psych Problems***	126746 (25%)	50654 (21%)
missing	n=144268	n=0
<b>Drug use reported at admit</b>		
Heroin***	96815 (15%)	34283 (14%)
missing	n=0	n=0
Non prescription Methadone	3541 (1%)	1371 (1%)
missing	n=0	n=0
Synthetic opioids***	38095 (6%)	14831 (6%)
missing	n=0	n=0



	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
Any opiates***	128273 (20%)	47089 (20%)
missing	n=0	n=0
Cocaine/Crack***	164331 (26%)	66898 (28%)
missing	n=0	n=0
Benzodiazepine***	10867 (2%)	4658 (2%)
missing	n=0	n=0
<b># of subs reported at admit</b>		
1***	276960 (43%)	116408 (48%)
2***	259462 (40%)	79896 (33%)
3***	82470 (13%)	44465 (18%)
missing	n=0	n=0
IDU***	84036 (14%)	24133 (10%)
missing	n=24551	n=0
<b>Client Insurance Type</b>		
Medicaid	38141 (18%)	36277 (15%)
Medicare***	11934 (6%)	10503 (4%)
No insurance***	134063 (63%)	161765 (67%)
Private Insurance	28811 (14%)	32224 (13%)
missing	n=430511	n=0
<b>Primary Source of Income</b>		
Public Assistance***	10634 (4%)	14773 (6%)
Retirement/Pension***	18455 (8%)	19472 (8%)
Other Income***	38623 (16%)	24009 (10%)
No income***	84673 (35%)	78022 (32%)
Salary***	90401 (37%)	104493 (43%)
missing	n=400674	n=0
<b>Continuous variables</b>		
Days Waiting to Enter Treatment***	8.39 (59.05)	6.75 (28.4)
Per capita Income***	\$38,791 (\$4,585)	\$38,625 (\$4,792)
Rate of bupe programs/10K pop***	5.31 (2.12)	6.49 (4.05)
Rate of individuals in tx/1M pop***	14.41 (10.41)	18.41 (16.32)
Percent of residents rec'v Medicaid***	19.9 (6.54)	16.38 (4.85)
SABG***	138.5 (119.3)	45.33 (29.74)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

**Table 2B.3: Descriptive Characteristics of Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Methadone, Combined 1998-2008**

	N=25,300
	n ( % )
Individuals in States with Medicaid Coverage of Buprenorphine	16607 (66%)
Male	17405 (69%)
<b>Race</b>	
White	16744 (66%)
Black	6031 (24%)
Other Race	2525 (10%)
Hispanic	2845 (11%)
HS Education	16307 (64%)
Married	5463 (22%)
Employed	8748 (35%)
Unstably housed	11322 (45%)
<b>Age</b>	
<18	2006 (8%)
18-24	4838 (19%)
25-34	6304 (25%)
35-44	6292 (25%)
≥45	5860 (23%)
<b>Program Type</b>	
Outpatient	14803 (59%)
Detox	6130 (24%)
Rehab	4367 (17%)
Patient receiving MAT	1341 (5%)
Psych Problems	5564 (22%)
<b>Drug use reported at admit</b>	
Heroin	3348 (13%)
Non prescription Methadone	130 (1%)
Cocaine/Crack	6562 (26%)
Synthetic opioids	1788 (7%)
Benzodiazepine	533 (2%)
Any Opioids	4937 (20%)
<b># of subs reported at admit</b>	
1	12168 (48%)
2	8185 (32%)
3	4947 (20%)
IDU	2534 (10%)
<b>Client Insurance Type</b>	
Medicaid	3746 (15%)
Medicare	1428 (6%)
No insurance	16779 (66%)
Private Insurance	3347 (13%)
<b>Primary Source of Income</b>	
Public Assistance	1406 (6%)
Retirement/Pension	2108 (8%)
Other Income	2458 (10%)
No income	8741 (35%)
Salary	10587 (42%)
<b>Continuous variables</b>	<b>Mean (SD)</b>
Days Waiting to Enter Treatment	6.39 (25.2)
Per Capita Income	\$40,255 (\$5,027)
Rate of buprenorphine programs/10K pop	7.11 (5.46)
Rate of individuals in tx/1M pop	18.75 (15.55)
Percent of residents rec'v Medicaid	17.19 (5.10)
SABG	43.86 (29.77)

**Table 2B.4: Comparison of Characteristics of Bootstrapped Listwise Deletion Sample by Medicaid Coverage of Buprenorphine, Combined 2006-2008**

	Medicaid Coverage	No Medicaid Coverage
	N=16,607	N=8,693
	n (%)	n (%)
Male	11411 (69%)	5994 (69%)
<b>Race</b>		
White***	10226 (62%)	6518 (75%)
Black***	4466 (27%)	1565 (18%)
Other Race***	1915 (12%)	610 (7%)
Hispanic***	1766 (11%)	1079 (12%)
HS Education*	10624 (64%)	5683 (65%)
Married***	3367 (20%)	2096 (24%)
Employed	5744 (35%)	3004 (35%)
Unstably housed***	7634 (46%)	3688 (42%)
<b>Age</b>		
<18***	1413 (9%)	593 (7%)
18-24*	3114 (19%)	1724 (20%)
25-34***	3825 (23%)	2479 (29%)
35-44*	4210 (25%)	2082 (24%)
≥45***	4045 (24%)	1815 (21%)
<b>Program Type</b>		
Rehab***	2413 (15%)	1954 (22%)
Outpatient***	10924 (66%)	3879 (45%)
Detox***	3270 (20%)	2860 (33%)
Patient receiving MAT***	1149 (7%)	192 (2%)
Psych Problems**	3548 (21%)	2016 (23%)
<b>Drug use reported at admit</b>		
Heroin***	2996 (18%)	352 (4%)
Non prescription Methadone	78 (<1%)	52 (1%)
Any opiates***	3816 (23%)	1121 (13%)
Cocaine/Crack*	4398 (26%)	2164 (25%)
Synthetic opioids***	971 (6%)	817 (9%)
Benzodiazepine***	240 (1%)	293 (3%)
<b># of subs reported at admit</b>		
1**	8113 (49%)	4055 (47%)
2***	5641 (34%)	2544 (29%)
3***	2853 (17%)	2094 (24%)
IDU*	1606 (10%)	928 (11%)
<b>Client Insurance Type</b>		
Medicaid***	2997 (18%)	749 (9%)
Medicare***	1053 (6%)	375 (4%)
No insurance***	10221 (62%)	6558 (75%)
Private Insurance***	2336 (14%)	1011 (12%)
<b>Primary Source of Income</b>		
Public Assistance***	1097 (7%)	309 (4%)
Retirement/Pension***	1610 (10%)	498 (6%)
Other Income***	1739 (10%)	719 (8%)
No income***	4918 (30%)	3823 (44%)
Salary***	7243 (44%)	3344 (38%)
<b>Continuous variables</b>		
Days Waiting to Enter Treatment***	7.5 (27.2)	4.3 (20.7)
Per capita Income***	\$42,582 (\$3,831)	\$35,810 (\$3,925)
Rate of buprenorphine programs/10K pop***	8.2 (6.0)	5.1 (3.3)
Rate of individuals in tx/1M pop***	22.7 (17.6)	11.1 (4.8)
Percent of residents rec'v Medicaid***	16.3 (3.4)	18.9 (7.0)

\*\*\*p=<0.0001

\*\*p=<0.001

\*p=<0.05

Table 2B.5: Model Building Summary Using Bootstrapped Ustwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, Combined 2006-2008 Analysis, N=25,300

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe covered	0.56 (0.48,0.65)***	75.07	0.6 (0.52,0.68)***	82.21	0.51 (0.43,0.6)***	66.53	0.49 (0.41,0.58)***	63.23	1.28 (1.16,1.41)***	259.66	1.3 (1.17,1.43)***	266.93	1.49 (1.34,1.64)***	343.71
Male			-0.05 (-0.13,0.03)	-4.88	-0.06 (-0.15,0.02)	-5.82	-0.08 (-0.17,0.002)*	-7.69	-0.1 (-0.19,-0.02)*	-9.52	-0.1 (-0.19,-0.02)*	-9.52	-0.1 (-0.19,-0.02)*	-9.52
Race														
Black			-0.04 (-0.13,0.06)	-3.92	-0.07 (-0.18,0.03)	-6.76	-0.07 (-0.17,0.03)	-6.76	-0.19 (-0.3,-0.09)**	-17.30	-0.19 (-0.3,-0.09)**	-17.30	-0.2 (-0.3,-0.09)**	-18.13
Other Race			-0.63 (-0.78,-0.49)	-46.74	0.14 (-0.01,0.29)	15.03	0.11 (-0.04,0.26)	11.63	0.04 (-0.1,0.18)	4.08	0.04 (-0.1,0.18)	4.08	0.03 (-0.11,0.17)	3.05
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.18 (0.03,0.33)***	19.72	-0.68 (-0.83,-0.54)***	-49.34	-0.67 (-0.81,-0.52)***	-48.83	-0.29 (-0.43,-0.15)***	-25.17	-0.29 (-0.43,-0.15)***	-25.17	-0.3 (-0.44,-0.16)***	-25.92
HS Education			0.04 (-0.05,0.13)	4.08	0.09 (0.0,0.17)	9.42	0.09 (0.0,0.18)*	9.42	0.15 (0.06,0.23)**	16.18	0.15 (0.06,0.23)**	16.18	0.16 (0.07,0.25)**	17.35
Married			0.05 (-0.05,0.15)	5.13	-0.03 (-0.13,0.07)	-2.96	0.01 (-0.09,0.1)	1.01	-0.02 (-0.12,0.07)	-1.98	-0.03 (-0.12,0.07)	-2.96	-0.02 (-0.12,0.07)	-1.98
Employed			-0.19 (-0.27,-0.1)***	-17.30	-0.3 (-0.38,-0.21)***	-25.92	0.44 (-0.56,-0.31)***	-35.60	-0.5 (-0.62,-0.38)***	-39.35	-0.49 (-0.61,-0.38)***	-38.74	-0.49 (-0.61,-0.37)***	-38.74
Unstably Housed			-0.08 (-0.16,0.01)	-7.69	-0.04 (-0.12,0.04)	-3.92	-0.05 (-0.13,0.04)	-4.88	-0.09 (-0.17,0)*	-8.61	-0.09 (-0.17,0)*	-8.61	-0.07 (-0.16,0.02)	-6.76
Age														
<18			0.59 (0.41,0.77)***	80.40	0.37 (0.19,0.55)***	44.77	0.36 (0.16,0.55)**	43.33	0.24 (0.05,0.43)*	27.12	0.24 (0.05,0.43)*	27.12	0.24 (0.05,0.43)*	27.12
18-24			0.5 (0.38,0.63)***	64.87	0.36 (0.23,0.48)***	43.33	0.35 (0.22,0.48)***	41.91	0.35 (0.22,0.47)***	41.91	0.34 (0.22,0.47)***	40.49	0.37 (0.24,0.49)***	44.77
25-34			0.45 (0.34,0.57)***	56.83	0.4 (0.29,0.52)***	49.18	0.39 (0.27,0.5)***	47.70	0.39 (0.27,0.5)***	47.70	0.39 (0.27,0.5)***	47.70	0.4 (0.28,0.51)***	49.18
35-44			0.21 (0.1,0.32)**	23.37	0.22 (0.11,0.33)**	24.61	0.19 (0.08,0.31)**	20.92	0.2 (0.09,0.31)**	22.14	0.2 (0.09,0.31)**	22.14	0.21 (0.1,0.32)**	23.37
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type														
Outpatient					-0.001 (-0.109,0.108)	0.07	-0.01 (-0.12,0.1)	-1.00	-0.2 (-0.31,-0.09)**	-18.13	-0.2 (-0.31,-0.09)**	-18.13	-0.19 (-0.3,-0.08)**	-17.30
Detox					-1.2 (-1.32,-1.07)***	-69.88	-1.22 (-1.34,-1.1)***	-70.48	-1.71 (-1.84,-1.58)***	-81.91	-1.7 (-1.83,-1.57)***	-81.73	-1.68 (-1.81,-1.55)***	-81.36
Rehab (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Enrolled in MAT					0.08 (-0.12,0.29)	8.33	0.03 (-0.18,0.24)	3.05	-0.11 (-0.31,0.1)	-10.42	-0.11 (-0.31,0.09)	-10.42	-0.13 (-0.33,0.07)	-12.19
Psych problems					0.12 (0.03,0.22)*	12.75	0.14 (0.04,0.23)*	15.03	0.17 (0.08,0.26)**	18.53	0.17 (0.08,0.26)**	18.53	0.19 (0.09,0.28)***	20.92
Drug Use														
Heroin					0.18 (-0.28,0.63)	19.72	0.26 (-0.2,0.72)	29.69	0.51 (0.05,0.96)*	66.53	0.51 (0.05,0.96)*	66.53	0.54 (0.09,0.99)*	71.60
Non-rx Methadone					-0.57 (-1.1,-0.03)*	-43.45	-0.54 (-1.07,-0.01)*	-41.73	-0.42 (-0.95,0.1)	-34.30	-0.43 (-0.95,0.1)	-34.95	-0.42 (-0.95,0.1)	-34.30
Cocaine					0.06 (-0.04,0.16)	6.18	0.07 (0.03,0.17)	7.25	-0.07 (-0.17,0.04)	-6.76	-0.07 (-0.18,0.03)	-6.76	-0.06 (-0.16,0.04)	-5.82
Synthetic Opioids					0.04 (-0.4,0.49)	4.08	0.14 (-0.31,0.59)	15.03	0.25 (-0.19,0.7)	28.40	0.26 (-0.19,0.7)	29.69	0.28 (-0.17,0.72)	32.31
Benzodiazepines					0 (-0.27,0.27)	0.00	0.03 (-0.24,0.31)	3.05	-0.14 (-0.4,0.13)	-13.06	-0.15 (-0.41,0.12)	-13.93	-0.17 (-0.44,0.1)	-15.63
Any Opioids					-0.07 (-0.54,0.41)	-6.76	-0.13 (-0.6,0.35)	-12.19	-0.48 (-0.95,-0.01)*	-38.12	-0.48 (-0.95,-0.01)*	-38.12	-0.5 (-0.97,-0.04)*	-39.35
Ttl # of Drugs Used														
1					-0.13 (-0.26,-0.01)*	-12.19	-0.12 (-0.24,0)	-11.31	-0.2 (-0.32,-0.08)*	-18.13	-0.21 (-0.33,-0.08)*	-18.94	-0.2 (-0.32,-0.08)*	-18.13
2					0.05 (-0.06,0.17)	5.13	0.06 (-0.05,0.18)	6.18	0.03 (-0.09,0.14)	3.05	0.03 (-0.09,0.14)	3.05	0.03 (-0.08,0.15)	3.05
3 (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
DU					-0.1 (-0.24,0.04)	-9.52	-0.11 (-0.25,0.03)	-10.42	0.05 (-0.08,0.19)	5.13	0.06 (-0.08,0.2)	6.18	0.04 (-0.1,0.17)	4.08
Health Insurance Type														
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Medicaid							0.4 (0.24,0.56)***	49.18	0.11 (-0.06,0.27)	11.63	0.1 (-0.06,0.27)	10.52	0.1 (-0.07,0.26)	10.52
Medicare							0.43 (0.24,0.63)***	53.73	0.58 (0.39,0.77)***	78.60	0.58 (0.39,0.77)***	78.60	0.6 (0.41,0.79)***	82.21
No insurance							0.34 (0.22,0.46)***	40.49	0.29 (0.16,0.41)***	33.64	0.28 (0.16,0.41)***	32.31	0.27 (0.15,0.4)***	31.00
Private Insurance (ref)							ref	ref	ref	ref	ref	ref	ref	ref
Primary Income														
Public Assistance							-0.55 (-0.75,-0.35)***	-42.31	-0.52 (-0.72,-0.33)***	-40.55	-0.52 (-0.71,-0.33)***	-40.55	-0.52 (-0.71,-0.33)***	-40.55
Retirement/Pension							-0.2 (-0.38,-0.02)*	-18.13	-0.28 (-0.45,-0.1)*	-24.42	-0.27 (-0.44,-0.1)*	-23.66	-0.24 (-0.41,-0.07)*	-21.34
Other Income Source							-0.38 (-0.54,-0.23)***	-31.61	-0.42 (-0.58,-0.27)***	-34.30	-0.42 (-0.57,-0.26)***	-34.30	-0.39 (-0.54,-0.23)***	-32.29
No Income							-0.23 (-0.36,-0.11)**	-20.55	-0.41 (-0.53,-0.29)***	-33.63	-0.4 (-0.52,-0.27)***	-32.97	-0.39 (-0.52,-0.27)***	-32.29
Salary (ref)							ref	ref	ref	ref	ref	ref	ref	ref
State Level Variables														
Per Capita Income									-0.0001 (-0.0001,-0.0001)***	0.01	-0.0001 (-0.0001,-0.0001)***	0.01	-0.0001 (-0.0001,-0.0001)***	0.01
Bupe Prog Rate									0.06 (0.04,0.08)***	6.18	0.06 (0.05,0.08)***	6.18	0.06 (0.05,0.08)***	6.18
Rate of Indiv in Tx									0.01 (0.0,0.01)*	1.01	0.01 (0.0,0.01)*	1.01	0.004 (-0.002,0.01)	0.42
% of res w/Medicaid									0.1 (0.09,0.11)***	10.52	0.1 (0.09,0.11)***	10.52	0.1 (0.09,0.11)***	10.52
SABG									0.01 (0.01,0.01)***	1.01	0.01 (0.01,0.01)***	1.01	0.01 (0.01,0.01)***	1.01
Time													0.25 (0.1,0.39)*	28.40
Medicaid Cov * Time											-0.06 (-0.15,0.04)	-5.82	-0.49 (-0.67,-0.31)***	-38.74

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

Model 6: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level variables and time

Model 7: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level variables, time and interaction term

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 28.6: Model Building Summary Using Ustwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, Combined 2006-2008, N=561,413

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe covered	0.56 (0.54,0.58)***	75.33	0.59 (0.58,0.61)***	80.40	0.45 (0.43,0.46)***	56.83	0.44 (0.43,0.46)***	55.27	1.35 (1.33,1.38)***	285.74	1.37 (1.34,1.4)***	293.54	1.54 (1.51,1.57)***	366.46
Male			-0.08 (-0.1,-0.06)***	-7.69	-0.07 (-0.09,-0.06)***	-6.76	-0.06 (-0.08,-0.05)***	-5.82	-0.06 (-0.08,-0.05)***	-5.82	-0.06 (-0.08,-0.05)***	-5.82	-0.06 (-0.08,-0.05)***	-5.82
Race														
Black			-0.07 (-0.09,-0.05)***	-6.76	-0.06 (-0.08,-0.04)***	-5.82	-0.08 (-0.1,-0.05)***	-7.69	-0.21 (-0.23,-0.19)***	-18.94	-0.21 (-0.24,-0.19)***	-18.94	-0.21 (-0.23,-0.19)***	-18.94
Other Race			-0.63 (-0.66,-0.6)***	-46.74	0.15 (0.12,0.18)***	16.18	0.13 (0.1,0.16)***	13.88	0.07 (0.04,0.09)***	7.25	0.07 (0.04,0.1)***	7.25	0.07 (0.04,0.09)***	7.25
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.15 (0.12,0.18)***	16.18	-0.71 (-0.73,-0.68)***	-50.84	-0.71 (-0.74,-0.68)***	-50.84	-0.39 (-0.42,-0.36)***	-32.29	-0.39 (-0.42,-0.36)***	-32.29	-0.4 (-0.43,-0.37)***	-32.97
HS Education			-0.09 (-0.1,-0.07)***	-8.61	-0.08 (-0.1,-0.06)***	-7.69	-0.05 (-0.07,-0.04)***	-4.88	-0.01 (-0.03,0.01)	-1.00	-0.01 (-0.03,0.01)	-1.00	-0.01 (-0.03,0.01)	-1.00
Married			0.03 (0.01,0.05)*	3.05	0.02 (0.003,0.04)	2.02	0.04 (0.02,0.06)***	4.08	0.04 (0.02,0.06)***	4.08	0.03 (0.02,0.05)**	3.05	0.04 (0.02,0.06)**	4.08
Employed			-0.001 (-0.02,0.02)	0.00	-0.11 (-0.13,-0.09)***	-10.42	-0.17 (-0.2,-0.14)***	-15.63	-0.23 (-0.25,-0.2)***	-20.55	-0.22 (-0.25,-0.2)***	-19.75	-0.21 (-0.24,-0.19)***	-18.94
Unstably Housed			-0.02 (-0.04,-0.001)*	-1.98	0.02 (0.001,0.04)*	2.02	0.004 (-0.01,0.02)	0.00	-0.02 (-0.04,-0.004)*	-1.98	-0.02 (-0.04,0)*	-1.98	-0.01 (-0.02,0.01)	-1.00
Age														
<18			0.4 (0.36,0.43)***	49.18	0.15 (0.11,0.19)***	16.18	0.15 (0.11,0.19)***	16.18	0.03 (-0.01,0.06)	3.05	0.03 (-0.01,0.06)	3.05	0.01 (-0.03,0.05)	1.01
18-24			0.34 (0.31,0.36)***	40.49	0.21 (0.19,0.24)***	23.37	0.2 (0.18,0.23)***	22.14	0.17 (0.15,0.2)***	18.53	0.17 (0.15,0.2)***	18.53	0.18 (0.15,0.2)***	19.72
25-34			0.27 (0.25,0.3)***	31.00	0.2 (0.18,0.23)***	22.14	0.17 (0.15,0.2)***	18.53	0.14 (0.12,0.17)***	15.03	0.14 (0.12,0.17)***	15.03	0.14 (0.12,0.17)***	15.03
35-44			0.13 (0.11,0.16)***	13.88	0.11 (0.09,0.14)***	11.63	0.09 (0.07,0.12)***	9.42	0.09 (0.07,0.11)***	9.42	0.09 (0.07,0.11)***	9.42	0.09 (0.07,0.11)***	9.42
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type														
Outpatient					-0.05 (-0.07,-0.03)***	-4.88	-0.06 (-0.09,-0.04)***	-5.82	-0.31 (-0.33,-0.29)***	-26.66	-0.31 (-0.33,-0.28)***	-26.66	-0.29 (-0.32,-0.27)***	-25.17
Detox					-1.39 (-1.42,-1.36)***	-75.09	-1.4 (-1.43,-1.38)***	-75.34	-1.93 (-1.96,-1.91)***	-85.49	-1.93 (-1.95,-1.9)***	-85.49	-1.9 (-1.92,-1.87)***	-85.04
Rehab (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Enrolled in MAT					0.05 (0.01,0.09)*	5.13	0.04 (-0.01,0.08)	4.08	-0.08 (-0.12,-0.04)**	-7.69	-0.08 (-0.12,-0.04)***	-7.69	-0.1 (-0.14,-0.05)**	-9.52
Psych problems					0.03 (0.01,0.05)*	3.05	0.05 (0.03,0.07)***	5.13	0.12 (0.1,0.14)***	12.75	0.13 (0.11,0.15)***	13.88	0.13 (0.11,0.15)***	13.88
Drug Use														
Heroin					-0.48 (-0.57,-0.38)***	-38.12	-0.43 (-0.52,-0.34)***	-34.95	-0.24 (-0.33,-0.15)***	-21.34	-0.24 (-0.33,-0.15)***	-21.34	-0.23 (-0.32,-0.14)***	-20.55
Non-rx Methadone					-0.46 (-0.57,-0.36)***	-36.87	-0.45 (-0.56,-0.35)***	-36.24	-0.38 (-0.48,-0.27)***	-31.61	-0.38 (-0.48,-0.28)***	-31.61	-0.38 (-0.48,-0.27)***	-31.61
Cocaine					-0.01 (-0.03,0.01)	-1.00	-0.02 (-0.04,0)	-1.98	-0.1 (-0.12,-0.07)***	-9.52	-0.1 (-0.12,-0.08)***	-9.52	-0.1 (-0.12,-0.08)***	-9.52
Synthetic Opioids					-0.52 (-0.61,-0.43)***	-40.55	-0.47 (-0.56,-0.38)***	-37.50	-0.42 (-0.5,-0.33)***	-34.30	-0.42 (-0.51,-0.33)***	-34.30	-0.41 (-0.5,-0.32)***	-33.63
Benzodiazepines					0.09 (0.04,0.15)**	9.42	0.13 (0.07,0.18)***	13.88	-0.09 (-0.15,-0.04)**	-8.61	-0.1 (-0.15,-0.04)***	-9.52	-0.12 (-0.17,-0.06)***	-11.31
Any Opioids					0.54 (0.44,0.63)***	71.60	0.5 (0.4,0.59)***	64.87	0.25 (0.16,0.34)***	28.40	0.26 (0.16,0.35)***	29.69	0.24 (0.14,0.33)***	27.12
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used														
1					-0.29 (-0.32,-0.27)***	-25.17	-0.28 (-0.31,-0.26)***	-24.42	-0.35 (-0.37,-0.32)***	-29.53	-0.35 (-0.37,-0.32)***	-29.53	-0.35 (-0.38,-0.33)***	-29.53
2					-0.01 (-0.03,0.01)	-1.00	-0.01 (-0.03,0.02)	-1.00	-0.05 (-0.07,-0.02)***	-4.88	-0.05 (-0.07,-0.02)***	-4.88	-0.05 (-0.07,-0.03)***	-4.88
3 (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
DU					0.06 (0.03,0.09)***	6.18	0.05 (0.02,0.07)*	5.13	0.11 (0.08,0.14)***	11.63	0.11 (0.08,0.14)***	11.63	0.11 (0.08,0.14)***	11.63
Health Insurance Type														
Medicaid							0.58 (0.54,0.61)***	78.60	0.32 (0.28,0.35)***	37.71	0.31 (0.28,0.35)***	36.34	0.3 (0.27,0.33)***	34.99
Medicare							0.47 (0.43,0.52)***	60.00	0.57 (0.53,0.61)***	76.83	0.57 (0.53,0.61)***	76.83	0.58 (0.54,0.62)***	78.60
No insurance							0.43 (0.41,0.46)***	53.73	0.36 (0.34,0.39)***	43.33	0.36 (0.34,0.39)***	43.33	0.35 (0.32,0.37)***	41.91
Private Insurance (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Primary Income														
Public Assistance							-0.28 (-0.32,-0.24)***	-24.42	-0.38 (-0.42,-0.34)***	-31.61	-0.38 (-0.42,-0.34)***	-31.61	-0.38 (-0.42,-0.34)***	-31.61
Retirement/Pension							-0.17 (-0.21,-0.14)***	-15.63	-0.31 (-0.35,-0.27)***	-26.66	-0.3 (-0.34,-0.27)***	-25.92	-0.28 (-0.32,-0.25)***	-24.42
Other Income Source							-0.26 (-0.29,-0.22)***	-22.89	-0.26 (-0.29,-0.23)***	-22.89	-0.26 (-0.29,-0.22)***	-22.89	-0.23 (-0.26,-0.2)***	-20.55
No Income							-0.14 (-0.17,-0.12)***	-13.06	-0.36 (-0.39,-0.34)***	-30.23	-0.35 (-0.38,-0.33)***	-29.53	-0.34 (-0.37,-0.32)***	-28.82
Salary (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
State Level Variables														
Per Capita Income									-0.0001 (-0.0001,-0.0001)***	0.01	-0.0001 (-0.0001,-0.0001)***	0.01	-0.0001 (-0.0001,-0.0001)***	0.01
Bupe Prog Rate									0.06 (0.05,0.06)***	6.18	0.06 (0.06,0.06)***	6.18	0.06 (0.06,0.06)***	6.18
Rate of Indiv in Tx									0.01 (0.01,0.01)***	1.01	0.01 (0.01,0.01)***	1.01	0.004 (0.002,0.005)***	0.50
% of res w/Medicaid									0.1 (0.1,0.1)***	10.52	0.1 (0.1,0.1)***	11.63	0.1 (0.1,0.1)***	10.52
SABG									0.01 (0.01,0.01)***	1.01	0.01 (0.01,0.01)***	1.01	0.01 (0.01,0.01)***	1.01
Time											-0.06 (-0.08,-0.04)***	-5.82	0.22 (0.19,0.25)***	24.61
Medicaid Cov * Time													-0.45 (-0.49,-0.41)***	-36.24

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

Model 6: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level variables and time

Model 7: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level variables, time and interaction term

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe Covered	0.11 (0.03,0.20)*	11.63	0.11 (0.03,0.2)*	11.63	-0.17 (-0.26,-0.07)**	-15.63	-0.17 (-0.26,-0.08)**	-15.63	1.82 (1.59,2.04)***	517.19
Male			-0.06 (-0.14,0.02)	-5.82	-0.01 (-0.09,0.07)	-1.00	-0.01 (-0.09,0.07)	-1.00	-0.03 (-0.11,0.05)	-2.96
Race										
Black			-0.06 (-0.15,0.04)	-5.82	-0.09 (-0.19,0.01)	-8.61	-0.1 (-0.19,-0.001)*	-9.52	-0.24 (-0.33,-0.14)***	-21.34
Other Race			-0.64 (-0.78,-0.51)*	-47.27	0.17 (0.03,0.3)*	18.53	0.11 (-0.03,0.24)	11.63	0.13 (-0.002,0.26)*	13.88
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.22 (0.09,0.36)***	24.61	-0.74 (-0.87,-0.61)***	-52.29	-0.77 (-0.9,-0.64)***	-53.70	-0.49 (-0.61,-0.36)***	-38.74
HS Education			-0.15 (-0.24,-0.07)*	-13.93	-0.14 (-0.22,-0.05)*	-13.06	-0.12 (-0.21,-0.04)*	-11.31	-0.08 (-0.16,-0.0003)*	-7.69
Married			0.02 (-0.07,0.12)	2.02	-0.04 (-0.13,0.05)	-3.92	-0.03 (-0.12,0.06)	-2.96	0.01 (-0.08,0.1)	1.01
Employed			-0.06 (-0.14,0.03)	-5.82	-0.21 (-0.3,-0.12)***	-18.94	-0.38 (-0.5,-0.27)***	-31.61	-0.43 (-0.54,-0.31)***	-34.95
Unstably Housed			0.07 (-0.01,0.15)	7.25	0.11 (0.03,0.19)*	11.63	0.09 (0.01,0.17)*	9.42	-0.1 (-0.18,-0.02)*	-9.52
Age										
<18			0.04 (-0.12,0.21)	4.08	-0.27 (-0.44,-0.1)*	-23.66	-0.27 (-0.45,-0.09)*	-23.66	-0.05 (-0.23,0.12)	-4.88
18-24			0.19 (0.07,0.3)*	20.92	0.09 (-0.03,0.21)	9.42	0.07 (-0.06,0.19)	7.25	0.07 (-0.05,0.19)	7.25
25-34			0.19 (0.08,0.29)**	20.92	0.15 (0.04,0.26)*	16.18	0.12 (0.01,0.23)*	12.75	0.12 (0.02,0.23)*	12.75
35-44			0.11 (0.01,0.22)*	11.63	0.06 (-0.05,0.16)***	6.18	0.03 (-0.08,0.14)	3.05	0.05 (-0.05,0.16)	5.13
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					0.22 (0.12,0.33)***	24.61	0.22 (0.12,0.33)***	24.61	-0.08 (-0.18,0.02)	-7.69
Detox					-1.23 (-1.35,-1.11)***	-70.77	-1.23 (-1.35,-1.12)	-70.77	-1.63 (-1.75,-1.51)***	-80.41
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.18 (-0.37,0.02)	-16.47	-0.18 (-0.37,0.01)	-16.47	-0.15 (-0.34,0.04)	-13.93
Psych Problems					0.06 (-0.03,0.15)	6.18	0.09 (0.0,0.18)*	9.42	0.22 (0.13,0.31)***	24.61
Drug Use										
Heroin					-0.21 (-0.64,0.22)	-18.94	-0.25 (-0.67,0.18)	-22.12	-0.57 (-0.98,-0.16)*	-43.45
Non-rx Methadone					-0.93 (-1.41,-0.44)**	-60.54	-0.86 (-1.34,-0.37)**	-57.68	-0.88 (-1.35,-0.41)**	-58.52
Cocaine					-0.02 (-0.12,0.08)	-1.98	-0.01 (-0.11,0.09)	-1.00	-0.13 (-0.23,-0.04)*	-12.19
Synthetic Opioids					-0.62 (-1.03,-0.2)*	-46.21	-0.66 (-1.07,-0.25)*	-48.31	-0.77 (-1.17,-0.37)**	-53.70
Benzodiazepines					-0.14 (-0.38,0.1)	-13.06	-0.09 (-0.33,0.15)	-8.61	-0.31 (-0.54,-0.08)*	-26.66
Any Opioids					0.6 (0.17,1.04)*	82.21	0.66 (0.23,1.1)*	93.48	0.68 (0.26,1.1)*	97.39
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
1					-0.36 (-0.47,-0.24)***	-30.23	-0.34 (-0.46,-0.23)***	-28.82	-0.52 (-0.63,-0.41)***	-40.55
2					-0.05 (-0.16,0.05)	-4.88	-0.06 (-0.16,0.05)	-5.82	-0.19 (-0.3,-0.09)**	-17.30
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					-0.08 (-0.22,0.06)	-7.69	-0.1 (-0.24,0.04)	-9.52	0.002 (-0.13,0.13)	0.00
Health Insurance Type										
Medicaid							0.48 (0.34,0.63)***	61.61	0.21 (0.06,0.36)*	23.37
Medicare							0.61 (0.42,0.79)***	84.04	0.76 (0.58,0.94)***	113.83
No Insurance							0.4 (0.28,0.52)***	49.18	0.36 (0.24,0.48)***	43.33
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.35 (-0.54,-0.17)**	-29.53	-0.56 (-0.75,-0.38)***	-42.88
Retirement/Pension							-0.42 (-0.59,-0.24)***	-34.30	-0.58 (-0.75,-0.41)***	-44.01
Other Income Source							-0.49 (-0.64,-0.34)***	-38.74	-0.57 (-0.72,-0.42)***	-43.45
No Income							-0.28 (-0.4,-0.16)***	-24.42	-0.38 (-0.5,-0.27)***	-31.61
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0002 (-0.0002,-0.0002)***	-0.02
Bupe Prog Rate									0.16 (0.14,0.19)***	17.35
Rate of Indiv in Tx									-0.02 (-0.03,-0.02)***	-1.98
% of res w/Medicaid									0.17 (0.16,0.19)***	18.53
SABG									0.01 (0.01,0.01)***	1.01

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

Table 2B.8: Model Building Summary Using Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2008, N=320,656

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe Covered	0.03 (0.003,0.05)*	3.04	0.04 (0.02,0.07)**	4.08	-0.13 (-0.15,-0.1)***	-12.19	-0.14 (-0.16,-0.11)***	-13.06	1.6 (1.54,1.66)***	395.30
Male			-0.06 (-0.09,-0.04)***	-5.82	-0.06 (-0.08,-0.04)***	-5.82	-0.06 (-0.08,-0.03)***	-5.82	-0.06 (-0.09,-0.04)***	-5.82
Race										
Black			0.001 (-0.03,0.03)	0.10	0.01 (-0.02,0.04)	1.01	-0.002 (-0.03,0.03)	-0.2	-0.15 (-0.18,-0.12)***	-13.93
Other Race			-0.58 (-0.62,-0.54)***	-44.01	0.2 (0.16,0.24)***	22.14	0.18 (0.14,0.22)***	19.72	0.21 (0.17,0.24)***	23.37
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.16 (0.13,0.2)***	17.35	-0.65 (-0.69,-0.61)***	-47.80	-0.66 (-0.7,-0.62)***	-48.31	-0.42 (-0.46,-0.39)***	-34.30
HS Education			-0.12 (-0.14,-0.09)***	-11.31	-0.1 (-0.12,-0.08)***	-9.52	-0.08 (-0.11,-0.06)***	-7.69	-0.06 (-0.08,-0.04)***	-5.82
Married			0.01 (-0.02,0.04)	1.01	-0.01 (-0.04,0.01)	-1.00	0.01 (-0.02,0.03)	1.01	0.002 (-0.02,0.03)	0.00
Employed			0.01 (-0.01,0.04)	1.01	-0.1 (-0.12,-0.07)***	-9.52	-0.22 (-0.25,-0.18)***	-19.75	-0.27 (-0.31,-0.24)***	-23.66
Unstably Housed			0.07 (0.05,0.1)***	7.25	0.12 (0.09,0.14)***	12.75	0.12 (0.09,0.14)***	12.75	-0.04 (-0.06,-0.02)*	-3.92
Age										
<18			0.24 (0.19,0.29)***	27.12	-0.01 (-0.06,0.04)	-1.00	-0.01 (-0.06,0.04)	-1.00	0.02 (-0.03,0.07)	2.02
18-24			0.32 (0.28,0.35)***	37.71	0.2 (0.16,0.23)***	22.14	0.19 (0.16,0.23)***	20.92	0.14 (0.11,0.17)***	15.03
25-34			0.26 (0.23,0.29)***	29.69	0.18 (0.15,0.21)***	19.72	0.16 (0.13,0.19)***	17.35	0.14 (0.11,0.17)***	15.03
35-44			0.15 (0.12,0.18)***	16.18	0.11 (0.08,0.14)***	11.63	0.1 (0.07,0.13)***	10.52	0.08 (0.05,0.11)***	8.33
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					0.1 (0.07,0.12)***	10.52	0.09 (0.06,0.12)***	9.42	-0.19 (-0.22,-0.16)***	-17.30
Detox					-1.27 (-1.31,-1.24)***	-71.92	-1.27 (-1.3,-1.24)***	-71.92	-1.64 (-1.67,-1.6)***	-80.60
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.29 (-0.35,-0.24)***	-25.17	-0.29 (-0.35,-0.24)***	-25.17	-0.23 (-0.28,-0.18)***	-20.55
Psych Problems					0.07 (0.05,0.1)***	7.25	0.1 (0.07,0.12)***	10.52	0.21 (0.18,0.23)***	23.37
Drug Use										
Heroin					-0.18 (-0.3,-0.06)*	-16.47	-0.12 (-0.24,0)*	-11.31	-0.28 (-0.4,-0.17)***	-24.42
Non-rx Methadone					-0.35 (-0.49,-0.21)***	-29.53	-0.34 (-0.47,-0.2)***	-28.82	-0.48 (-0.61,-0.35)***	-38.12
Cocaine					0.07 (0.05,0.1)***	7.25	0.07 (0.04,0.1)***	7.25	-0.08 (-0.11,-0.05)***	-7.69
Synthetic Opioids					-0.51 (-0.63,-0.4)***	-39.95	-0.46 (-0.58,-0.35)***	-36.87	-0.5 (-0.61,-0.39)***	-39.35
Benzodiazepines					0.04 (-0.03,0.11)	4.08	0.05 (-0.02,0.12)	5.13	-0.19 (-0.26,-0.13)***	-17.30
Any Opioids					0.55 (0.43,0.67)***	73.33	0.5 (0.38,0.62)***	64.87	0.37 (0.25,0.49)***	44.77
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
0					-1.57 (-5.67,2.54)	-79.20	-1.53 (-5.63,2.56)	-78.35	-2.22 (-6.2,1.76)	-89.14
1					-0.2 (-0.23,-0.17)***	-18.13	-0.19 (-0.22,-0.16)***	-17.30	-0.39 (-0.42,-0.35)***	-32.29
2					0.03 (0.001,0.06)*	3.05	0.03 (0.004,0.07)***	3.05	-0.07 (-0.1,-0.04)***	-6.76
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					-0.02 (-0.06,0.02)	-1.98	-0.03 (-0.07,0.01)	-2.96	0.13 (0.09,0.17)***	13.88
Health Insurance Type										
Medicaid							0.48 (0.43,0.52)***	61.61	0.25 (0.2,0.29)***	28.40
Medicare							0.34 (0.29,0.39)***	40.49	0.49 (0.44,0.54)***	63.23
No Insurance							0.39 (0.35,0.42)***	47.70	0.39 (0.36,0.42)***	47.70
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.31 (-0.36,-0.25)***	-26.66	-0.46 (-0.51,-0.4)***	-36.87
Retirement/Pension							-0.2 (-0.25,-0.15)***	-18.13	-0.33 (-0.38,-0.28)***	-28.11
Other Income Source							-0.33 (-0.37,-0.29)***	-28.11	-0.41 (-0.45,-0.36)***	-33.63
No Income							-0.24 (-0.27,-0.2)***	-21.34	-0.38 (-0.42,-0.35)***	-31.61
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0002 (-0.0002,-0.0002)***	-0.2
Bupe Prog Rate									0.15 (0.14,0.16)***	16.18
Rate of Indiv in Tx									-0.02 (-0.02,-0.02)***	-1.98
% of res w/Medicaid									0.16 (0.15,0.16)***	17.35
SABG									0.01 (0.01,0.01)***	1.01

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2B.9: Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2008, N=4,698,055

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe Covered	0.44 (0.43,0.45)***	54.94	0.48 (0.47,0.49)***	61.61	0.36 (0.35,0.37)***	43.33	0.45 (0.44,0.46)***	56.83	0.35 (0.34,0.36)***	41.91
Male			-0.01 (-0.02,-0.01)**	-1.00	0.08 (0.07,0.08)***	8.33	0.002 (-0.004,0.01)	0.20	0.01 (0.01,0.02)***	1.01
Race										
Black			-0.11 (-0.11,-0.1)***	-10.42	-0.07 (-0.08,-0.06)***	-6.76	-0.11 (-0.12,-0.11)***	-10.42	-0.14 (-0.15,-0.13)***	-13.06
Other Race			-0.3 (-0.31,-0.29)***	-25.92	-0.27 (-0.28,-0.27)***	-23.66	-0.23 (-0.24,-0.23)***	-20.55	-0.12 (-0.13,-0.12)***	-11.31
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			-0.4 (-0.4,-0.39)***	-32.97	-0.26 (-0.27,-0.25)***	-22.89	-0.26 (-0.27,-0.26)***	-22.89	-0.17 (-0.18,-0.17)***	-15.63
HS Education			-0.05 (-0.06,-0.04)***	-4.88	-0.04 (-0.05,-0.04)***	-3.92	-0.01 (-0.02,-0.01)***	-1.00	-0.01 (-0.02,-0.003)*	-1.00
Married			0.05 (0.04,0.05)***	5.13	0.01 (0.001,0.02)*	1.01	0.07 (0.06,0.07)***	7.25	0.07 (0.07,0.08)***	7.25
Employed			-0.002 (-0.01,0.005)	-0.20	0.02 (0.02,0.03)***	2.02	0.01 (0.003,0.02)*	1.01	0.03 (0.02,0.04)***	3.05
Unstably Housed			-0.15 (-0.15,-0.14)***	-13.93	-0.13 (-0.13,-0.12)***	-12.19	-0.13 (-0.14,-0.12)***	-12.19	-0.04 (-0.04,-0.03)***	-3.92
Age										
<18			0.69 (0.67,0.7)***	99.37	0.27 (0.26,0.28)***	31.00	0.47 (0.46,0.49)***	60.00	0.33 (0.31,0.34)***	39.10
18-24			0.3 (0.29,0.3)***	34.99	0.2 (0.19,0.21)***	22.14	0.21 (0.2,0.22)***	23.37	0.15 (0.14,0.16)***	16.18
25-34			0.21 (0.2,0.22)***	23.37	0.14 (0.13,0.15)***	15.03	0.12 (0.11,0.13)***	12.75	0.07 (0.07,0.08)***	7.25
35-44			0.09 (0.09,0.1)***	9.42	0.05 (0.04,0.05)***	5.13	0.04 (0.03,0.05)***	4.08	0.02 (0.01,0.03)***	2.02
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.2 (-0.21,-0.2)***	-18.13	-0.27 (-0.28,-0.26)***	-23.66	-0.34 (-0.35,-0.34)***	-28.82
Detox					-0.67 (-0.67,-0.66)***	-48.83	-0.75 (-0.76,-0.74)***	-52.76	-0.88 (-0.89,-0.87)***	-58.52
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					-0.54 (-0.55,-0.53)***	-41.73	-0.54 (-0.55,-0.53)***	-41.73	-0.47 (-0.48,-0.46)***	-37.50
Psych Problems					0.83 (0.82,0.83)***	129.33	0.65 (0.65,0.66)***	91.55	0.62 (0.61,0.63)***	85.89
Drug Use										
Heroin					0.03 (0.005,0.06)*	3.05	-0.002 (-0.03,0.03)	-0.20	-0.04 (-0.06,-0.01)*	-3.92
Non-rx Methadone					0 (-0.03,0.04)	0.00	-0.03 (-0.06,0.003)	-2.96	-0.02 (-0.05,0.02)	-1.98
Cocaine					0.04 (0.03,0.05)***	4.08	-0.001 (-0.01,0.01)	-0.10	-0.04 (-0.04,-0.03)***	-3.92
Synthetic Opioids					-0.05 (-0.07,-0.02)**	-4.88	-0.04 (-0.06,-0.01)*	-3.92	-0.04 (-0.07,-0.02)**	-3.92
Benzodiazepines					0.02 (-0.001,0.04)	2.02	0.03 (0.01,0.05)*	3.05	0.01 (-0.01,0.03)	1.01
Any Opioids					0.05 (0.02,0.07)*	5.13	0.05 (0.02,0.08)**	5.13	0.05 (0.02,0.07)**	5.13
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
1					-0.04 (-0.05,-0.03)***	-3.92	-0.03 (-0.04,-0.02)***	-2.96	-0.01 (-0.02,-0.001)*	-1.00
2					-0.11 (-0.12,-0.1)***	-10.42	-0.06 (-0.07,-0.05)***	-5.82	-0.02 (-0.03,-0.01)**	-1.98
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					-0.18 (-0.19,-0.17)***	-16.47	-0.17 (-0.18,-0.16)***	-15.63	-0.13 (-0.14,-0.12)***	-12.19
Health Insurance Type										
Medicaid							0.44 (0.43,0.45)***	55.27	0.58 (0.57,0.6)***	78.60
Medicare							0.87 (0.86,0.89)***	138.69	0.73 (0.71,0.74)***	107.51
No Insurance							0.92 (0.91,0.93)***	150.93	0.91 (0.91,0.92)***	148.43
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.06 (-0.07,-0.04)***	-5.82	-0.06 (-0.07,-0.04)***	-5.82
Retirement/Pension							0.09 (0.07,0.1)***	9.42	0.01 (-0.01,0.02)	1.01
Other Income Source							-0.13 (-0.14,-0.12)***	-12.19	-0.18 (-0.2,-0.17)***	-16.47
No Income							-0.18 (-0.19,-0.17)***	-16.47	-0.13 (-0.14,-0.12)***	-12.19
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0001 (-0.0001,-0.0001)***	-0.01
Bupe Prog Rate									-0.08 (-0.08,-0.08)***	-7.69
Rate of Indiv in Tx									0.04 (0.03,0.04)***	4.08
% of res w/Medicaid									-0.06 (-0.06,-0.06)***	-5.82
SABG									0.002 (0.002,0.002)***	0.20

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05



Table 2B.10: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2006, N=24,100

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe Covered	1.13 (1.05,1.21)***	209.57	1.2 (1.12,1.28)***	232.01	1.13 (1.04,1.21)***	209.57	1.14 (1.05,1.23)***	212.68	2.23 (2.09,2.36)***	829.99
Male			-0.1 (-0.19,-0.01)*	-9.52	-0.08 (-0.16,0.01)	-7.69	-0.06 (-0.15,0.02)	-5.82	-0.07 (-0.15,0.02)	-6.76
Race										
Black			-0.28 (-0.38,-0.18)***	-24.42	-0.2 (-0.31,-0.09)**	-18.13	-0.23 (-0.34,-0.12)***	-20.55	-0.35 (-0.45,-0.24)***	-29.53
Other Race			-0.72 (-0.86,-0.57)*	-51.32	0.12 (-0.04,0.28)	12.75	0.12 (-0.03,0.28)	12.75	-0.24 (-0.39,-0.09)*	-21.34
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.18 (0.02,0.34)***	19.72	-0.72 (-0.87,-0.58)***	-51.32	-0.75 (-0.9,-0.61)***	-52.76	-0.13 (-0.27,0.01)	-12.19
HS Education			-0.03 (-0.12,0.06)	-2.96	-0.03 (-0.12,0.06)	-2.96	-0.01 (-0.09,0.08)	-1.00	0.02 (-0.07,0.11)	2.02
Married			0.21 (0.11,0.31)***	23.37	0.15 (0.06,0.25)*	16.18	0.2 (0.1,0.3)***	22.14	0.15 (0.06,0.25)*	16.18
Employed			-0.07 (-0.15,0.02)	-6.76	-0.16 (-0.25,-0.07)**	-14.79	-0.17 (-0.3,-0.04)*	-15.63	-0.22 (-0.34,-0.09)**	-19.75
Unstably Housed			-0.05 (-0.13,0.04)	-4.88	-0.03 (-0.11,0.06)	-2.96	-0.03 (-0.12,0.05)	-2.96	0.004 (-0.08,0.09)	0.36
Age										
<18			0.51 (0.33,0.69)***	66.53	0.16 (-0.03,0.34)	17.35	0.17 (-0.04,0.37)	18.53	-0.05 (-0.25,0.14)	-4.88
18-24			0.38 (0.25,0.52)***	46.23	0.21 (0.07,0.34)*	23.37	0.21 (0.07,0.34)*	23.37	0.11 (-0.02,0.25)	11.63
25-34			0.23 (0.11,0.35)**	25.86	0.12 (0.0,0.24)*	12.75	0.08 (-0.04,0.21)	8.33	0.09 (-0.03,0.21)	9.42
35-44			0.18 (0.07,0.3)*	19.72	0.19 (0.08,0.31)**	20.92	0.16 (0.05,0.28)*	17.35	0.17 (0.06,0.29)*	18.53
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.23 (-0.34,-0.12)***	-20.55	-0.22 (-0.34,-0.11)***	-19.75	-0.65 (-0.77,-0.53)***	-47.80
Detox					-1.52 (-1.64,-1.39)***	-78.13	-1.53 (-1.65,-1.4)***	-78.35	-2.38 (-2.52,-2.25)***	-90.74
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					0.76 (0.54,0.97)***	113.83	0.7 (0.49,0.92)***	101.38	0.42 (0.21,0.63)**	52.20
Psych Problems					0.11 (0.01,0.21)*	11.63	0.11 (0.01,0.21)*	11.63	0.09 (-0.01,0.18)	9.42
Drug Use										
Heroin					-1.54 (-2.02,-1.05)***	-78.56	-1.35 (-1.84,-0.87)***	-74.08	-0.77 (-1.24,-0.31)*	-53.70
Non-rx Methadone					-0.02 (-0.51,0.48)	-1.98	-0.03 (-0.53,0.46)	-2.96	0.37 (-0.11,0.86)	44.77
Cocaine					-0.22 (-0.32,-0.12)***	-19.75	-0.2 (-0.3,-0.1)***	-18.13	-0.23 (-0.33,-0.13)***	-20.55
Synthetic Opioids					-1.04 (-1.5,-0.57)***	-64.65	-0.88 (-1.35,-0.41)**	-58.52	-0.77 (-1.22,-0.32)**	-53.70
Benzodiazepines					0.1 (-0.18,0.38)	10.52	0.21 (-0.07,0.49)	23.37	0.25 (-0.02,0.53)	28.40
Any Opioids					0.85 (0.36,1.35)**	133.96	0.69 (0.2,1.19)*	99.37	0.39 (-0.09,0.87)	47.70
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
1					-0.56 (-0.68,-0.43)***	-42.88	-0.53 (-0.65,-0.41)***	-41.14	-0.42 (-0.54,-0.29)***	-34.30
2					-0.17 (-0.29,-0.05)*	-15.63	-0.14 (-0.26,-0.02)*	-13.06	-0.12 (-0.24,-0.01)*	-11.31
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.23 (0.08,0.37)*	25.86	0.19 (0.04,0.34)*	20.92	0.12 (-0.03,0.26)	12.75
Health Insurance Type										
Medicaid							0.54 (0.38,0.7)***	71.60	0.15 (-0.01,0.3)	16.18
Medicare							0.64 (0.43,0.86)***	89.65	0.59 (0.38,0.8)***	80.40
No Insurance							0.43 (0.31,0.55)***	53.73	0.27 (0.15,0.39)***	31.00
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.2 (-0.4,0)*	-18.13	-0.24 (-0.43,-0.05)*	-21.34
Retirement/Pension							-0.14 (-0.33,0.05)	-13.06	-0.26 (-0.44,-0.09)*	-22.89
Other Income Source							-0.23 (-0.39,-0.07)*	-20.55	-0.09 (-0.25,0.07)	-8.61
No Income							-0.03 (-0.16,0.11)	-2.96	-0.33 (-0.46,-0.2)***	-28.11
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0002 (-0.0002,-0.0002)***	-0.02
Bupe Prog Rate									-0.1 (-0.12,-0.07)***	-9.52
Rate of Indiv in Tx									0.03 (0.03,0.04)***	3.05
% of res w/Medicaid									0.04 (0.03,0.06)***	4.08
SABG									0.0009 (-0.001,0.003)	0.09

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2B.11: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2006, N=240,757

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Bupe Covered	1.14 (1.11,1.17)***	212.68	1.19 (1.17,1.22)***	228.71	1.08 (1.05,1.11)***	194.47	1.09 (1.07,1.12)***	197.43	2.2 (2.16,2.24)***	802.50
Male			-0.1 (-0.13,-0.07)***	-9.52	-0.09 (-0.12,-0.06)***	-8.61	-0.08 (-0.11,-0.05)***	-7.69	-0.07 (-0.1,-0.05)***	-6.76
Race										
Black			-0.22 (-0.25,-0.19)***	-19.75	-0.17 (-0.2,-0.13)***	-15.63	-0.18 (-0.22,-0.15)	-16.47	-0.26 (-0.3,-0.23)***	-22.89
Other Race			-0.63 (-0.67,-0.59)*	-46.74	0.002 (-0.05,0.05)	0.00	-0.03 (-0.08,0.02)***	-2.96	-0.34 (-0.38,-0.29)***	-28.82
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.05 (0,0.1)***	5.13	-0.7 (-0.74,-0.65)***	-50.34	-0.7 (-0.75,-0.66)***	-50.34	-0.16 (-0.21,-0.12)***	-14.79
HS Education			-0.03 (-0.06,0)*	-2.96	-0.04 (-0.07,-0.01)*	-3.92	-0.01 (-0.04,0.02)	-1.00	0.05 (0.02,0.08)**	5.13
Married			0.08 (0.05,0.11)***	8.33	0.07 (0.04,0.1)***	7.25	0.1 (0.07,0.13)***	10.52	0.08 (0.05,0.11)***	8.33
Employed			-0.02 (-0.05,0.01)	-1.98	-0.13 (-0.16,-0.1)***	-12.19	-0.11 (-0.16,-0.07)***	-10.42	-0.11 (-0.15,-0.07)***	-10.42
Unstably Housed			-0.05 (-0.08,-0.03)**	-4.88	-0.03 (-0.06,-0.01)***	-2.96	-0.05 (-0.08,-0.02)**	-4.88	0.01 (-0.01,0.04)	1.01
Age										
<18			0.54 (0.48,0.6)***	71.60	0.25 (0.19,0.31)***	28.40	0.28 (0.22,0.34)***	32.31	0.1 (0.04,0.16)*	10.52
18-24			0.4 (0.36,0.44)***	49.18	0.25 (0.21,0.29)***	28.40	0.24 (0.2,0.28)***	27.12	0.21 (0.17,0.25)***	23.37
25-34			0.32 (0.28,0.36)***	37.71	0.23 (0.2,0.27)***	25.86	0.2 (0.16,0.24)***	22.14	0.16 (0.12,0.19)***	17.35
35-44			0.13 (0.1,0.17)***	13.88	0.12 (0.09,0.16)***	12.75	0.1 (0.06,0.13)***	10.52	0.11 (0.08,0.15)***	11.63
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Tx Program Type										
Outpatient					-0.17 (-0.2,-0.13)***	-15.63	-0.17 (-0.21,-0.14)***	-15.63	-0.59 (-0.63,-0.55)***	-44.57
Detox					-1.51 (-1.55,-1.47)***	-77.91	-1.52 (-1.56,-1.48)***	-78.13	-2.34 (-2.38,-2.3)***	-90.37
Rehab (ref)					ref	ref	ref	ref	ref	ref
Enrolled in MAT					0.52 (0.46,0.59)***	68.20	0.5 (0.43,0.56)***	64.87	0.32 (0.26,0.39)***	37.71
Psych Problems					0.04 (0.01,0.07)*	4.08	0.05 (0.02,0.08)*	5.13	0.1 (0.07,0.14)***	10.52
Drug Use										
Heroin					-0.96 (-1.11,-0.81)***	-61.71	-0.94 (-1.09,-0.79)***	-60.94	-0.41 (-0.56,-0.27)***	-33.63
Non-rx Methadone					-0.6 (-0.77,-0.44)***	-45.12	-0.6 (-0.77,-0.43)***	-45.12	-0.25 (-0.41,-0.09)*	-22.12
Cocaine					-0.14 (-0.17,-0.11)***	-13.06	-0.15 (-0.18,-0.12)***	-13.93	-0.12 (-0.15,-0.08)***	-11.31
Synthetic Opioids					-0.46 (-0.6,-0.31)***	-36.87	-0.44 (-0.58,-0.29)***	-35.60	-0.23 (-0.37,-0.1)**	-20.55
Benzodiazepines					0.06 (-0.03,0.16)	6.18	0.14 (0.04,0.23)**	15.03	-0.003 (-0.09,0.09)	-0.30
Any Opioids					0.42 (0.27,0.57)***	52.20	0.41 (0.26,0.56)***	50.68	0.05 (-0.1,0.19)	5.13
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est	Estimate (95% CI)	% Diff Est
Ttl # of Drugs Used										
1					-0.43 (-0.47,-0.39)***	-34.95	-0.42 (-0.46,-0.38)***	-34.30	-0.3 (-0.34,-0.26)***	-25.92
2					-0.09 (-0.13,-0.05)***	-8.61	-0.09 (-0.13,-0.05)***	-8.61	-0.04 (-0.08,-0.01)*	-3.92
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.21 (0.16,0.25)***	23.37	0.19 (0.14,0.24)***	20.92	0.18 (0.13,0.23)***	19.72
Health Insurance Type										
Medicaid							0.66 (0.61,0.71)***	93.48	0.28 (0.23,0.33)***	32.31
Medicare							0.76 (0.7,0.83)***	113.83	0.66 (0.59,0.73)***	93.48
No Insurance							0.52 (0.48,0.56)***	68.20	0.26 (0.22,0.3)***	29.69
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							-0.23 (-0.29,-0.17)***	-20.55	-0.22 (-0.28,-0.16)***	-19.75
Retirement/Pension							-0.13 (-0.19,-0.07)***	-12.19	-0.2 (-0.26,-0.15)***	-18.13
Other Income Source							-0.13 (-0.19,-0.08)***	-12.19	-0.05 (-0.1,0)*	-4.88
No Income							-0.05 (-0.09,-0.01)*	-4.88	-0.26 (-0.3,-0.22)***	-22.89
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Per Capita Income									-0.0002 (-0.0002,-0.0001)***	-0.20
Bupe Prog Rate									-0.11 (-0.12,-0.1)***	-10.42
Rate of Indiv in Tx									0.03 (0.03,0.03)***	3.05
% of res w/Medicaid									0.04 (0.04,0.05)***	4.08
SABG									-0.002 (-0.002,-0.001)***	-0.02

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 2B.12: Model Building Summary Using Multiple Imputation Sample for Treatment Wait Time and Medicaid Coverage of Buprenorphine, 2006, N=4,258,996

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est
Bupe Covered	0.68 (0.67,0.68)***	97.39		0.7 (0.69,0.7)***	101.38		0.56 (0.56,0.57)***	75.07		0.58 (0.57,0.59)***	78.60		0.97 (0.96,0.98)***	163.79	
Male				0.02 (0.02,0.03)***	2.02		0.08 (0.07,0.08)***	8.33		0.05 (0.05,0.06)***	5.13		0.02 (0.01,0.02)***	2.02	
Race															
Black				-0.14 (-0.15,-0.14)***	-13.06		-0.11 (-0.11,-0.1)***	-10.42		-0.14 (-0.14,-0.13)***	-13.06		-0.1 (-0.11,-0.09)***	-9.52	
Other Race				-0.26 (-0.27,-0.25)***	-22.89		-0.09 (-0.1,-0.08)***	-8.61		-0.11 (-0.12,-0.1)***	-10.42		0.04 (0.03,0.05)***	4.08	
White (ref)				ref	ref		ref	ref		ref	ref		ref	ref	
Hispanic				-0.25 (-0.26,-0.24)***	-22.12		-0.31 (-0.32,-0.31)***	-26.66		-0.33 (-0.34,-0.32)***	-28.11		-0.21 (-0.22,-0.2)***	-18.94	
HS Education				0.001 (-0.01,0.01)	0.00		0.005 (-0.002,0.01)	0.50		0.02 (0.02,0.03)***	2.02		0.03 (0.02,0.04)***	3.05	
Married				-0.02 (-0.02,-0.01)***	-1.98		-0.03 (-0.04,-0.02)***	-2.96		0.01 (0.0,0.02)*	1.01		0.03 (0.03,0.04)***	3.05	
Employed				-0.01 (-0.01,-0.0002)*	-1.00		0.04 (0.03,0.04)***	4.08		0.08 (0.07,0.09)***	8.33		0.13 (0.12,0.14)***	13.88	
Unstably Housed				0.03 (0.02,0.04)***	3.05		-0.02 (-0.03,-0.01)***	-1.98		-0.04 (-0.05,-0.03)***	-3.92		0.02 (0.01,0.02)***	2.02	
Age															
<18				0.59 (0.58,0.61)***	80.40		0.28 (0.27,0.29)***	32.31		0.39 (0.38,0.4)***	47.70		0.25 (0.23,0.26)***	28.40	
18-24				0.23 (0.22,0.24)***	25.86		0.14 (0.13,0.15)***	15.03		0.15 (0.14,0.16)***	16.18		0.09 (0.08,0.1)***	9.42	
25-34				0.19 (0.18,0.2)***	20.92		0.11 (0.1,0.12)***	11.63		0.09 (0.09,0.1)***	9.42		0.05 (0.04,0.06)***	5.13	
35-44				0.09 (0.08,0.1)***	9.42		0.05 (0.04,0.05)***	5.13		0.04 (0.03,0.05)***	4.08		0.02 (0.01,0.03)***	2.02	
>44 (ref)				ref	ref		ref	ref		ref	ref		ref	ref	
Tx Program Type															
Outpatient							-0.39 (-0.4,-0.38)***	-32.29		-0.4 (-0.41,-0.39)***	-32.97		-0.51 (-0.52,-0.5)***	-39.95	
Detox							-0.69 (-0.7,-0.68)***	-49.84		-0.7 (-0.71,-0.69)***	-50.34		-0.81 (-0.82,-0.8)***	-55.51	
Rehab (ref)							ref	ref		ref	ref		ref	ref	
Enrolled in MAT							-0.16 (-0.17,-0.15)***	-14.79		-0.16 (-0.18,-0.15)***	-14.79		-0.06 (-0.08,-0.05)***	-5.82	
Psych Problems							0.58 (0.57,0.58)***	78.60		0.53 (0.52,0.54)***	69.89		0.37 (0.36,0.37)***	44.77	
Drug Use															
Heroin							-0.19 (-0.23,-0.16)***	-17.30		-0.2 (-0.23,-0.16)***	-18.13		-0.29 (-0.32,-0.26)***	-25.17	
Non-rx Methadone							-0.28 (-0.32,-0.25)***	-24.42		-0.28 (-0.32,-0.25)***	-24.42		-0.24 (-0.28,-0.2)***	-21.34	
Cocaine							-0.04 (-0.05,-0.03)***	-3.92		-0.05 (-0.06,-0.05)***	-4.88		-0.11 (-0.12,-0.1)***	-10.42	
Synthetic Opioids							-0.31 (-0.34,-0.28)***	-26.66		-0.29 (-0.32,-0.26)***	-25.17		-0.25 (-0.28,-0.22)***	-22.12	
Benzodiazepines							0.17 (0.15,0.2)***	18.53		0.19 (0.17,0.22)***	20.92		0.19 (0.17,0.21)***	20.92	
Any Opioids							0.1 (0.07,0.14)***	10.52		0.1 (0.07,0.14)***	10.52		0.11 (0.08,0.14)***	11.63	
	Model 1			Model 2			Model 3			Model 4			Model 5		
	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est	Estimate (95% CI)	% Diff	Est
Ttl # of Drugs Used															
1							-0.23 (-0.24,-0.21)***	-20.55		-0.22 (-0.23,-0.21)***	-19.75		-0.18 (-0.19,-0.17)***	-16.47	
2							-0.23 (-0.24,-0.22)***	-20.55		-0.22 (-0.23,-0.21)***	-19.75		-0.1 (-0.11,-0.09)***	-9.52	
3 (ref)				ref	ref		ref	ref		ref	ref		ref	ref	
IDU							-0.11 (-0.12,-0.1)***	-10.42		-0.13 (-0.14,-0.12)***	-12.19		0.01 (0.0,0.02)*	1.01	
Health Insurance Type															
Medicaid										0.37 (0.36,0.38)***	44.77		0.43 (0.42,0.45)***	53.73	
Medicare										0.7 (0.69,0.72)***	101.38		0.3 (0.29,0.31)***	34.99	
No Insurance										0.5 (0.5,0.51)***	64.87		0.46 (0.45,0.47)***	58.41	
Private Insurance (ref)										ref	ref		ref	ref	
Primary Income															
Public Assistance										-0.003 (-0.02,0.01)	-0.30		-0.09 (-0.1,-0.07)***	-8.61	
Retirement/Pension										0.04 (0.02,0.05)***	4.08		0.01 (-0.01,0.02)	1.01	
Other Income Source										-0.08 (-0.09,-0.07)***	-7.69		-0.09 (-0.1,-0.08)***	-8.61	
No Income										-0.01 (-0.02,-0.002)***	-1.00		0.11 (0.1,0.12)***	11.63	
Salary (ref)										ref	ref		ref	ref	
State Level Variables															
Per Capita Income													-0.0001 (-0.0001,-0.0001)***	-0.01	
Bupe Prog Rate													-0.1 (-0.1,-0.1)***	-9.52	
Rate of Indiv in Tx													-0.003 (-0.003,-0.002)***	-0.30	
% of res w/Medicaid													-0.04 (-0.04,-0.04)***	-3.92	
SABG													-0.002 (-0.002,-0.002)***	-0.20	

Model 1: Unadjusted association between Medicaid coverage of buprenorphine and wait time for substance use treatment

Model 2: Medicaid coverage of buprenorphine and demographic covariates

Model 3: Medicaid coverage of buprenorphine, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates and health insurance and income covariates

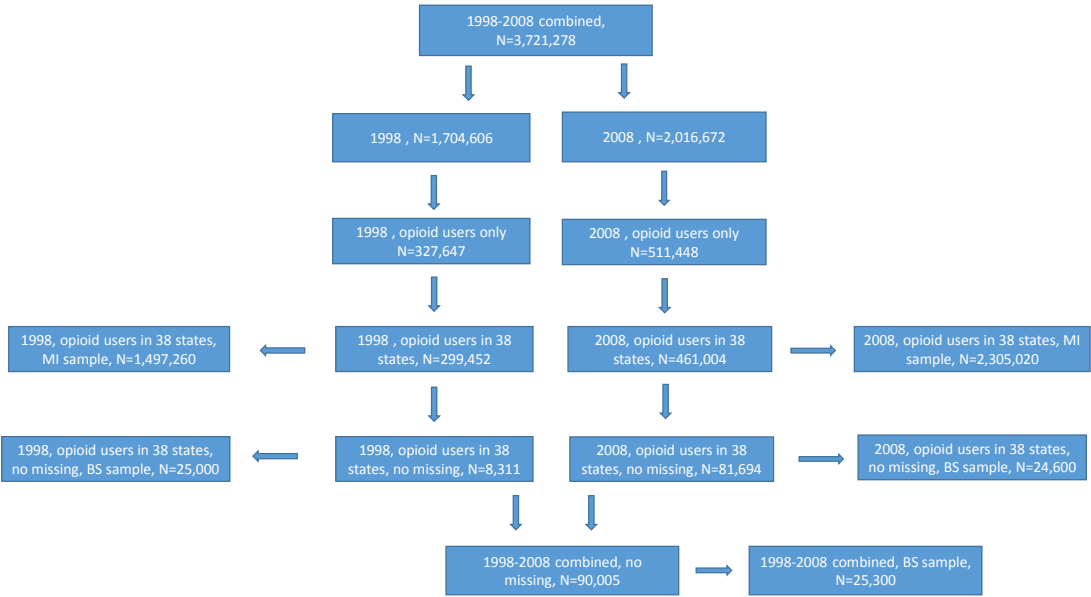
Model 5: Medicaid coverage of buprenorphine, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level variables

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Figure 3.1: Analytic Sample for Aim 3, Utilization of MAT and Medicaid Coverage of Methadone



**Table 3.1 Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Utilization of MAT and Medicaid Coverage of Methadone, 2008**

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
	N=378828	N=81584
	n ( %)	n ( %)
Medicaid Coverage of Methadone***	367225 (97%)	69986 (86%)
missing	n=0	n=0
Male***	244451 (65%)	48852 (60%)
missing	n=62	n=0
<b>Race</b>		
White***	263753 (71%)	53958 (66%)
Black***	53366 (14%)	22521 (28%)
Other Race***	54961 (15%)	5105 (6%)
missing	n=6748	n=0
Hispanic***	61206 (17%)	5544 (7%)
missing	n=12087	n=0
HS Education	251892 (67%)	54849 (67%)
missing	n=4272	n=0
Married	53888 (20%)	15920 (20%)
missing	n=106634	n=0
Employed	69389 (19%)	15205 (19%)
missing	n=6057	n=0
Unstably housed***	105404 (30%)	33116 (41%)
missing	n=33060	n=0
<b>Age</b>		
<24***	84384 (22%)	17409 (21%)
25-34***	117639 (31%)	24730 (30%)
35-44***	90639 (24%)	20967 (26%)
≥45	86166 (23%)	18478 (23%)
missing	n=0	n=0
<b>Program Type</b>		
Rehab	73860 (20%)	15677 (19%)
Non-Rehab Outpatient/Detox	304877 (81%)	65907 (81%)
missing	n=91	n=0
Patient receiving MAT***	83094 (22%)	15360 (19%)
missing	n=2693	n=0
Psych Problems***	79806 (32%)	22614 (28%)
missing	n=133120	n=0
<b>Drug use reported at admit</b>		
Heroin***	259003 (68%)	57719 (71%)
missing	n=0	n=0
Non prescription Methadone***	11268 (3%)	1917 (2%)
missing	n=0	n=0
Synthetic opioids***	142610 (38%)	27424 (34%)
missing	n=0	n=0
Cocaine/Crack***	120412 (32%)	27939 (34%)
missing	n=0	n=0

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
Benzodiazepine***	28724 (8%)	6569 (8%)
missing	n=0	n=0
<b># of subs reported at admit</b>		
1***	106509 (28%)	25642 (31%)
2***	133427 (35%)	27121 (33%)
3***	138892 (37%)	28821 (35%)
missing	n=0	n=0
IDU***	175659 (46%)	344448 (42%)
missing	n=0	n=0
<b>Client Insurance Type</b>		
Medicaid***	31961 (24%)	25225 (31%)
Medicare***	18147 (14%)	6210 (8%)
No insurance	70196 (53%)	42969 (53%)
Private Insurance**	12161 (9%)	7180 (9%)
missing	n=201085	n=0
<b>Primary Source of Income</b>		
Public Assistance***	21449 (10%)	6384 (8%)
Retirement/Pension***	8943 (4%)	10069 (12%)
Other Income***	52081 (24%)	10155 (12%)
No income***	94022 (43%)	35891 (44%)
Salary***	41892 (19%)	19085 (23%)
missing	n=113201	n=0
<b>Continuous variables</b>		
Rate of methadone programs/10K pop*	6.01 (3.08)	6.16 (3.19)
Rate of individuals in tx/1M pop***	36.09 (21.02)	37.97 (25.0)
Percent of residents rec'v Medicaid***	21.53 (5.48)	19.89 (4.42)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

**Table 3.2 Comparison of Characteristics of Cases with Missing Data on Any Variables Compared to Cases with No Missing Data, Utilization of MAT and Medicaid Coverage of Methadone, 1998**

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
	N=291141 n ( %)	N=8311 n ( %)
Medicaid Coverage of Methadone*** missing	270503 (93%) n=0	6417 (77%) n=0
Male*** missing	193509 (67%) n=235	5062 (61%) n=0
<b>Race</b>		
White***	152899 (53%)	5739 (69%)
Black**	71073 (25%)	1911 (23%)
Other Race*** missing	65235 (23%) n=1934	661 (8%) n=0
Hispanic*** missing	67199 (23%) n=3077	781 (9%) n=0
HS Education*** missing	179228 (62%) n=1879	5750 (69%) n=0
Married* missing	44319 (25%) n=111391	2158 (26%) n=0
Employed*** missing	60065 (21%) n=5122	2725 (33%) n=0
Unstably housed*** missing	59681 (31%) n=95744	3439 (41%) n=0
<b>Age</b>		
<24***	37365 (13%)	1298 (16%)
25-34**	91907 (32%)	2475 (30%)
35-44	110603 (38%)	3241 (39%)
≥45*** missing	51266 (18%) n=0	1297 (16%) n=0
<b>Program Type***</b>		
Rehab	43247 (15%)	1754 (21%)
Non-Rehab Outpatient/Detox missing	247806 (85%) n=88	6557 (79%) n=0
Patient receiving MAT*** missing	91660 (32%) n=606	2085 (25%) n=0
Psych Problems*** missing	28858 (14%) n=87644	1962 (24%) n=0
<b>Drug use reported at admit</b>		
Heroin*** missing	267149 (92%) n=0	6242 (75%) n=0
Non prescription Methadone** missing	5375 (2%) n=0	195 (2%) n=0
Synthetic opioids*** missing	29552 (10%) n=0	2466 (30%) n=0
Cocaine/Crack*** missing	113053 (39%) n=0	3501 (42%) n=0

	Missing Data on Any Predictor Variable	No Missing Data on Any Predictor Variable
Benzodiazepine***	8609 (3%)	398 (5%)
missing	n=0	n=0
<b># of subs reported at admit</b>		
1***	96160 (33%)	1872 (23%)
2	97206 (33%)	2793 (34%)
3***	97775 (34%)	3646 (44%)
missing	n=0	n=0
IDU	154895 (53%)	4335 (52%)
missing	n=0	n=0
<b>Client Insurance Type</b>		
Medicaid***	24913 (18%)	1239 (15%)
Medicare***	13780 (10%)	730 (9%)
No insurance**	82278 (61%)	5225 (63%)
Private Insurance***	13997 (10%)	1117 (13%)
missing	n=201085	n=0
<b>Primary Source of Income</b>		
Public Assistance***	25144 (23%)	775 (9%)
Retirement/Pension***	3557 (3%)	845 (10%)
Other Income***	30459 (27%)	1308 (16%)
No income*	29250 (26%)	2306 (28%)
Salary***	22534 (20%)	3077 (37%)
missing	n=180197	n=0
<b>Continuous variables</b>		
Rate of methadone programs/10K pop*	5.33 (2.85)	3.37 (2.59)
Rate of individuals in tx/1M pop***	29.84 (17.04)	12.82 (14.89)
Percent of residents rec'v Medicaid***	15.85 (3.80)	13.67 (2.82)

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05



**Table 3.3: Descriptive Characteristics of Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, Combined 1998-2008, N=25,300**

	n ( % )
Individuals in States with Medicaid Coverage of Methadone	21584 (85%)
Male	15172 (60%)
<b>Race</b>	
White	16787 (66%)
Black	6910 (27%)
Other Race	1603 (6%)
Hispanic	1738 (7%)
HS Education	16929 (67%)
Married	5124 (20%)
Employed	5061 (20%)
Unstably housed	10303 (41%)
<b>Age</b>	
<18	520 (2%)
18-24	4841 (19%)
25-34	7469 (30%)
35-44	6901 (27%)
≥45	5569 (22%)
<b>Program Type</b>	
Rehabilitation	4854 (19%)
Non-Rehabilitation (Outpatient and Detoxification)	20,446 (81%)
Patient receiving MAT	4883 (19%)
Psych Problems	6995 (28%)
<b>Drug use reported at admit</b>	
Heroin	18004 (71%)
Non prescription Methadone	630 (2%)
Cocaine/Crack	8869 (35%)
Synthetic opioids	8384 (33%)
Benzodiazepine	1926 (8%)
<b># of subs reported at admit</b>	
1	7735 (31%)
2	8452 (33%)
3	9113 (36%)
IDU	10797 (43%)
<b>Client Insurance Type</b>	
Medicaid	7369 (29%)
Medicare	2044 (8%)
No insurance	13426 (53%)
Private Insurance	2461 (10%)
<b>Primary Source of Income</b>	
Public Assistance	1967 (8%)
Retirement/Pension	3087 (12%)
Other Income	3206 (13%)
No income	10770 (43%)
Salary	6270 (25%)
<b>Continuous variables</b>	<b>Mean (SD)</b>
Rate of methadone programs/10K pop	5.89 (3.24)
Rate of individuals in tx/1M pop	35.59 (25.33)
Percent of residents rec'v Medicaid	19.26 (4.65)

**Table 3.4: Comparison of Characteristics of Bootstrapped Listwise Deletion Sample by Medicaid Coverage of Methadone, Combined 1998-2008**

	Medicaid Coverage	No Medicaid Coverage
	N=21,584	N=3,716
	n ( % )	n ( % )
Male*	13049 (60%)	2123 (57%)
<b>Race</b>		
White***	13575 (63%)	3212 (86%)
Black***	6548 (30%)	362 (10%)
Other Race***	1461 (7%)	142 (4%)
Hispanic	1463 (7%)	275 (7%)
HS Education*	14529 (67%)	2400 (65%)
Married***	4080 (19%)	1044 (28%)
Employed***	4207 (19%)	854 (23%)
Unstably housed***	9021 (42%)	1282 (35%)
<b>Age</b>		
≤24***	4439 (21%)	922 (25%)
25-34***	6127 (28%)	1342 (36%)
35-44***	6012 (28%)	889 (24%)
≥45***	5006 (23%)	563 (15%)
<b>Program Type</b>		
Rehab***	3833 (18%)	1021 (27%)
Non-Rehab (Outpatient/Detox)***	17751 (82%)	2695 (73%)
Patient receiving MAT***	4680 (22%)	203 (5%)
Psych Problems***	5625 (26%)	1370 (37%)
<b>Drug use reported at admit</b>		
Heroin***	17058 (79%)	946 (25%)
Non prescription Methadone***	384 (2%)	246 (7%)
Cocaine/Crack***	7811 (36%)	1058 (28%)
Synthetic opioids***	5618 (26%)	2766 (74%)
Benzodiazepine***	1510 (7%)	416 (11%)
<b># of subs reported at admit</b>		
1***	7160 (33%)	575 (15%)
2***	7343 (34%)	1109 (30%)
3***	7081 (33%)	2032 (55%)
IDU***	9716 (45%)	1081 (29%)
<b>Client Insurance Type</b>		
Medicaid***	6842 (32%)	527 (14%)
Medicare	1742 (8%)	302 (8%)
No insurance***	10761 (50%)	2665 (71%)
Private Insurance***	2239 (10%)	222 (6%)
<b>Primary Source of Income</b>		
Public Assistance***	1753 (8%)	214 (6%)
Retirement/Pension***	2851 (13%)	236 (6%)
Other Income***	2896 (13%)	310 (8%)
No income***	8906 (41%)	1864 (50%)
Salary***	5178 (24%)	1092 (29%)
	Medicaid Coverage	No Medicaid Coverage
	N=21,584	N=3,716
<b>Continuous variables</b>		
Rate of methadone programs/10K pop***	6.56	1.99
Rate of individuals in tx/1M pop***	40.15	9.11
Percent of residents rec'v Medicaid***	18.9	21.32

\*\*\*p<.0001

\*\*p<.001

\*p<.05

Table 3.5: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, Combined 1998-2008, N=25,300

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	4.79***	4.14-5.54	4.48***	3.87-5.21	3.03***	2.58-3.56	3.16***	2.69-3.73	6.11***	5.03-7.40	6.42***	5.26-7.78	5.37***	3.72-7.76
Male			0.66***	0.62-0.71	0.64***	0.59-0.68	0.65***	0.60-0.70	0.73***	0.68-0.79	0.733***	0.68-0.79	0.73***	0.68-0.79
Race														
Black			1.54***	1.42-1.67	1.26***	1.13-1.39	1.19*	1.07-1.31	0.88*	0.79-0.98	0.88*	0.79-0.98	0.88*	0.79-0.98
Other Race			0.59***	0.50-0.71	0.52***	0.43-0.62	0.53***	0.44-0.64	0.57***	0.47-0.68	0.55***	0.46-0.67	0.55***	0.46-0.68
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			1.85***	1.59-2.15	1.68***	1.44-1.97	1.73***	1.48-2.04	1.57***	1.33-1.85	1.57***	1.34-1.85	1.57***	1.34-1.86
HS Education			0.90*	0.84-0.97	0.87**	0.81-0.94	0.90**	0.83-0.97	0.93	0.87-1.01	0.94	0.85-1.01	0.94	0.87-1.02
Married			1.22***	1.13-1.32	1.27***	1.17-1.39	1.26***	1.15-1.37	1.19**	1.09-1.30	1.19**	1.09-1.30	1.19**	1.09-1.30
Employed			1.90***	1.76-2.06	1.88***	1.72-2.05	1.48***	1.30-1.69	1.30**	1.13-1.50	1.27**	1.11-1.47	1.28**	1.11-1.47
Unstably Housed			1.03	0.96-1.10	1.16***	1.08-1.25	1.15**	1.07-1.25	0.91*	0.85-1.00	0.92	0.85-1.00	0.92	0.85-1.00
Age														
age124			0.32***	0.28-0.36	0.33***	0.29-0.38	0.33***	0.29-0.38	0.37***	0.32-0.42	0.37***	0.32-0.42	0.37***	0.32-0.42
age2534			0.53***	0.49-0.59	0.57***	0.51-0.62	0.54***	0.49-0.60	0.63***	0.56-0.70	0.62***	0.56-0.69	0.62***	0.56-0.69
age3544			0.70***	0.65-0.77	0.74***	0.68-0.81	0.72***	0.65-0.78	0.76***	0.70-0.84	0.76***	0.69-0.83	0.76***	0.69-0.83
age45ov (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.17***	0.14-0.20	0.16***	0.14-0.19	0.16***	0.14-0.19	0.16***	0.14-0.19	0.16***	0.14-0.19
Psych problems					0.76***	0.69-0.83	0.76***	0.70-0.84	0.89*	0.80-0.97	0.90*	0.81-0.98	0.90*	0.81-0.98
Drug Use														
Heroin					5.64***	4.77-6.62	5.75***	4.88-6.80	6.44***	5.41-7.66	6.42***	5.37-7.61	6.36***	5.36-7.60
Non-rx Methadone					8.94***	7.17-11.08	8.25***	6.64-10.31	7.17***	5.70-8.98	7.17***	5.74-9.05	7.24***	5.76-9.11
Cocaine					1.34***	1.20-1.48	1.30***	1.16-1.45	1.22**	1.09-1.36	1.21**	1.09-1.36	1.22**	1.08-1.35
Synthetic Opioids					3.94***	3.39-4.58	3.90***	3.36-4.55	3.90***	3.32-4.57	3.94	3.36-4.63	3.97***	3.37-4.65
Benzodiazepines					1.30**	1.09-1.54	1.43***	1.21-1.71	2.03***	1.69-2.44	2.01***	1.68-2.43	2.03***	1.67-2.42
Ttl # of Drugs Used														
1					4.18***	3.65-4.77	4.44***	3.88-5.09	4.35***	3.77-4.96	4.35***	3.81-5.01	4.39***	3.82-5.03
2					1.99***	1.81-2.21	2.03***	1.83-2.24	1.97***	1.79-2.20	1.99***	1.80-2.22	1.99***	1.79-2.21
3 (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
IDU					1.04***	0.96-1.13	1.06	0.97-1.16	1.31***	1.20-1.44	1.30***	1.19-1.42	1.30***	1.19-1.42
Health Insurance Type														
Medicaid							1.09	0.94-1.27	1.52***	1.30-1.78	1.52***	1.30-1.78	1.52***	1.29-1.78
Medicare							0.57***	0.46-0.70	0.88	0.71-1.09	0.87	0.70-1.08	0.86	0.70-1.07
No insurance							1.62***	1.40-1.84	1.39***	1.21-1.60	1.40***	1.22-1.61	1.40***	1.22-1.61
Private Insurance (ref)							ref	ref	ref	ref	ref	ref	ref	ref
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Primary Income														
Public Assistance							1.43***	1.22-1.70	1.16	0.98-1.38	1.15	0.96-1.36	1.15	0.97-1.37
Retirement/Pension							0.72***	0.61-0.85	0.55***	0.46-0.65	0.55***	0.46-0.66	0.55***	0.46-0.66
Other Income Source							1.07	0.92-1.24	0.93	0.80-1.10	0.92	0.78-1.08	0.92	0.79-1.08
No Income							0.61***	0.53-0.70	0.66***	0.57-0.76	0.66***	0.57-0.77	0.66***	0.57-0.77
Salary (ref)							ref	ref	ref	ref	ref	ref	ref	ref
State Level Variables														
Methadone Prog Rate									1.40***	1.37-1.45	1.43***	1.39-1.47	1.43***	1.39-1.47
Rate of Indiv in Tx									0.93***	0.93-0.94	0.93***	0.93-0.94	0.93***	0.93-0.94
% of res w/Medicaid									1.04***	1.03-1.05	1.05***	1.04-1.07	1.05***	1.04-1.07
Time											0.73***	0.63-0.84	0.59*	0.40-0.88
Medicaid Cov * Time													1.26	0.83-1.89

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level

Model 6: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level

Model 7: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

Table 3.6: Model Building Summary Using Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, Combined 1998-2008, N=90,005

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	4.41***	4.10-4.75	4.22***	3.90-4.53	2.80***	2.59--3.05	2.94***	2.72-3.20	5.58***	5.04-6.13	5.81***	5.26-6.41	4.30***	3.61-5.18
Male			0.68***	0.66-0.71	0.65***	0.63-0.68	0.66***	0.63-0.68	0.76***	0.73-0.79	0.76***	0.73-0.79	0.76***	0.73-0.79
Race														
Black			1.55***	1.49-1.63	1.23***	1.16-1.30	1.14***	1.08-1.21	0.89***	0.84-0.94	0.88***	0.83-0.93	0.88***	0.83-0.93
Other Race			0.63***	0.57-0.69	0.53***	0.48-0.58	0.55***	0.50-0.60	0.61***	0.55-0.67	0.60***	0.54-0.66	0.59***	0.54-0.66
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			1.77***	1.63-1.91	1.65***	1.52-1.80	1.72***	1.58-1.87	1.51***	1.39-1.65	1.51***	1.39-1.65	1.51***	1.39-1.65
HS Education			0.89***	0.85-0.92	0.86***	0.83-0.90	0.90***	0.86-0.93	0.94*	0.91-0.99	0.95*	0.91-0.99	0.94*	0.91-0.99
Married			1.24***	1.18-1.28	1.31***	1.25-1.37	1.30***	1.24-1.35	1.22***	1.16-1.28	1.22***	1.16-1.28	1.22***	1.16-1.28
Employed			2.03***	1.95-2.12	1.97***	1.88-2.06	1.55***	1.45-1.67	1.40***	1.31-1.52	1.39***	1.29-1.50	1.39***	1.30-1.50
Unstably Housed			1.03	0.99-1.07	1.17***	1.13-1.22	1.19***	1.14-1.23	0.93**	0.89-0.97	0.93*	0.89-0.97	0.93*	0.89-0.97
Age														
<24			0.36***	0.34-0.38	0.38***	0.35-0.40	0.38***	0.36-0.41	0.43***	0.40-0.47	0.44***	0.40-0.46	0.43***	0.40-0.46
25-34			0.56***	0.53-0.59	0.58***	0.56-0.62	0.58***	0.55-0.61	0.66***	0.63-0.70	0.66***	0.62-0.70	0.66***	0.63-0.70
35-44			0.70***	0.68-0.74	0.74***	0.71-0.78	0.73***	0.69-0.76	0.79***	0.75-0.82	0.77***	0.73-0.81	0.77***	0.73-0.81
>44 (ref)			ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.16***	0.15-0.18	0.16***	0.14-0.17	0.16***	0.15-0.17	0.16***	0.14-0.17	0.16***	0.14-0.17
Psych problems					0.83***	0.79-0.86	0.84***	0.79-0.87	0.96	0.91-1.01	0.97	0.92-1.02	0.97	0.92-1.02
Drug Use														
Heroin					6.17***	5.68-6.74	6.36***	5.82-6.92	7.03***	6.44-7.72	6.96***	6.36-7.62	6.96***	6.32-7.58
Non-rx Methadone					7.17***	6.33-8.06	6.69***	5.94-7.59	6.23***	5.50-7.07	6.23***	5.50-7.07	6.30***	5.54-7.12
Cocaine					1.39***	1.32-1.48	1.36***	1.29-1.44	1.30***	1.23-1.38	1.30***	1.23-1.38	1.31***	1.23-1.38
Synthetic Opioids					4.10***	3.80-4.43	4.06***	3.75-4.39	4.10***	3.79-4.47	4.18***	3.83-4.52	4.18***	3.85-4.54
Benzodiazepines					1.30***	1.18-1.41	1.43***	1.31-1.57	1.97***	1.79-2.17	1.95***	1.78-2.16	1.97***	1.79-2.17
Ttl # of Drugs Used														
1					3.97***	3.72-4.28	4.31***	3.99-4.60	4.26***	3.96-4.58	4.31***	4.00-4.61	4.31***	4.01-4.63
2					1.90***	1.80-2.00	1.93***	1.84-2.05	1.92***	1.82-2.03	1.93***	1.83-2.04	1.93***	1.83-2.04
3 (ref)					ref	ref	ref	ref	ref	ref	ref	ref	ref	ref
IDU					0.99	0.95-1.03	1.01	0.97-1.06	1.26***	1.20-1.32	1.25***	1.19-1.31	1.25***	1.19-1.31
Health Insurance Type														
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Medicaid							0.99	0.91-1.07	1.39***	1.28-1.52	1.39***	1.28-1.51	1.39***	1.27-1.51
Medicare							0.58***	0.52-0.64	0.90	0.81-1.01	0.90	0.80-1.00	0.89*	0.80-1.00
No insurance							1.63***	1.52-1.75	1.42***	1.31-1.52	1.42***	1.32-1.53	1.42***	1.32-1.53
Private Insurance (ref)							ref	ref	ref	ref	ref	ref	ref	ref
Primary Income														
Public Assistance							1.46***	1.35-1.60	1.26***	1.15-1.38	1.25***	1.14-1.37	1.26***	1.14-1.37
Retirement/Pension							0.84***	0.77-0.92	0.64***	0.59-0.71	0.65***	0.59-0.71	0.65***	0.59-0.71
Other Income Source							1.07	0.99-1.16	0.98	0.90-1.06	0.97	0.89-1.05	0.97	0.89-1.06
No Income							0.61***	0.57-0.66	0.68***	0.63-0.73	0.69***	0.64-0.74	0.68***	0.63-0.74
Salary (ref)							ref	ref	ref	ref	ref	ref	ref	ref
State Level Variables														
Methadone Prog Rate									1.39***	1.37-1.40	1.40***	1.39-1.43	1.40***	1.39-1.43
Rate of Indiv in Tx									0.93***	0.93-0.94	0.93***	0.93-0.94	0.93***	0.93-0.94
% of res w/Medicaid									1.04***	1.03-1.04	1.05***	1.04-1.06	1.05***	1.04-1.06
Time											0.73***	0.67-0.78	0.51***	0.42-0.62
Medicaid Cov * Time													1.48**	1.21-1.81

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance and income covariates

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates and state-level

Model 6: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level

Model 7: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and income covariates, state-level

\*\*\*=p&lt;0.0001

\*\*=p&lt;0.001

\*=p&lt;0.05

Table 3.7: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, 2008, N=24,600

	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	5.24***	4.46-6.16	4.86***	4.12-5.73	3.32***	2.79-3.99	3.53***	2.93-4.21	8.16***	6.51-10.22
Male			0.68***	0.63-0.73	0.65***	0.61-0.70	0.65***	0.61-0.70	0.76***	0.71-0.82
Race										
Black			1.67***	1.53-1.82	1.25***	1.13-1.39	1.16*	1.04-1.30	0.86*	0.77-0.96
Other Race			0.65***	0.54-0.78	0.57***	0.48-0.69	0.59***	0.49-0.72	0.65***	0.54-0.79
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			1.63***	1.39-1.90	1.40***	1.20-1.65	1.48***	1.26-1.75	1.40***	1.19-1.66
HS Education			0.87**	0.81-0.94	0.84***	0.79-0.91	0.88**	0.81-0.95	0.92*	0.85-1.00
Married			1.26***	1.16-1.37	1.34***	1.23-1.46	1.31***	1.20-1.43	1.22***	1.12-1.34
Employed			2.05***	1.88-2.23	1.97***	1.81-2.17	1.63***	1.41-1.88	1.52***	1.31-1.78
Unstably Housed			1.13**	1.05-1.21	1.30***	1.20-1.40	1.28***	1.18-1.39	0.97	0.89-1.06
Age										
age<24			0.38***	0.34-0.43	0.40***	0.35-0.46	0.39***	0.35-0.45	0.43***	0.34-0.49
age25-34			0.57***	0.51-0.62	0.57***	0.52-0.63	0.55***	0.50-0.62	0.62***	0.55-0.69
age35-44			0.69***	0.63-0.75	0.70***	0.64-0.77	0.69***	0.63-0.76	0.76***	0.69-0.83
age45+ (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.20***	0.17-0.23	0.19***	0.17-0.23	0.20***	0.17-0.23
Psych problems					0.84**	0.77-0.92	0.85**	0.78-0.94	1.02	0.93-1.13
Drug Use										
Heroin					5.47***	4.63-6.45	5.53***	4.68-6.55	6.05***	5.08-7.22
Non-rx Methadone					7.24***	5.74-9.06	6.62***	5.24-8.32	6.17***	4.88-7.86
Cocaine					1.36***	1.22-1.52	1.32***	1.18-1.48	1.25***	1.11-1.40
Synthetic Opioids					3.67***	3.16-4.27	3.56***	3.06-4.15	3.78***	3.22-4.45
Benzodiazepines					1.04	0.86-1.25	1.16	0.96-1.40	1.62***	1.33-1.98
Ttl # of Drugs Used										
1					3.86***	3.35-4.41	4.10***	3.56-4.69	3.94***	3.42-4.52
2					1.95***	1.76-2.16	1.97***	1.78-2.20	1.92***	1.72-2.13
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.94	0.86-1.03	0.96	0.88-1.05	1.26***	1.14-1.38
Health Insurance Type										
Medicaid							0.94	0.81-1.11	1.36**	1.15-1.61
Medicare							0.51***	0.41-0.63	0.86	0.68-1.08
No insurance							1.57***	1.36-1.82	1.40***	1.21-1.63
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							1.39**	1.17-1.66	1.19	0.98-1.43
Retirement/Pension							0.84*	0.70-0.99	0.65***	0.54-0.78
Other Income Source							1.20*	1.02-1.41	1.06	0.93-1.26
No Income							0.68***	0.59-0.78	0.75**	0.64-0.88
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Methadone Prog Rate									1.42***	1.38-1.46
Rate of Indiv in Tx									0.93***	0.93-0.94
% of res w/Medicaid									1.05***	1.04-1.07

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

Table 3.8: Model Building Summary Using Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone 2008, N=81,694

	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Methadone covered	4.72***	4.34-5.12	4.39***	4.03-4.78	3.00***	2.74-3.30	3.19***	2.90-3.50	8.00***	7.08-8.99
Male			0.67***	0.65-0.70	0.64***	0.62-0.67	0.64***	0.62-0.67	0.75***	0.72-0.78
Race										
Black			1.72***	1.64-1.80	1.30***	1.23-1.38	1.22***	1.15-1.29	0.86***	0.81-0.91
Other Race			0.56***	0.51-0.62	0.47***	0.42-0.52	0.49***	0.44-0.54	0.56***	0.50-0.62
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			2.01***	1.84-2.18	1.88***	1.72-2.05	1.95***	1.80-2.15	1.75***	1.60-1.92
HS Education			0.88***	0.84-0.91	0.85***	0.82-0.89	0.88***	0.85-0.92	0.94*	0.90-0.98
Married			1.26***	1.21-1.32	1.32***	1.27-1.39	1.31***	1.24-1.37	1.23***	1.18-1.30
Employed			2.05***	1.97-2.16	1.97***	1.88-2.08	1.51***	1.40-1.63	1.40***	1.30-1.53
Unstably Housed			1.13***	1.08-1.17	1.27***	1.22-1.32	1.27***	1.21-1.32	0.93*	0.89-0.98
Age										
age124			0.39***	0.36-0.41	0.41***	0.38-0.44	0.41***	0.38-0.44	0.43***	0.40-0.47
age2534			0.59***	0.56-0.63	0.61***	0.58-0.65	0.60***	0.57-0.64	0.66***	0.62-0.70
age3544			0.69***	0.66-0.73	0.71***	0.680.75	0.70***	0.66-0.73	0.76***	0.72-0.80
age45ov (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.19***	0.17-0.21	0.18***	0.17-0.20	0.19***	0.18-0.21
Psych problems					0.84***	0.81-0.89	0.85***	0.81-0.90	1.02	0.96-1.07
Drug Use										
Heroin					5.42***	4.96-5.97	5.53***	5.06-6.10	6.05***	5.51-6.69
Non-rx Methadone					7.54***	6.62-8.53	6.96***	6.14-7.91	6.49***	5.67-7.37
Cocaine					1.35***	1.28-1.44	1.32***	1.25-1.41	1.26***	1.19-1.35
Synthetic Opioids					3.63***	3.36-3.97	3.60***	3.29-3.90	3.78***	3.44-4.12
Benzodiazepines					1.14*	1.03-1.25	1.26***	1.14-1.39	1.79***	1.60-1.98
Ttl # of Drugs Used										
1					3.82***	3.54-4.11	4.10***	3.78-4.40	3.94***	3.64-4.25
2					1.86***	1.75-1.97	1.90***	1.78-2.00	1.84***	1.73-1.95
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					0.92**	0.88-0.97	0.94*	0.90-0.99	1.23***	1.18-1.30
Health Insurance Type										
Medicaid							0.98	0.90-1.07	1.35***	1.23-1.48
Medicare							0.59***	0.53-0.66	0.93	0.82-1.05
No insurance							1.60***	1.49	1.38***	1.28-1.50
Private Insurance (ref)							ref	1.74	ref	ref
Primary Income										
Public Assistance							1.35***	1.23-1.48	1.19**	1.07-1.31
Retirement/Pension							0.76***	0.69-0.83	0.59***	0.53-0.65
Other Income Source							1.04	0.95-1.13	0.95	0.87-1.04
No Income							0.61***	0.56-0.65	0.68***	0.63-0.75
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Methadone Prog Rate									1.43***	1.41-1.46
Rate of Indiv in Tx									0.93***	0.93-0.93
% of res w/Medicaid									1.07***	1.06-1.08

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

Table 3.9: Model Building Summary Using Multiple Imputation Sample for Utilization of MAT and Medicaid Coverage of Methadone, 2008, N=2,305,020

	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	2.79*	2.73-2.84	2.72***	2.66-2.78	1.95***	1.91-2.00	1.97***	1.93-2.01	2.59***	2.54-2.65
Male			0.75***	0.75-0.76	0.73***	0.73-0.74	0.76***	0.75-0.76	0.79***	0.79-0.80
Race										
Black			1.22***	1.21-1.23	1.12***	1.10-1.12	1.06***	1.05-1.07	1.05***	1.04-1.07
Other Race			1.16***	1.15-1.18	1.16***	1.14-1.17	1.12***	1.10-1.13	1.11***	1.09-1.12
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			1.49***	1.47-1.51	1.30***	1.28-1.31	1.27***	1.26-1.29	1.27***	1.25-1.28
HS Education			0.90***	0.89-0.90	0.89***	0.88-0.89	0.90***	0.90-0.91	0.91***	0.91-0.92
Married			1.09***	1.08-1.10	1.14***	1.13-1.15	1.16***	1.15-1.17	1.13***	1.12-1.14
Employed			1.77***	1.76-1.79	1.73***	1.71-1.74	1.67***	1.64-1.69	1.57***	1.56-1.60
Unstably Housed			0.61***	0.60-0.61	0.68***	0.67-0.68	0.68***	0.68-0.69	0.64***	0.63-0.64
Age										
aget24			0.38***	0.37-0.38	0.44***	0.43-0.44	0.45***	0.44-0.45	0.48***	0.48-0.49
age2534			0.55***	0.55-0.56	0.58***	0.58-0.59	0.58***	0.58-0.59	0.63***	0.62-0.63
age3544			0.66***	0.65-0.66	0.70***	0.69-0.71	0.70***	0.69-0.70	0.74***	0.74-0.75
age45ov (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.13***	0.13-0.14	0.13***	0.13-0.14	0.13***	0.13-0.14
Psych problems					0.99	0.99-1.00	0.98**	0.98-0.99	1.08***	1.08-1.09
Drug Use										
Heroin					5.64***	5.57-5.73	5.58***	5.51-5.68	6.55***	6.46-6.66
Non-rx Methadone					6.69***	6.53-6.79	6.55***	6.45-6.72	6.75***	6.62-6.89
Cocaine					1.57***	1.55-1.58	1.54***	1.53-1.56	1.65***	1.63-1.66
Synthetic Opioids					3.42***	3.38-3.48	3.42***	3.39-3.48	3.46***	3.39-3.49
Benzodiazepines					1.38***	1.36-1.40	1.39***	1.38-1.42	1.51***	1.49-1.54
Ttl # of Drugs Used										
1					5.05***	5.00-5.12	5.21***	5.12-5.25	5.10***	5.02-5.15
2					2.25***	2.22-2.26	2.25***	2.23-2.27	2.18***	2.15-2.20
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					1.13***	1.12-1.14	1.15***	1.14-1.15	1.09***	1.08-1.10
Health Insurance Type										
Medicaid							1.38***	1.36-1.40	1.31***	1.30-1.34
Medicare							1.03*	1.01-1.04	0.91***	0.90-0.93
No insurance							1.34***	1.32-1.35	1.19***	1.17-1.20
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Asstistance							1.52***	1.50-1.55	1.43***	1.42-1.47
Retirement/Pension							0.88***	0.86-0.89	0.91***	0.89-0.93
Other Income Source							0.91***	0.90-0.93	0.90***	0.88-0.91
No Income							0.83***	0.82-0.84	0.76***	0.75-0.77
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Methadone Prog Rate									1.003*	1.00-1.01
Rate of Indiv in Tx									0.99***	0.99-0.99
% of res w/Medicaid									1.02***	1.02-1.02

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

Table 3.10: Model Building Summary Using Bootstrapped Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, 1998, N=25,000

	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	4.22***	3.84-4.65	4.48***	4.05-4.94	3.39***	3.05-3.80	2.75***	2.45-3.07	2.32***	2.06-2.62
Male			0.84***	0.79-0.89	0.82***	0.76-0.88	0.93	0.87-1.01	0.94	0.87-1.02
Race										
Black			0.90*	0.83-0.96	0.85**	0.78-0.93	0.76***	0.70-0.84	0.63***	0.56-0.69
Other Race			0.97	0.85-1.11	0.75**	0.64-0.88	0.75**	0.64-0.89	0.78*	0.66-0.92
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.75***	0.66-0.86	0.70***	0.60-0.83	0.72***	0.61-0.85	0.82*	0.69-0.96
HS Education			0.95	0.88-1.01	0.98	0.91-1.06	1.06	0.98-1.15	1.11*	1.02-1.19
Married			0.92*	0.86-0.99	1.00	0.92-1.09	1.09*	1.01-1.19	1.11*	1.02-1.20
Employed			1.57***	1.46-1.67	1.31***	1.22-1.42	1.51***	1.35-1.68	1.62***	1.44-1.81
Unstably Housed			0.43***	0.40-0.46	0.51***	0.47-0.55	0.55***	0.51-0.59	0.51***	0.47-0.55
Age										
age124			0.26***	0.23-0.30	0.30***	0.26-0.35	0.35***	0.31-0.41	0.33***	0.29-0.39
age2534			0.50***	0.46-0.55	0.64***	0.57-0.71	0.70***	0.63-0.79	0.69***	0.62-0.77
age3544			0.66***	0.61-0.72	0.78***	0.71-0.86	0.82***	0.74-0.90	0.80***	0.72-0.89
age45ov (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.02***	0.02-0.03	0.02***	0.02-0.03	0.02***	0.02-0.03
Psych problems					0.84***	0.77-0.91	0.77***	0.70-0.85	0.75***	0.69-0.82
Drug Use										
Heroin					23.34***	19.79-27.68	25.28***	21.22-29.96	22.65***	18.99-26.82
Non-rx Methadone					3.90***	2.98-5.13	4.71***	3.57-6.19	4.71***	3.56-6.20
Cocaine					1.60***	1.44-1.76	1.60***	1.45-1.77	1.54***	1.39-1.71
Synthetic Opioids					9.97***	8.59-11.55	11.13***	9.58-13.02	12.18***	10.49-14.27
Benzodiazepines					4.57***	3.90-5.38	4.85***	4.12-5.75	5.00***	4.23-5.90
Ttl # of Drugs Used										
1					7.32***	6.49-8.27	7.69***	6.80-8.71	7.39***	6.55-8.40
2					2.51***	2.28-2.74	2.66***	2.43-2.92	2.61***	2.38-2.86
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					1.40***	1.29-1.52	1.51***	1.39-1.64	1.63***	1.50-1.78
Health Insurance Type										
Medicaid							1.90***	1.64-2.19	2.18***	1.89-2.54
Medicare							0.57***	0.47-0.69	0.58***	0.48-0.70
No insurance							1.70***	1.52-1.90	1.84***	1.65-2.07
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Asstistance							1.97***	1.69-2.31	2.10***	1.79-2.45
Retirement/Pension							1.99***	1.71-2.33	2.27***	1.94-2.66
Other Income Source							1.48***	1.30-1.69	1.51***	1.32-1.72
No Income							0.52***	0.46-0.60	0.678***	0.59-0.78
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Methadone Prog Rate									1.12*	1.04-1.20
Rate of Indiv in Tx									1.00	0.98-1.01
% of res w/Medicaid									0.94***	0.93-0.97

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05



Table 3.11: Model Building Summary Using Listwise Deletion Sample for Utilization of MAT and Medicaid Coverage of Methadone, 1998, N=8,311

	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	4.02***	3.42-4.73	4.24***	3.59-5.01	3.19***	2.66-3.84	2.57***	2.12-3.11	2.18***	1.78-2.67
Male			0.84*	0.75-0.93	0.82*	0.72-0.93	0.92	0.80-1.05	0.92	0.81-1.05
Race										
Black			0.89	0.78-1.01	0.85*	0.72-0.99	0.76*	0.64-0.90	0.63***	0.53-0.76
Other Race			1.06	0.84-1.34	0.88	0.67-1.15	0.87	0.66-1.15	0.90	0.68-1.18
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.75*	0.59-0.94	0.66*	0.51-0.86	0.69*	0.53-0.90	0.76*	0.58-0.99
HS Education			0.95	0.85-1.08	0.96	0.84-1.09	1.04	0.91-1.20	1.08	0.94-1.24
Married			0.95	0.84-1.07	1.01	0.88-1.16	1.11	0.95-1.27	1.12	0.97-1.29
Employed			1.51***	1.35-1.69	1.28**	1.13-1.46	1.47**	1.21-1.78	1.57***	1.29-1.91
Unstably Housed			0.44***	0.39-0.50	0.51***	0.45-0.59	0.56***	0.49-0.64	0.52***	0.45-0.60
Age										
age<24			0.28***	0.23-0.35	0.32***	0.25-0.40	0.37***	0.29-0.48	0.35***	0.28-0.46
age25-34			0.51***	0.44-0.60	0.62***	0.51-0.74	0.67***	0.55-0.81	0.65***	0.54-0.79
age35-44			0.67***	0.58-0.78	0.77*	0.65-0.91	0.80*	0.67-0.95	0.78*	0.66-0.93
age45+ (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.02***	0.01-0.03	0.02***	0.01-0.03	0.02***	0.01-0.03
Psych problems					0.83*	0.71-0.97	0.76*	0.65-0.90	0.75**	0.64-0.88
Drug Use										
Heroin					20.25***	15.20-26.97	21.83***	16.27-29.32	19.89***	14.82-26.71
Non-rx Methadone					4.45***	2.82-7.01	5.15***	3.24-8.18	5.16***	3.23-8.22
Cocaine					1.66***	1.40-1.96	1.66***	1.40-1.97	1.60***	1.35-1.91
Synthetic Opioids					9.15***	7.10-11.79	10.07***	7.76-13.09	11.02***	8.46-14.31
Benzodiazepines					4.37***	3.31-5.77	4.80***	3.60-6.39	4.85***	3.65-6.48
Ttl # of Drugs Used										
1					7.51***	6.09-9.25	7.77***	6.28-9.61	7.54***	6.09-9.33
2					2.44***	2.09-2.85	2.59***	2.21-3.03	2.53***	2.16-2.98
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					1.46***	1.28-1.68	0.45***	1.36-1.80	1.67***	1.44-1.92
Health Insurance Type										
Medicaid							1.70***	1.33-2.19	1.93***	1.50-2.49
Medicare							0.54**	0.39-0.75	0.55**	0.40-0.76
No insurance							1.62***	1.33-1.95	1.73***	1.43-2.11
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							2.03***	1.56-2.68	2.14***	1.63-2.82
Retirement/Pension							1.95***	1.49-2.56	2.18***	1.66-2.88
Other Income Source							1.42*	1.13-1.78	1.43*	1.14-1.81
No Income							0.53***	0.42-0.67	0.68*	0.53-0.87
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Methadone Prog Rate									1.14*	1.01-1.29
Rate of Indiv in Tx									0.99	0.97-1.01
% of res w/Medicaid									0.96*	0.92-0.99

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance and

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

Table 3.12: Model Building Summary Using Multiple Imputation Sample for Utilization of MAT and Medicaid Coverage of Methadone, 1998, N=1,497,260

	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Methadone covered	2.38***	2.35-2.43	2.06***	2.02-2.09	1.45***	1.42-1.47	1.57***	1.53-1.59	2.69***	2.63-2.74
Male			0.73***	0.72-0.73	0.68***	0.68-0.69	0.72***	0.71-0.73	0.78***	0.77-0.79
Race										
Black			1.09***	1.08-1.10	1.12***	1.10-1.13	1.03***	1.02-1.05	1.16***	1.15-1.18
Other Race			1.84***	1.82-1.87	1.62***	1.60-1.65	1.55***	1.53-1.59	1.48***	1.46-1.51
White (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Hispanic			0.97***	0.95-0.98	0.90***	0.89-0.92	0.87***	0.85-0.88	0.99	0.97-1.01
HS Education			0.96***	0.95-0.96	0.93***	0.93-0.95	0.96***	0.95-0.97	0.93***	0.92-0.94
Married			0.99*	0.98-1.00	1.04***	1.03-1.05	1.12***	1.10-1.12	1.06***	1.05-1.08
Employed			2.12***	2.10-2.14	2.03***	2.01-2.05	2.83***	2.79-2.89	1.97***	1.94-2.01
Unstably Housed			0.48***	0.48-0.49	0.59***	0.58-0.60	0.59***	0.59-0.60	0.73***	0.72-0.74
Age										
age124			0.30***	0.29-0.30	0.34***	0.34-0.35	0.38***	0.37-0.38	0.41***	0.40-0.42
age2534			0.45***	0.45-0.46	0.52***	0.51-0.52	0.53***	0.52-0.53	0.61***	0.60-0.62
age3544			0.64***	0.63-0.64	0.69***	0.68-0.70	0.70***	0.69-0.71	0.76***	0.76-0.77
age45ov (ref)			ref	ref	ref	ref	ref	ref	ref	ref
Rehab					0.07***	0.07-0.07	0.07***	0.07-0.08	0.07***	0.07-0.07
Psych problems					0.55***	0.55-0.56	0.58***	0.57-0.59	0.79***	0.78-0.80
Drug Use										
Heroin					10.18***	9.86-10.46	9.78***	9.52-10.11	15.03***	14.64-15.58
Non-rx Methadone					2.75***	2.66-2.83	2.44***	2.35-2.51	3.25***	3.16-3.37
Cocaine					2.16***	2.13-2.19	2.16***	2.13-2.19	2.34***	2.31-2.37
Synthetic Opioids					3.67***	3.60-3.78	3.67***	3.60-3.78	3.42***	3.32-3.49
Benzodiazepines					2.05***	2.00-2.11	2.10***	2.04-2.15	2.44***	2.38-2.51
Ttl # of Drugs Used										
1					10.18***	9.98-10.29	9.97***	9.85-10.16	10.38***	10.19-10.51
2					2.83***	2.79-2.85	2.80***	2.77-2.84	2.92***	2.89-2.96
3 (ref)					ref	ref	ref	ref	ref	ref
IDU					1.95***	1.94-1.98	1.84***	1.83-1.86	1.26***	1.24-1.27
Health Insurance Type										
Medicaid							2.61***	2.56-2.65	1.86***	1.83-1.90
Medicare							1.48***	1.45-1.50	1.21***	1.19-1.24
No insurance							1.73***	1.71-1.76	1.25***	1.23-1.27
Private Insurance (ref)							ref	ref	ref	ref
Primary Income										
Public Assistance							1.35***	1.33-1.38	1.05***	1.03-1.07
Retirement/Pension							1.63***	1.59-1.68	1.20***	1.17-1.23
Other Income Source							1.07***	1.06-1.10	0.89***	0.87-0.90
No Income							1.51***	1.48-1.53	0.78***	0.76-0.79
Salary (ref)							ref	ref	ref	ref
State Level Variables										
Methadone Prog Rate									0.84***	0.84-0.85
Rate of Indiv in Tx									0.99***	0.99-0.99
% of res w/Medicaid									1.09***	1.09-1.09

Model 1: Unadjusted association between Medicaid coverage of methadone and MAT use

Model 2: Medicaid coverage of methadone and demographic covariates

Model 3: Medicaid coverage of methadone, demographic covariates and substance use and treatment covariates

Model 4: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates and health insurance

Model 5: Medicaid coverage of methadone, demographic covariates, substance use and treatment covariates, health insurance

\*\*\*=p<0.0001

\*\*=p<0.001

\*=p<0.05

## References

1. Substance Abuse and Mental Health Services Administration. Treatment Episode Data Set (TEDS): 2002-2012. National Admissions to Substance Abuse Treatment Services. Rockville, MD; 2014. [http://www.samhsa.gov/data/sites/default/files/TEDS2012N\\_Web.pdf](http://www.samhsa.gov/data/sites/default/files/TEDS2012N_Web.pdf).
2. Substance Abuse and Mental Health Services Administration. Results from the 2002 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD; 2003.
3. Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD; 2014. <http://www.samhsa.gov/data/sites/default/files/NSDUHresultsPDFWHTML2013/Web/NSDUHresults2013.pdf>. Accessed February 4, 2015.
4. Mattick RP, Kimber J, Breen C, Davoli M. Buprenorphine maintenance versus placebo or methadone maintenance for opioid dependence. *Cochrane Database Syst Rev*. 2008;(2):CD002207. doi:10.1002/14651858.CD002207.pub3.
5. Mattick RP, Breen C, Kimber J, Davoli M. Methadone maintenance therapy versus no opioid replacement therapy for opioid dependence. *Cochrane Database Syst Rev*. 2009;(3):CD002209. doi:10.1002/14651858.CD002209.pub2.
6. Center for Substance Abuse Treatment. Medication-Assisted Treatment for Opioid Addiction in Opioid Treatment Programs. Rockville, MD; 2005. <http://www.ncbi.nlm.nih.gov/books/NBK64164/pdf/TOC.pdf>.
7. Becker WC, Fiellin D a, Merrill JO, et al. Opioid use disorder in the United States: insurance status and treatment access. *Drug Alcohol Depend*. 2008;94(1-3):207-213. doi:10.1016/j.drugalcdep.2007.11.018.
8. Adelman PK. Mental and substance use disorders among Medicaid recipients: prevalence estimates from two national surveys. *Adm Policy Ment Health*. 2003;31(2):111-129.
9. Rinaldo D. 50-State Table: Medicaid Financing of Medication-Assisted Treatment for Opiate Addiction.; 2008.
10. Lankenau SE, Teti M, Silva K, Jackson Bloom J, Harocopos A, Treese M. Initiation into prescription opioid misuse amongst young injection drug users. *Int J Drug Policy*. 2012;23(1):37-44. doi:10.1016/j.drugpo.2011.05.014.
11. Quintero G. Rx for a party: a qualitative analysis of recreational pharmaceutical use in a collegiate setting. *J Am Coll Health*. 58(1):64-70. doi:10.3200/JACH.58.1.64-72.
12. Benotsch EG, Koester S, Luckman D, Martin AM, Cejka A. Non-medical use of prescription drugs and sexual risk behavior in young adults. *Addict Behav*. 36(1-2):152-155. doi:10.1016/j.addbeh.2010.08.027.

13. Smith MY, Schneider MF, Wentz A, Hughes A, Haddox JD, Dart R. Quantifying morbidity associated with the abuse and misuse of opioid analgesics: a comparison of two approaches. *Clin Toxicol (Phila)*. 2007;45(1):23-30.
14. Hall AJ, Logan JE, Toblin RL, et al. Patterns of abuse among unintentional pharmaceutical overdose fatalities. *JAMA*. 2008;300(22):2613-2620. doi:10.1001/jama.2008.802.
15. Wunsch MJ, Nakamoto K, Behonick G, Massello W. Opioid deaths in rural Virginia: a description of the high prevalence of accidental fatalities involving prescribed medications. *Am J Addict*. 18(1):5-14. doi:10.1080/10550490802544938.
16. Substance Abuse and Mental Health Services Administration. Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD; 2014. <http://www.samhsa.gov/data/sites/default/files/NSDUHresultsPDFWHTML2013/Web/NSDUHresults2013.pdf>.
17. Lally R. Rising Opiate and Heroin Abuse among Young Adults a Public Health Epidemic. *Rutgers Today*. 2012.
18. Falkowski C. Drug Abuse Trends in Minneapolis/St. Paul, Minnesota-January 2013 Update.; 2013.
19. Cicero T, Ellis M, Surratt H. Effects of Abuse-Deterrent Formulation of OxyContin. *New Engl J Med*. 2012;367:187-189.
20. Banta-Green C. Heroin Trends Across Washington State (ADAI Info Brief).; 2013.
21. Pollini RA, Banta-Green CJ, Cuevas-Mota J, Metzner M, Teshale E, Garfein RS. Problematic use of prescription-type opioids prior to heroin use among young heroin injectors. *Subst Abuse Rehabil*. 2011;2(1):173-180. doi:10.2147/SAR.S24800.
22. Peavy KM, Banta-Green CJ, Kingston S, Hanrahan M, Merrill JO, Coffin PO. "Hooked on" prescription-type opiates prior to using heroin: results from a survey of syringe exchange clients. *J Psychoactive Drugs*. 44(3):259-265.
23. Unick GJ, Rosenblum D, Mars S, Ciccarone D. Intertwined epidemics: national demographic trends in hospitalizations for heroin- and opioid-related overdoses, 1993-2009. *PLoS One*. 2013;8(2):e54496. doi:10.1371/journal.pone.0054496.
24. Ouellet LJ, Wiebel WW, Jimenez AD, Needle R, Lambert E. Team research methods for studying intranasal heroin use and its HIV risks. In: Vol #157. Rockville, Md.: NIDA; 1995:182-211.
25. Gossop M, Griggiths P, Powis B, Strang J. Severity of heroin dependence and HIV risk. I. Sexual behavior. *AIDS Care*. 1993;5(2):149-157.
26. Nguyen TA, Vu VT, Nguyen VT, al. et. Explosive HIV epidemic among young heroin users in Quang Ninh Province, Vietnam: risk factors for HIV seropositivity. In: Barcelona, Spain; 2002.

27. Gyarmathy VA, Neaigus A, Miller M, Friedman SR, Des Jarlais DC. Risk correlates of prevalent HIV, hepatitis B virus, and hepatitis C virus infections among noninjecting heroin users. *J Acquir Immune Defic Syndr*. 2002;30(4):448-456.
28. Neaigus A, Gyarmathy VA, Miller M, Frajzyngier VM, Friedman SR, Des Jarlais DC. Transitions to injecting drug use among noninjecting heroin users: social network influence and individual susceptibility. *J Acquir Immune Defic Syndr*. 2006;41(4):493-503.
29. Neaigus A, Miller M, Friedman SR, Des Jarlais DC. Sexual transmission risk among noninjecting heroin users infected with human immunodeficiency virus or hepatitis C virus. *J Infect Dis*. 2001;184(3):359-363.
30. Des Jarlais DC, Arasteh K, Perlis T, et al. The transition from injection to non-injection drug use: long-term outcomes among heroin and cocaine users in New York City.
31. Parry C, Petersen P, Carney T, Dewing S, Needle R. Rapid assessment of drug use and sexual HIV risk patterns among vulnerable drug-using populations in Cape Town, Durban and Pretoria, South Africa. *SAHARA J*. 2008;5(3):113-119.
32. Birnbaum HG, White AG, Schiller M, Waldman T, Cleveland JM, Roland CL. Societal Costs of Prescription Opioid Abuse, Dependence, and Misuse in the United States. *Pain Med*. 2011;12(4):657-667. doi:10.1111/j.1526-4637.2011.01075.x.
33. Jaffe J. Opiates: Clinical Aspects. In: Lowinson JH, Ruiz P, Millman RB, Langrod JG, eds. *Substance Abuse: A Comprehensive Textbook*. 2nd ed. Philadelphia: Williams & Wilkins; 1992:186-194.
34. Greenstein R, Fudala P, O'Brien C. Alternative Pharmacotherapies for Opiate Addiction. In: Lowinson J, Ruiz P, Millman RB, Langrod J, eds. *Substance Abuse: A Comprehensive Textbook*. 2nd ed. Philadelphia: Williams & Wilkins; 1992:562-573.
35. Lowinson JH, Marion IJ, Joseph H, Dole VP. Methadone Maintenance. In: Lowinson J, Ruiz P, Millman R, Langrod J, eds. *Substance Abuse: A Comprehensive Textbook*. 2nd ed. Philadelphia: Williams & Wilkins; 1992:550-561.
36. Walsh SL, Eissenberg T. The clinical pharmacology of buprenorphine: extrapolating from the laboratory to the clinic. *Drug Alcohol Depend*. 2003;70(2 Suppl):S13-S27. <http://www.ncbi.nlm.nih.gov/pubmed/12738347>. Accessed August 9, 2013.
37. Kreek MJ, Borg L, Ducat E, Ray B. Pharmacotherapy in the treatment of addiction: methadone. *J Addict Dis*. 2010;29(2):200-216. doi:10.1080/10550881003684798.
38. Bukten A, Skurtveit S, Gossop M, et al. Engagement with opioid maintenance treatment and reductions in crime: a longitudinal national cohort study. *Addiction*. 2012;107(2):393-399. doi:10.1111/j.1360-0443.2011.03637.x.
39. Grönbladh L, Ohlund LS, Gunne LM. Mortality in heroin addiction: impact of methadone treatment. *Acta Psychiatr Scand*. 1990;82(3):223-227.

40. Caplehorn JR, Dalton MS, Cluff MC, Petrenas AM. Retention in methadone maintenance and heroin addicts' risk of death. *Addiction*. 1994;89(2):203-209.
41. Avants SK, Margolin A, Sindelar JL, et al. Day treatment versus enhanced standard methadone services for opioid-dependent patients: a comparison of clinical efficacy and cost. *Am J Psychiatry*. 1999;156(1):27-33.
42. Caplehorn JR, Ross MW. Methadone maintenance and the likelihood of risky needle-sharing. *Int J Addict*. 1995;30(6):685-698.
43. Metzger DS, Woody GE, McLellan AT, et al. Human immunodeficiency virus seroconversion among intravenous drug users in- and out-of-treatment: an 18-month prospective follow-up. *J Acquir Immune Defic Syndr*. 1993;6(9):1049-1056.
44. Novick DM, Joseph H, Croxson TS, et al. Absence of antibody to human immunodeficiency virus in long-term, socially rehabilitated methadone maintenance patients. *Arch Intern Med*. 1990;150(1):97-99.
45. Weber R, Ledergerber B, Opravil M, Siegenthaler W, Lüthy R. Progression of HIV infection in misusers of injected drugs who stop injecting or follow a programme of maintenance treatment with methadone. *BMJ*. 1990;301(6765):1362-1365.
46. Kandall SR, Doberczak TM, Jantunen M, Stein J. The methadone-maintained pregnancy. *Clin Perinatol*. 1999;26(1):173-183.
47. Whelan PJ, Remski K. Buprenorphine vs methadone treatment: A review of evidence in both developed and developing worlds. *J Neurosci Rural Pract*. 2012;3(1):45-50. doi:10.4103/0976-3147.91934.
48. Barnett PG, Rodgers JH, Bloch DA. A meta-analysis comparing buprenorphine to methadone for treatment of opiate dependence. *Addiction*. 2001;96(5):683-690. doi:10.1080/09652140020039053.
49. Levine H, Reif S, Lee M, Ritter G, Horgan C. Alcohol and Drug Services Study (ADSS) The National Treatment System: Outpatient Methadone Facilities. Rockville; 2004.
50. SAMHSA. Medication Assisted Treatment for Substance Use Disorders.
51. Reisinger HS, Schwartz RP, Mitchell SG, et al. Premature discharge from methadone treatment: patient perspectives. *J Psychoactive Drugs*. 2009;41(3):285-296.
52. Harris J, McElrath K. Methadone as social control: institutionalized stigma and the prospect of recovery. *Qual Health Res*. 2012;22(6):810-824. doi:10.1177/1049732311432718.
53. Holt M. Agency and dependency within treatment: drug treatment clients negotiating methadone and antidepressants. *Soc Sci Med*. 2007;64(9):1937-1947. doi:10.1016/j.socscimed.2007.01.011.

54. Ducharme LJ, Abraham AJ. State policy influence on the early diffusion of buprenorphine in community treatment programs. *Subst Abuse Treat Prev Policy*. 2008;3:17. doi:10.1186/1747-597X-3-17.
55. Stein BD, Gordon AJ, Sorbero M, Dick AW, Schuster J, Farmer C. The impact of buprenorphine on treatment of opioid dependence in a Medicaid population: recent service utilization trends in the use of buprenorphine and methadone. *Drug Alcohol Depend*. 2012;123(1-3):72-78. doi:10.1016/j.drugalcdep.2011.10.016.
56. Effective medical treatment of opiate addiction. National Consensus Development Panel on Effective Medical Treatment of Opiate Addiction. *JAMA*. 1998;280(22):1936-1943.
57. Knudsen HK, Abraham AJ, Oser CB. Barriers to the implementation of medication-assisted treatment for substance use disorders: the importance of funding policies and medical infrastructure. *Eval Program Plann*. 2011;34(4):375-381. doi:10.1016/j.evalprogplan.2011.02.004.
58. Knudsen HK, Roman PM. Financial factors and the implementation of medications for treating opioid use disorders. *J Addict Med*. 2012;6(4):280-286. doi:10.1097/ADM.0b013e318262a97a.
59. Center for Substance Abuse Treatment. Medication-Assisted Treatment for Opioid Addiction: 2010 State Profiles. Rockville, MD; 2011. [http://dpt.samhsa.gov/pdf/MedicationAssistedTreatmentForOpioidAddiction\\_2010StateProfiles03.pdf](http://dpt.samhsa.gov/pdf/MedicationAssistedTreatmentForOpioidAddiction_2010StateProfiles03.pdf).
60. Booth RE, Corsi KF, Mikulich SK. Improving entry to methadone maintenance among out-of-treatment injection drug users. *J Subst Abuse Treat*. 2003;24(4):305-311. <http://www.ncbi.nlm.nih.gov/pubmed/12867204>. Accessed May 30, 2015.
61. Kerr T, Marsh D, Li K, Montaner J, Wood E. Factors associated with methadone maintenance therapy use among a cohort of polysubstance using injection drug users in Vancouver. *Drug Alcohol Depend*. 2005;80(3):329-335. doi:10.1016/j.drugalcdep.2005.05.002.
62. Shah NG, Celentano DD, Vlahov D, et al. Correlates of enrollment in methadone maintenance treatment programs differ by HIV-serostatus. *AIDS*. 2000;14(13):2035-2043.
63. Hunt DE, Lipton DS, Goldsmith DS, Strug DL, Spunt B. "It takes your heart": the image of methadone maintenance in the addict world and its effect on recruitment into treatment. *Int J Addict*. 20(11-12):1751-1771. <http://www.ncbi.nlm.nih.gov/pubmed/3833809>. Accessed April 6, 2015.
64. Fischer B, Chin AT, Kuo I, Kirst M, Vlahov D. Canadian illicit opiate users' views on methadone and other opiate prescription treatment: an exploratory qualitative study. *Subst Use Misuse*. 2002;37(4):495-522. <http://www.ncbi.nlm.nih.gov/pubmed/12064431>. Accessed April 6, 2015.
65. Peterson JA, Schwartz RP, Mitchell SG, et al. Why don't out-of-treatment individuals enter methadone treatment programmes? *Int J Drug Policy*. 2010;21(1):36-42. doi:10.1016/j.drugpo.2008.07.004.

66. Murphy S, Irwin J. "Living with the Dirty Secret": Problems of Disclosure for Methadone Maintenance Clients. *J Psychoactive Drugs*. 1992;24(3):257-264.
67. Zule WA, Desmond DP. Attitudes toward methadone maintenance: implications for HIV prevention. *J Psychoactive Drugs*. 30(1):89-97. doi:10.1080/02791072.1998.10399674.
68. Kleber HD. Methadone maintenance 4 decades later: thousands of lives saved but still controversial. *JAMA*. 2008;300(19):2303-2305. doi:10.1001/jama.2008.648.
69. Frank D. The trouble with morality: the effects of 12-step discourse on addicts' decision-making. *J Psychoactive Drugs*. 43(3):245-256. <http://www.ncbi.nlm.nih.gov/pubmed/22111408>. Accessed April 2, 2014.
70. Best D, Harris J, Gossop M, Farrell M, Finch E, Noble A. Use of non-prescribed methadone and other illicit drugs during methadone maintenance treatment. *Drug Alcohol Rev*. 2000;19:9-16.
71. Schütz CG, Rapiti E, Vlahov D, Anthony JC. Suspected determinants of enrollment into detoxification and methadone maintenance treatment among injecting drug users. *Drug Alcohol Depend*. 1994;36(2):129-138. <http://www.ncbi.nlm.nih.gov/pubmed/7851280>. Accessed April 6, 2015.
72. Knudsen H, Roman P, Oser C. Facilitating Factors and Barriers to the Use of Medications in Publicly Funded Addiction Treatment Organizations. *J Addict Med*. 2010;4(2):99-107. doi:10.1097/ADM.0b013e3181b41a32.Facilitating.
73. Knudsen HK, Ducharme LJ, Roman PM. The adoption of medications in substance abuse treatment: associations with organizational characteristics and technology clusters. *Drug Alcohol Depend*. 2007;87(2-3):164-174. doi:10.1016/j.drugalcdep.2006.08.013.
74. Knudsen HK, Abraham AJ. Perceptions of the state policy environment and adoption of medications in the treatment of substance use disorders. *Psychiatr Serv*. 2012;63(1):19-25. doi:10.1176/appi.ps.201100034.
75. Ducharme LJ, Knudsen HK, Roman PM, Johnson JA. Innovation adoption in substance abuse treatment: exposure, trialability, and the Clinical Trials Network. *J Subst Abuse Treat*. 2007;32(4):321-329. doi:10.1016/j.jsat.2006.05.021.
76. McGovern MP, Fox TS, Xie H, Drake RE. A survey of clinical practices and readiness to adopt evidence-based practices: Dissemination research in an addiction treatment system. *J Subst Abuse Treat*. 2004;26(4):305-312. doi:10.1016/j.jsat.2004.03.003.
77. Rieckmann T, Daley M, Fuller BE, Thomas CP, McCarty D. Client and counselor attitudes toward the use of medications for treatment of opioid dependence. *J Subst Abuse Treat*. 2007;32(2):207-215. doi:10.1016/j.jsat.2006.09.002.



78. McCarty D, Fuller BE, Arfken C, et al. Direct care workers in the National Drug Abuse Treatment Clinical Trials Network: characteristics, opinions, and beliefs. *Psychiatr Serv.* 2007;58(2):181-190. doi:10.1176/appi.ps.58.2.181.
79. Netherland J, Botsko M, Egan JE, et al. Factors affecting willingness to provide buprenorphine treatment. *J Subst Abuse Treat.* 2009;36(3):244-251. doi:10.1016/j.jsat.2008.06.006.
80. Fiellin DA. The first three years of buprenorphine in the United States: experience to date and future directions. *J Addict Med.* 2007;1(2):62-67. doi:10.1097/ADM.0b013e3180473c11.
81. Barry DT, Irwin KS, Jones ES, et al. Integrating buprenorphine treatment into office-based practice: a qualitative study. *J Gen Intern Med.* 2009;24(2):218-225. doi:10.1007/s11606-008-0881-9.
82. Gordon AJ, Kavanagh G, Krumm M, et al. Facilitators and barriers in implementing buprenorphine in the Veterans Health Administration. *Psychol Addict Behav.* 2011;25(2):215-224. doi:10.1037/a0022776.
83. Albright J, Ciaverelli R, Essex A, Tkacz J, Ruetsch C. Psychiatrist characteristics that influence use of buprenorphine medication-assisted treatment. *J Addict Med.* 2010;4(4):197-203. doi:10.1097/ADM.0b013e3181c816f3.
84. Cunningham CO, Kunins H V, Roose RJ, Elam RT, Sohler NL. Barriers to obtaining waivers to prescribe buprenorphine for opioid addiction treatment among HIV physicians. *J Gen Intern Med.* 2007;22(9):1325-1329. doi:10.1007/s11606-007-0264-7.
85. Cunningham CO, Sohler NL, McCoy K, Kunins H V. Attending physicians' and residents' attitudes and beliefs about prescribing buprenorphine at an urban teaching hospital. *Fam Med.* 2006;38(5):336-340.
86. West JC, Kosten TR, Wilk J, et al. Challenges in increasing access to buprenorphine treatment for opiate addiction. *Am J Addict.* 2004;13 Suppl 1:S8-S16. doi:10.1080/10550490490440753.
87. Walley AY, Alperen JK, Cheng DM, et al. Office-based management of opioid dependence with buprenorphine: clinical practices and barriers. *J Gen Intern Med.* 2008;23(9):1393-1398. doi:10.1007/s11606-008-0686-x.
88. Rieckmann T, Kovas AE, Rutkowski B a. Adoption of medications in substance abuse treatment: priorities and strategies of single state authorities. *J Psychoactive Drugs.* 2010;Suppl 6(September):227-238.
89. Heinrich CJ, Hill CJ. Role of state policies in the adoption of naltrexone for substance abuse treatment. *Health Serv Res.* 2008;43(3):951-970. doi:10.1111/j.1475-6773.2007.00812.x.
90. Appel PW, Ellison AA, Jansky HK, Oldak R. Barriers to enrollment in drug abuse treatment and suggestions for reducing them: opinions of drug injecting street outreach clients and other system stakeholders. *Am J Drug Alcohol Abuse.* 2004;30(1):129-153.

91. Claus RE, Kindleberger LR. Engaging substance abusers after centralized assessment: predictors of treatment entry and dropout. *J Psychoactive Drugs*. 34(1):25-31.
92. Festinger DS, Lamb RJ, Kountz MR, Kirby KC, Marlowe D. Pretreatment dropout as a function of treatment delay and client variables. *Addict Behav*. 20(1):111-115.
93. Wenger LD, Rosenbaum M. Drug treatment on demand--not. *J Psychoactive Drugs*. 26(1):1-11.
94. Redko C, Rapp RC, Carlson RG. Waiting Time as a Barrier to Treatment Entry: Perceptions of Substance Users. *J Drug Issues*. 2006;36(4):831-852.
95. Kaplan EH, Johri M. Treatment on demand: an operational model. *Health Care Manag Sci*. 2000;3:171-183. doi:10.1023/A:1019001726188.
96. Carr CJA, Xu J, Redko C, et al. Individual and system influences on waiting time for substance abuse treatment. *J Subst Abuse Treat*. 2008;34(2):192-201. doi:10.1016/j.jsat.2007.03.005.
97. Maddux JF, Desmond DP, Esquivel M. Rapid admission and retention on methadone. *Am J Drug Alcohol Abuse*. 1995;21(4):533-547. <http://www.ncbi.nlm.nih.gov/pubmed/8561101>. Accessed May 6, 2015.
98. Hoffman KA, Ford JH, Tillotson CJ, Choi D, McCarty D. Days to treatment and early retention among patients in treatment for alcohol and drug disorders. *Addict Behav*. 2011;36(6):643-647. doi:10.1016/j.addbeh.2011.01.031.
99. Quanbeck A, Wheelock A, Ford JH, Pulvermacher A, Capoccia V, Gustafson D. Examining access to addiction treatment: scheduling processes and barriers. *J Subst Abuse Treat*. 2013;44(3):343-348. doi:10.1016/j.jsat.2012.08.017.
100. Downey L, Rosengren DB, Donovan DM. Gender, waitlists, and outcomes for public-sector drug treatment. *J Subst Abuse Treat*. 2003;25(1):19-28. <http://www.ncbi.nlm.nih.gov/pubmed/14512104>. Accessed May 6, 2015.
101. Stewart MT, Horgan CM, Garnick DW, Ritter G, McLellan AT. Performance contracting and quality improvement in outpatient treatment: effects on waiting time and length of stay. *J Subst Abuse Treat*. 2013;44(1):27-33. doi:10.1016/j.jsat.2012.02.001.
102. Arfken CL, Klein C, di Menza S, Schuster CR. Gender differences in problem severity at assessment and treatment retention. *J Subst Abuse Treat*. 2001;20(1):53-57. <http://www.ncbi.nlm.nih.gov/pubmed/11239728>. Accessed May 6, 2015.
103. Gryczynski J, Schwartz RP, Salkever DS, Mitchell SG, Jaffe JH. Patterns in admission delays to outpatient methadone treatment in the United States. *J Subst Abuse Treat*. 2011;41(4):431-439. doi:10.1016/j.jsat.2011.06.005.

104. Woody G, O'Hare K, Mintz J, O'Brien C. Rapid intake: a method for increasing retention rate of heroin addicts seeking methadone treatment. *Compr Psychiatry*. 16(2):165-169. <http://www.ncbi.nlm.nih.gov/pubmed/1120417>. Accessed February 5, 2015.
105. Brown BS, Hickey JE, Chung AS, Craig RD, Jaffe JH. The functioning of individuals on a drug abuse treatment waiting list. *Am J Drug Alcohol Abuse*. 1989;15(3):261-274.
106. Peles E, Schreiber S, Adelson M. Opiate-dependent patients on a waiting list for methadone maintenance treatment are at high risk for mortality until treatment entry. *J Addict Med*. 7(3):177-182. doi:10.1097/ADM.0b013e318287cfc9.
107. Schwartz RP, Jaffe JH, O'Grady KE, et al. Interim methadone treatment: impact on arrests. *Drug Alcohol Depend*. 2009;103(3):148-154. doi:10.1016/j.drugalcdep.2009.03.007.
108. Chun J, Guydish JR, Silber E, Gleghorn A. Drug treatment outcomes for persons on waiting lists. *Am J Drug Alcohol Abuse*. 2008;34(5):526-533. doi:10.1080/00952990802146340.
109. Cooper JR. Methadone treatment and acquired immunodeficiency syndrome. *JAMA*. 262(12):1664-1668. <http://www.ncbi.nlm.nih.gov/pubmed/2491420>. Accessed February 6, 2015.
110. French JF, Safford J. AIDS and intranasal heroin. *Lancet*. 1989;1:1082.
111. Hser YI, Maglione M, Polinsky ML, Anglin MD. Predicting drug treatment entry among treatment-seeking individuals. *J Subst Abuse Treat*. 15(3):213-220.
112. Stark MJ, Campbell BK, Brinkerhoff C V. "Hello, may we help you?" A study of attrition prevention at the time of the first phone contact with substance-abusing clients. *Am J Drug Alcohol Abuse*. 1990;16(1-2):67-76. <http://www.ncbi.nlm.nih.gov/pubmed/2330937>. Accessed May 6, 2015.
113. Donovan DM, Rosengren DB, Downey L, Cox GB, Sloan KL. Attrition prevention with individuals awaiting publicly funded drug treatment. *Addiction*. 2001;96(8):1149-1160. doi:10.1080/09652140120060743.
114. Gryczynski J, Schwartz R, O'Grady K, Jaffe J. Treatment entry among individuals on a waiting list for methadone maintenance. *Am J Drug Alcohol Abuse*. 2009;35(5):290-294. doi:10.1080/00952990902968577.
115. Friedmann PD, Lemon SC, Stein MD, D'Aunno TA. Accessibility of addiction treatment: results from a national survey of outpatient substance abuse treatment organizations. *Health Serv Res*. 2003;38(3):887-903. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1360921&tool=pmcentrez&rendertype=abstract>. Accessed May 6, 2015.
116. Andrews CM, Shin H-C, Marsh JC, Cao D. Client and program characteristics associated with wait time to substance abuse treatment entry. *Am J Drug Alcohol Abuse*. 2013;39(1):61-68. doi:10.3109/00952990.2012.694515.

117. Friedmann PD, Lemon SC, Stein MD, D'Aunno TA. Accessibility of addiction treatment: results from a national survey of outpatient substance abuse treatment organizations. *Health Serv Res.* 2003;38(3):887-903.
118. McCarty D, Gustafson D, Capoccia VA, Cotter F. Improving care for the treatment of alcohol and drug disorders. *J Behav Health Serv Res.* 2009;36(1):52-60. doi:10.1007/s11414-008-9108-4.
119. Institute of Medicine. Improving the Quality of Health Care for Mental and Substance-Use Conditions: Quality Chasm Series. Washington, DC: National Academy Press; 2006.
120. Ryan RM, Plant RW, O'Malley S. Initial motivations for alcohol treatment: relations with patient characteristics, treatment involvement, and dropout. *Addict Behav.* 20(3):279-297. <http://www.ncbi.nlm.nih.gov/pubmed/7653312>. Accessed May 6, 2015.
121. Joe GW, Simpson DD, Broome KM. Effects of readiness for drug abuse treatment on client retention and assessment of process. *Addiction.* 1998;93(8):1177-1190. <http://www.ncbi.nlm.nih.gov/pubmed/9813899>. Accessed May 6, 2015.
122. Center for Behavioral Health Statistics. Treatment Episodes Data Set-Admissions (TEDS-A)-Concatenated, 1992 to 2012 Codebook.; 2013.
123. McCaughrin WC, Howard DL. Variation in access to outpatient substance abuse treatment: organizational factors and conceptual issues. *J Subst Abuse.* 1996;8(4):403-415. <http://www.ncbi.nlm.nih.gov/pubmed/9058353>. Accessed August 8, 2013.
124. Centers for Medicare and Medicaid Services. Medicaid At A Glance.; 2005.
125. Substance Abuse and Mental Health Services Administration. Behavioral Health Treatment Needs Assessment Toolkit for States. Rockville, MD; 2013. <http://store.samhsa.gov/shin/content/SMA13-4757/SMA13-4757.pdf>.
126. Substance Abuse and Mental Health Services Administration. Treatment Episode Data Set (TEDS): 2000-2010. National Admissions to Substance Abuse Treatment Services. Rockville, MD; 2012. <http://www.samhsa.gov/data/2k12/TEDS2010N/TEDS2010NWeb.pdf>.
127. Substance Abuse and Mental Health Services Administration. Treatment Episodes Data Set. <http://www.icpsr.umich.edu/icpsrweb/ICPSR/series/56>.
128. Centers for Medicare & Medicaid Services. Medicaid Financing and Reimbursement. <http://www.medicare.gov/medicaid-chip-program-information/by-topics/financing-and-reimbursement/financing-and-reimbursement.html>.
129. The Henry J Kaiser Family Foundation. Medicaid Financing: An Overview of the Federal Medicaid Matching Rate (FMAP). Washington D.C.; 2012. <http://kaiserfamilyfoundation.files.wordpress.com/2013/01/8352.pdf>.

130. U.S. Department of Health and Human Services. Federal Medical Assistance Percentages or Federal Financial Participation in State Assistance Expenditures FMAP. <http://aspe.hhs.gov/health/fmap.htm>.
131. National Association of State Budget Officers. State Expenditure Report 2008. Washington, D.C.; 2009. [https://www.nasbo.org/sites/default/files/FY08 State Expenditure Report.pdf](https://www.nasbo.org/sites/default/files/FY08%20State%20Expenditure%20Report.pdf).
132. National Association of State Budget Officers. State Expenditure Report 2006. Washington, D.C.; 2007. [https://www.nasbo.org/sites/default/files/ER\\_2006.pdf](https://www.nasbo.org/sites/default/files/ER_2006.pdf).
133. National Association of State Budget Officers. State Expenditure Report 1998. Washington, D.C.; 1999. [https://www.nasbo.org/sites/default/files/ER\\_1998.PDF](https://www.nasbo.org/sites/default/files/ER_1998.PDF).
134. Centers for Medicare & Medicaid Services. Fiscal Year 1999 - Medicaid Eligibles, Beneficiaries, and Payments.; 2010.
135. Centers for Medicare & Medicaid Services. Fiscal Year 2006 - Medicaid Eligibles, Beneficiaries, and Payments.; 2010.
136. Centers for Medicare & Medicaid Services. Fiscal Year 2008 - Medicaid Eligibles, Beneficiaries, and Payments.; 2010.
137. United States Census Bureau. State Population Estimates. <http://www.census.gov/popest/data/historical/index.html>.
138. United States Department of Commerce. Annual Per Capita Income Estimates and Revisions. <http://www.bea.gov/newsreleases/relsarchivespi.htm>.
139. Substance Abuse and Mental Health Services Administration. Substance Abuse Prevention and Treatment Block Grant Fact Sheet.; 2013.
140. Substance Abuse and Mental Health Services Administration. SAMHSA Grant Awards By State. 2013. <http://media.samhsa.gov/statesummaries/index.aspx>.
141. Samhsa. National Survey of Substance Abuse Treatment Services (N-SSATS): 2007. 2007:216. <http://www.icpsr.umich.edu/icpsrweb/SAMHDA/series/58>.
142. McCarty D, Frank RG, Denmead GC. Methadone maintenance and state Medicaid managed care programs. *Milbank Q.* 1999;77(3):341-362, 274.
143. Steyerberg EW, Harrell FE, Borsboom GJ, Eijkemans MJ, Vergouwe Y, Habbema JD. Internal validation of predictive models: efficiency of some procedures for logistic regression analysis. *J Clin Epidemiol.* 2001;54(8):774-781. <http://www.ncbi.nlm.nih.gov/pubmed/11470385>. Accessed March 10, 2015.

144. Newman D. Missing data techniques and low response rates: The role of systematic nonresponse parameters. In: *Statistical and Methodological Myths and Urban Legends: Doctrine, Verity, and Fable in the Organizational and Social Sciences*. New York: Routledge; 2009:7-36.
145. Kaambwa B, Bryan S, Billingham L. Do the methods used to analyse missing data really matter? An examination of data from an observational study of Intermediate Care patients. *BMC Res Notes*. 2012;5(1):330. doi:10.1186/1756-0500-5-330.
146. Fox-Wasylyshyn SM, El-Masri MM. Handling missing data in self-report measures. *Res Nurs Health*. 2005;28(6):488-495. doi:10.1002/nur.20100.
147. Donders ART, van der Heijden GJMG, Stijnen T, Moons KGM. Review: a gentle introduction to imputation of missing values. *J Clin Epidemiol*. 2006;59(10):1087-1091. doi:10.1016/j.jclinepi.2006.01.014.
148. Allison P. Multiple Imputation for Missing Data: A Cautionary Tale. *Sociol Methods Res*. 2000;28(3):301-309.
149. Little R. A Test of Missing Completely at Random for Multivariate Data With Missing Values. *J Am Stat Assoc*. 1988;83(404):1198-1202.
150. Saunders J, Morrow-Howell N, Spitznagel E, Dore P, Proctor E, Pescarino R. Imputing Missing Data: A Comparison of Methods for Social Work Researchers. *Soc Work Res*. 2006;30(1):19-30.
151. Croninger R, Douglas K. Missing data and institutional research. *New Dir Institutional Res*. 2005;127(127):33-49.
152. Gyimah S. Missing Data in Quantitative Social Research. *PSC Discuss Pap Ser*. 2001;15(14):1-28.
153. McPherson S, Barbosa-Leiker C, Burns GL, Howell D, Roll J. Missing data in substance abuse treatment research: Current methods and modern approaches. *Exp Clin Psychopharmacol*. 2012;20(3):243-250. doi:10.1037/a0027146.
154. Allison P. *Missing Data*. Newbury Park, CA: Sage Series: Quantitative Applications in the Social Sciences; 2001.
155. Millsap R, Maydeu-Olivares A. *The SAGE Handbook of Quantitative Methods in Psychology*. Thousand Oaks: Sage Publications; 2009.
156. Roth P. Missing Data: A Conceptual Review for Applied Psychologists. *Pers Psychol*. 1994;47(3):537-560.
157. Graham JW. Missing data analysis: making it work in the real world. *Annu Rev Psychol*. 2009;60:549-576. doi:10.1146/annurev.psych.58.110405.085530.
158. Kalton G, Kasprzyk D. The Treatment of Missing Survey Data. *Surv Methodol*. 1986;12(1):1-16.

159. Durrant G. Imputation Methods for Handling Item-Nonresponse in the Social Sciences: A Methodological Review.; 2005.
160. Lepkowski JM, Landis JR, Stehouwer SA. Strategies for the analysis of imputed data from a sample survey. The National Medical Care Utilization and Expenditure Survey. *Med Care*. 1987;25(8):705-716. <http://www.ncbi.nlm.nih.gov/pubmed/3121954>. Accessed June 29, 2012.
161. Myers T. Goodbye, Listwise Deletion: Presenting Hot Deck Imputation as an Easy and Effective Tool for Handling Missing Data. *Commun Methods Meas*. 2011;5(4):297-310.
162. Andridge RR, Little RJA. A Review of Hot Deck Imputation for Survey Non-response. *Int Stat Rev*. 2010;78(1):40-64. doi:10.1111/j.1751-5823.2010.00103.x.
163. Raghunathan TE. What do we do with missing data? Some options for analysis of incomplete data. *Annu Rev Public Health*. 2004;25:99-117. doi:10.1146/annurev.publhealth.25.102802.124410.
164. Cunningham CO, Sohler NL, Wong MD, et al. Utilization of health care services in hard-to-reach marginalized HIV-infected individuals. *AIDS Patient Care STDS*. 2007;21(3):177-186. doi:10.1089/apc.2006.103.
165. Grau E, Frechrel P, Odom D, Painter D. A Simple Evaluation of the Imputation Procedures Used in NSDUH. *ASA Proc Sect Surv Res Methods*. 2004:3588-3595.
166. Graham JW, Hofer SM, Piccinin AM. Analysis with missing data in drug prevention research. *NIDA Res Monogr*. 1994;142:13-63. <http://www.ncbi.nlm.nih.gov/pubmed/9243532>. Accessed June 29, 2012.
167. Horton NJ, Kleinman KP. Much ado about nothing: A comparison of missing data methods and software to fit incomplete data regression models. *Am Stat*. 2007;61(1):79-90. doi:10.1198/000313007X172556.
168. Wayman J. Multiple Imputation for Missing data: What Is It and How Can I Use It? In: Annual Meeting of the American Educational Research Association. Chicago, IL; 2003:1-15.
169. Larsen C, Delarocque-Astagneau E, Pioche C, Roudot-Thoraval F, Desenclos J. Hepatitis C virus genotype 3 and the risk of severe liver disease in a large population of drug users in France. *J Med Virol*. 2010;82(10):1647-1654.
170. Mehta SH, Cox A, Hoover DR, et al. Protection against persistence of hepatitis C. *Lancet*. 2002;359(9316):1478-1483. <http://www.ncbi.nlm.nih.gov/pubmed/11988247>. Accessed August 18, 2012.
171. Thomas DL, Astemborski J, Rai RM, et al. The natural history of hepatitis C virus infection: host, viral, and environmental factors. *JAMA*. 2000;284(4):450-456. <http://www.ncbi.nlm.nih.gov/pubmed/10904508>. Accessed August 18, 2012.

172. Alter MJ, Margolis HS, Krawczynski K, et al. The natural history of community-acquired hepatitis C in the United States. The Sentinel Counties Chronic non-A, non-B Hepatitis Study Team. *N Engl J Med.* 1992;327(27):1899-1905. <http://www.ncbi.nlm.nih.gov/pubmed/1280771>. Accessed August 18, 2012.
173. Villano SA, Vlahov D, Nelson KE, Cohn S, Thomas DL. Persistence of viremia and the importance of long-term follow-up after acute hepatitis C infection. *Hepatology.* 1999;29(3):908-914. <http://www.ncbi.nlm.nih.gov/pubmed/10051497>. Accessed August 18, 2012.
174. Ku L, St Louis M, Farshy C, et al. Risk behaviors, medical care, and chlamydial infection among young men in the United States. *Am J Public Health.* 2002;92(7):1140-1143. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1447204&tool=pmcentrez&rendertype=abstract>. Accessed August 17, 2012.
175. Sterne JAC, White IR, Carlin JB, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ.* 2009;338:b2393. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2714692&tool=pmcentrez&rendertype=abstract>. Accessed March 20, 2012.
176. Hippisley-Cox J, Coupland C, Vinogradova Y, Robson J, May M, Brindle P. Derivation and validation of QRISK, a new cardiovascular disease risk score for the United Kingdom: prospective open cohort study. *BMJ.* 2007;335(7611):136. <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1925200&tool=pmcentrez&rendertype=abstract>. Accessed July 30, 2012.
177. Cooney M. Derivation and validation of QRISK, a new cardiovascular disease risk score for the United Kingdom: prospective open cohort study. *BMJ.* 2007.
178. Tunstall-Pedoe H. An independent external validation and evaluation of QRISK cardiovascular risk prediction: a prospective open cohort study. *BMJ.* 2009.
179. Peto R. QRISK score: total/HDL cholesterol should be important. *BMJ.* 2007.
180. Hippisley-Cox J. QRISK - authors response. *BMJ.* 2007.
181. Young R, Johnson D. Imputing the Missing Y's: Implications for Survey Producers and Survey Users. In: *Proceedings of the Survey Research Methods Section, American Statistical Association, Invited Papers.*; 2010:7.
182. Dong Y, Peng C-YJ. Principled missing data methods for researchers. *Springerplus.* 2013;2(1):222. doi:10.1186/2193-1801-2-222.
183. Schafer JL, Graham JW. Missing data: our view of the state of the art. *Psychol Methods.* 2002;7(2):147-177. <http://www.ncbi.nlm.nih.gov/pubmed/12090408>. Accessed June 29, 2012.
184. Lin M, Lucas H, Shmueli G. Too Big to Fail: Large Samples and the p-Value Problem. *Inf Syst Res.* 2013;24(4):906-917.



185. Ang R. Use of the Jackknife Statistic to Evaluate Result Replicability. *J Gen Psychol.* 1998;125(3):218-228.
186. Efron B, Gong G. A Leisurely Look at the Bootstrap, the Jackknife, and Cross-Validation. *Am Stat.* 1983;37(1):36-48.
187. Abdi H, Williams L. Jackknife. In: Salkind N, ed. *Encyclopedia of Research Design.* Thousand Oaks, CA: Sage Publications; 2010:656-661.
188. Cassell D. BootstrapMania! Re-Sampling the SAS Way. *SAS Glob Forum.* 2010;268-2010:11.
189. Horowitz J. The Bootstrap. In: Heckman J, Leamer E, eds. *Handbook of Econometrics.* 1st ed. Elsevier Inc.; 2001:3159-3228.
190. Barker N. A Practical Introduction to the Bootstrap Using the SAS System. <http://www.lexjansen.com/phuse/2005/pk/pk02.pdf>.
191. Davison A, Hinkley D. *Bootstrap Methods and Their Application.* Cambridge: Cambridge University Press; 1997.
192. Gong G. Cross-Validation, the Jackknife and the Bootstrap: Excess Error Estimation in Forward Logistic Regression.; 1982.
193. Schneider S, Jacoby W. Influences on Bureaucratic Policy Initiatives in the American States. *J Public Adm Theory.* 1996;4:495-522.
194. Center for Medicaid Services. Medicaid Benefits. <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Benefits/Medicaid-Benefits.html>.
195. National Association of Medicaid Directors. National Association of Medicaid Directors: Operations Survey.; 2012. [http://medicaiddirectors.org/sites/medicaiddirectors.org/files/public/namd\\_mcdops\\_summary\\_final\\_102612.pdf](http://medicaiddirectors.org/sites/medicaiddirectors.org/files/public/namd_mcdops_summary_final_102612.pdf).
196. Substance Abuse and Mental Health Services Administration. Treatment Episode Data Set (TEDS): 1998-2008. National Admissions to Substance Abuse Treatment Services. Rockville, MD; 2010.
197. National Institute on Drug Abuse. Overdose Death Rates. 2015. <http://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates>.
198. Volkow ND, Frieden TR, Hyde PS, Cha SS. Medication-assisted therapies--tackling the opioid-overdose epidemic. *N Engl J Med.* 2014;370(22):2063-2066. doi:10.1056/NEJMp1402780.
199. Ryan P. Patient Protection and Affordable Care Act Standards Related to Essential Health Benefits, Actuarial Value, and Accreditation. 2012:3. [http://www.cmhda.org/go/portals/0/cmhda\\_files/breaking news/1212\\_dec/cmhda comments to hhs on ehb proposed rule 12-20-12.pdf](http://www.cmhda.org/go/portals/0/cmhda_files/breaking%20news/1212_dec/cmhda%20comments%20to%20hhs%20on%20ehb%20proposed%20rule%2012-20-12.pdf).

200. Kitchenman A. Expanded Medicaid Will Cover Mental Health, Substance-Abuse Treatment. NJ Spotlight. <http://www.njspotlight.com/stories/13/09/17/nj-expanded-medicaid-will-cover-mental-health-substance-abuse-treatme/>. Published September 18, 2013.
201. Substance Abuse and Mental Health Services Administration. Alcohol and Drug Services Study (ADSS). The National Treatment System: Outpatient Methadone Facilities. Rockville; 2004. <http://www.samhsa.gov/data/ADSS/methadone.pdf>.
202. Nardini K, Anderson R. State Issue Brief on the Use of Buprenorphine and Implications for State AOD Systems. Washington, D.C.; 2006. [http://nasadad.org/resource.php?base\\_id=718](http://nasadad.org/resource.php?base_id=718).
203. Prescription Opioid and Heroin Abuse | National Institute on Drug Abuse (NIDA). <http://www.drugabuse.gov/about-nida/legislative-activities/testimony-to-congress/2014/prescription-opioid-heroin-abuse>. Accessed February 4, 2015.
204. National Institute on Drug Abuse. Buprenorphine Update.; 2009. <http://archives.drugabuse.gov/bupupdate.html>.
205. Kinlock TW, Gordon MS, Schwartz RP, O'Grady K, Fitzgerald TT, Wilson M. A randomized clinical trial of methadone maintenance for prisoners: results at 1-month post-release. *Drug Alcohol Depend.* 2007;91(2-3):220-227. doi:10.1016/j.drugalcdep.2007.05.022.
206. Dolan KA, Shearer J, MacDonald M, Mattick RP, Hall W, Wodak AD. A randomised controlled trial of methadone maintenance treatment versus wait list control in an Australian prison system. *Drug Alcohol Depend.* 2003;72(1):59-65. <http://www.ncbi.nlm.nih.gov/pubmed/14563543>. Accessed May 28, 2015.
207. Hilbe JM. Negative Binomial Regression. 2nd ed. New York: Cambridge University Press; 2011.
208. Atkins DC, Baldwin SA, Zheng C, Gallop RJ, Neighbors C. A tutorial on count regression and zero-altered count models for longitudinal substance use data. *Psychol Addict Behav.* 2013;27(1):166-177. doi:10.1037/a0029508.
209. Smith VA, Preisser JS, Neelon B, Maciejewski ML. A marginalized two-part model for semicontinuous data. *Stat Med.* 2014;33(28):4891-4903. doi:10.1002/sim.6263.
210. Knudsen HK, Abraham AJ, Roman PM. Adoption and implementation of medications in addiction treatment programs. *J Addict Med.* 2011;5(1):21-27. doi:10.1097/ADM.0b013e3181d41ddb.
211. Paulozzi LJ, Mack KA, Hockenberry JM. Vital signs: variation among States in prescribing of opioid pain relievers and benzodiazepines - United States, 2012. *MMWR Morb Mortal Wkly Rep.* 2014;63(26):563-568. <http://www.ncbi.nlm.nih.gov/pubmed/24990489>. Accessed August 6, 2015.
212. Institute for Clinical and Economic Review. Management of Patients with Opioid Dependence: A Review of Clinical, Delivery System, and Policy Options.; 2014. <http://cepac.icer-review.org/wp-content/uploads/2014/04/CEPAC-Opioid-Dependence-Final-Report-For-Posting-July-211.pdf>.

- 213. Rinaldo S, Rinaldo D. Availability Without Accessibility? State Medicaid Coverage and Authorization Requirements for Opioid Dependence Medications.; 2013.
- 214. Peterson J a., Schwartz RP, Mitchell SG, et al. Why don't out-of-treatment individuals enter methadone treatment programmes? *Int J Drug Policy*. 2010;21:36-42. doi:10.1016/j.drugpo.2008.07.004.
- 215. Substance Abuse and Mental Health Services Administration. National Survey of Substance Abuse Treatment Services (N-SSATS): 2012. Rockville, MD; 2013.
- 216. Fowler F. Survey Research Methods. 4th ed. Thousand Oaks, CA: Sage Publications; 2009.
- 217. McLellan AT, Woodworth AM. The affordable care act and treatment for "substance use disorders:" implications of ending segregated behavioral healthcare. *J Subst Abuse Treat*. 46(5):541-545. doi:10.1016/j.jsat.2014.02.001.
- 218. Capoccia VA, Grazier KL, Toal C, Ford JH, Gustafson DH. Massachusetts's experience suggests coverage alone is insufficient to increase addiction disorders treatment. *Health Aff (Millwood)*. 2012;31(5):1000-1008. doi:10.1377/hlthaff.2011.0326.
- 219. Department of Health and Human Services: Substance Abuse and Mental Health Services Administration. National Survey of Substance Abuse Treatment Services (N-SSATS): 2013 - Data on Substance Abuse Treatment Facilities. 2013:228.
- 220. Department of Health and Human Services: Substance Abuse and Mental Health Services Administration. National Survey of Substance Abuse Treatment Services (N-SSATS): 2010 - Data on Substance Abuse Treatment Facilities. 2011:224.