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**Impact of Permanent Housing on Opioid Dependence in Homeless Adults in Allegheny County**

by

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Earl Hord, MPH

University of Pittsburgh, 2019

**Abstract**

**Introduction:** Previous studies have suggested that substance abuse decreases once homeless individuals enter into permanent housing. However, there has not been a consensus on whether this relationship exists.

**Objective:** The objective of this study is to evaluate if opioid addiction, measured through methadone maintenance treatments, decreases once homeless adults enter into permanent housing.

**Methods:** Data were collected from the Allegheny Country Department of Human Services data warehouse. Individuals who enrolled in permanent housing between 2015 and 2017 and had ICD-10 billable codes for Methadone Maintenance Treatment (MMT) were included. The change in MMT after enrollment was evaluated using negative binomial regression models.

**Results:** The mean number MMT are associated with a small decrease in the time period after housing enrollment compared to the time before enrollment (RR = 0.95). For every increase in month prior to enrollment MMT also increases (RR = 1.02), while monthly MMT decreases slightly after enrollment (RR = 0.99).

**Conclusion:** Permanent housing may mitigate opioid addiction in homeless adults, and sobriety should not be considered a precursor for enrollment. These findings are significant in the field of public health considering that homeless populations are extremely vulnerable, and we offer evidence for an intervention that can reduce opioid dependence in homeless individuals.

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# Introduction

## Homelessness in the United States

Homelessness is a major public health concern in every metropolitan area in the United States (US). Many factors can influence one’s entry into homelessness, how they experience it, and whether or not they are able to overcome it. Drug abuse is among these determinants, and has been thoroughly studied in relation to homelessness to assess its effects. More specifically, the current opioid epidemic in the US is among the major public health concerns. This creates a unique scenario when attempting to address homelessness, and begs the question of how this crisis and homelessness are intertwined. This relationship is the foundation of this study, which addresses the effect of permanent housing on opioid dependence among homeless adults in Allegheny County.

The US Department of Housing and Urban Redevelopment (HUD) completes an annual Point-in-Time (PIT) homeless count, which includes sheltered and unsheltered homeless individuals. The PIT count also gathers information on people enrolled in permanent housing programs. These are formerly homeless individuals who are living in long-term assisted housing and may also be receiving supportive services. The PIT homeless count does not include individuals in permanent housing. The 2017 count found that there were 553,742 homeless people in the US on a single night, or 17 per 10,000 US citizens. Sheltered individuals made up 68% of this count, at 360,867 people, and the remaining 192,575 people were unsheltered. The count found that men made up the majority at unsheltered locations (71%) and women made up the majority at sheltered locations (55%). Statistics on race revealed disparities among homeless people. African Americans made up 13.4% of the U.S. population in 2017, while representing 41% of the total homelessness population. Hispanic or Latinos made up 18.1% of the U.S. population, and 22% of the homeless population. In the U.S., 76.6% of people are white, compared to 47% of homeless people.

## Homelessness in Allegheny County

The number of homeless people in Allegheny County, Pennsylvania, is best captured by the annual PIT homeless count that the Allegheny County Department of Human Services completes as required by HUD. The count was 1,424 in 2015, 1,156 in 2016, and 1,145 in 2017. The PIT count for Allegheny County also includes those in transitional housing, emergency shelters, and living in places not meant for habitation (Halfhill & Burger, 2017).

## Opioid Epidemic Background

Opioid misuse is not a new phenomenon in the US. The first opioid epidemic began in the mid-1800s. Opioid consumption increased by 538% from 1840 to 1890, and began to decline moving into the 20th century (Kolodny et al., 2015). Nearly a century later, campaigns and educational programs funded by pharmaceutical companies and other organizations promoted the use of opioids and simultaneously downplayed the risk of addiction, despite concerns from healthcare providers (Kolodny et al., 2015). Physicians began to generously prescribe opioids for pain relief, and by 2012, the number of opioid prescriptions was equal to the population of the US (Brady, McCauley, & Back, 2016). In every year since 1991, opioid prescriptions have increased. However, the majority of opioid prescriptions are attributed to only a small number of prescribers (Department of Health and Human Services, n.d.). For instance, Oregon Health Authority’s Prescription Drug Monitoring Program found that 60% of class two, three, and four controlled substance prescriptions were written by only 4% of prescribers in the state (Oregon Health Authority, 2012).

Since the 1980s, drug overdose death rates have increased five-fold, and opioids were involved in 60% of overdose deaths in 2010, compared to 40% in 1999. Between 2004 and 2011, emergency department visits due to pharmaceutical abuse or misuse increased by 114% (Department of Health and Human Services, n.d.). The US age-adjusted mortality rate for drug overdose in 2000 was 6.2 per 100,000, and by 2014, it rose to 14.7 per 100,000. In the same year 61% of drug overdose deaths involved some sort of opioid. Pennsylvania was one of 14 states in the US that had a significant increase in drug overdose death rates from 2013 to 2014 (Rudd, Aleshire, Zibbell, & Gladden, 2016).

From 2016 to 2017, 29 states and the District of Columbia saw increases in overdose death rates, while only 13 states had a decrease (Trust for America’s Health & Well Being Health, 2019). There were 46,128 reported deaths from opioid overdose in the twelve-month period ending in June 2018, a 48% increase from the twelve-month period ending in June 2015, and a 24% increase from June 2016 (Ahmad, Rossen, Spencer, Warner, & Sutton, 2018). Death from synthetic opioids, specifically, has risen ten-fold over the past decade, and increased 45% between 2016 and 2017 (Trust for America’s Health & Well Being Health, 2019). Opioid use and deaths are both predicted to increase dramatically in the coming years. Overdose death from opioids is projected to increase by 147% from 2015 to 2025, and the number of people using opioids is projected to increase by 61% from 2015 to 2025 (Chen et al., 2019).

Synthetic opioid misuse is attributable to prescription opioids, but there are strong ties between the use of these and heroin use, and unregulated opioid. A national study found a strong association between the nonmedical use of pain relievers subsequent heroin use, with heroin use being 19 times higher among those who reported nonmedical use of pain relievers compared to those that did not report nonmedical use of pain relievers (Muhuri, Gfroerer, & Davies, 2013). The number overdose deaths from heroin have increased fivefold from 2002, and this is tied to the increased availability of prescription opioid drugs (National Institute on Drug Abuse, 2018).

## Homelessness and Substance Abuse

People experiencing homelessness often suffer from conditions such as mental illness and substance abuse. A report found that 30% of chronic homeless individuals have mental health conditions, and 50% of chronic homeless individuals have co-occurring substance abuse problems (SAMHSA, 2009). Compared to low-income housed women, homeless women have three times the rate of post-traumatic stress disorder and twice the rate of drug and alcohol dependence (SAMHSA, 2009). In Allegheny County, nearly a third of homeless individuals have a severe mental illness, and substance abuse problems occur at the same rate (Halfhill & Burger, 2017). At the same time, people experiencing homelessness also face many barriers to care for substance abuse treatment. A study that surveyed staff at Veterans Affairs community-based clinics about the service needs of rural homeless veterans found that 53% believed that there are fewer resources available, 28% said that a lack of transportation was a barrier, and 20% said that there is limited access to health and other services (Alder, Pritchett, Kauth, & Mott, 2015). Homeless individuals who have co-occurring mental health and substance abuse disorders face challenges to treatment. A few reasons have been cited as clients displaying difficult behavior such as frequently disappearing or engaging in criminal behavior, outreach or providers believing that they needed more time to work through the clients issues, inadequate staffing at treatment centers, and systemic barriers, such as Medicaid not covering drug treatment in every state, or substance use disorders not being supplemental security income eligible (Foster, LeFauve, Kresky-Wolff, & Rickards, 2010).

Substance abuse is not only common among people experiencing homelessness, but in many cases has been found to be a risk factor for homelessness. A survey in New Haven, Connecticut, that questioned homeless persons found that drug use was the most common reason for people being homeless (Spinner & Leaf, 1992). One study (Bachhuber, Roberts, Metraux, & Montgomery, 2015) found that veterans with opioid use disorder were ten times more likely to be homeless than veterans without opioid use disorder.

In early models for service delivery for homeless people suffering from substance abuse or mental illness, providers encouraged and sometimes required clients to become sober or more compliant in order to access permanent housing (Tsemberis, Gulcur, & Nakae, 2004). Housing First is an alternate approach to housing assistance that has no abstinence requirements for individuals to gain access to permanent housing, and emphasizes choice in regard to using supportive services and housing selection (National Alliance to End Homelessness, 2016). This model can be effective in providing stable housing for people with substance abuse disorders (Appel, Tsemberis, Joseph, Stefancic, & Lambert-Wacey, 2012; Palepu, Patterson, Moniruzzaman, Frankish, & Somers, 2013).

There have been mixed results for the effect of housing on substance abuse. A study (Rhoades et al., 2018) looking at substance use in individuals placed in permanent housing found that in their first year of housing, substance use remained relatively stable, and that substance use is modified by social networks. Conversely, another study (Asana, Ayvaci, Pollio, Hong, & North, 2018) supports the idea that stable housing can lead to a cascade effect of clients receiving alcohol abuse treatment, substance abuse treatment, and later psychiatric services and medical services. No study has assessed opioid addiction prior to entry into a housing program and continuing into the housing program while measuring non-self-reported drug use.

We evaluated if housing can reduce addiction to a substance, opioids, that has been one of the leading causes of death in the US. We analyzed the rates of methadone maintenance treatment (MMT) for a cohort of homeless individuals in a six-month period prior to entry into a housing program and two years following enrollment. We hypothesize that rates of MMT will decrease in the six-month period after homeless individuals enter a housing program compared to the six-month period before they enter the program.

# Objective

The objective of this study is to evaluate if opioid addiction, measured through methadone maintenance treatments, decreases once homeless adults enter into permanent housing.

# Methods

## Data Collection

Data were obtained through the Allegheny County Department of Human Services data warehouse. The cohort includes individuals who were active in a county-funded permanent housing program between 2015 and 2017, so experiencing any level of homelessness prior to enrollment. These individuals were matched with medical claims data to obtain information about their opioid dependence. The inclusion criterion was and having an ICD code for opioid-type dependence at any time. The opioid dependence information used in this study includes medical claims that were paid for by Allegheny County or Community Care Behavioral Health Organization, a Medicaid managed care program. Based on this study inclusion criterion, 293 individuals were eligible to be included. Demographic information was present in both the Medicaid claims data as well as the data gathered from the Department of Human Services. Some discrepancies existed for race and gender data between the two sources, and in these cases the Medicaid data were used since they were more complete and regarded as more reliable since the data are not self-reported. Other covariates used in this study were obtained through self-reported data that the Department of Human Services collects when individuals enroll in a housing program.

## Measures

The exposure for this study is enrolling in a county funded housing program for one month. There are five types of housing programs: rapid re-housing, transitional housing, permanent supportive housing, emergency shelter, and street outreach. This study focuses on individuals who are in permanent type housing, i.e. permanent supportive housing and rapid re-housing. Enrollment in these housing programs can last years compared to just a few days for the temporary housing programs. Permanent housing was used in this study to evaluate the effect of long-term housing intervention on opioid dependence. This study used the time period of six months before and two years after housing enrollment because we were interested in evaluating the long-term effect of housing on opioid dependence, and interested in getting an idea of opioid dependence just prior to enrollment. Some individuals had multiple enrollments in permanent housing programs during 2015 and 2017. For this study, we used an individual’s first enrollment.

The outcome is defined as opioid dependence and determined by methadone maintenance, which is an opioid replacement therapy. Information was collected on location of the methadone maintenance treatment and when the treatment was administered. We aggregated methadone maintenance treatments for each individual by the number of months from housing enrollment, and these were averaged for each month. Methadone maintenance treatments were also averaged across all individuals before and after housing intervention. These measures were used to compare the average difference in both time periods and monthly changes.

## Statistical Analysis

Descriptive statistics were presented for the individuals included in this study. We used negative binomial regression, a generalized linear model with a Poisson distribution. Repeated measures were used in each model to evaluate the effect of the housing intervention on opioid dependence. The first model addressed the overall difference in average counts of methadone maintenance treatments before and after entry into permanent housing. Individuals were assigned a value to designate if the methadone maintenance treatment occurred before the date of their enrollment, or the treatment occurred after enrollment. The log difference in the average counts were calculated in this model. The second model addressed the change in average monthly methadone maintenance treatments, which used the aggregated average monthly counts. This model was stratified by being before or after entry into permanent housing and evaluated to assess the monthly differences in both time periods. Both models were fitted manually and tested variables that were considered to play a role in this relationship. Variables were removed from the model in a stepwise fashion until each had P < 0.2. Each model adjusted for the presence of a reported chronic health condition or disabling condition. All analyses were performed in SAS 9.4 using PROC GLIMMIX.

# Results

All tables and figures are found in the appendix. Table 1 presents characteristics of the study cohort. More than half of individuals in this cohort were female (67 percent). The majority of the individuals were White (81 percent), while African Americans primarily made up the remainder (15 percent). The mean ± standard deviation age was 36.4 ± 10.6. Most individuals entered into a Permanent Supportive Housing Program (79 percent), with the rest enrolling in Rapid Rehousing (21 percent). A large proportion of individuals reported a chronic health condition (44 percent). The majority of the individuals reported that this was their first time being homeless (76 percent). A few individuals indicated that they were veterans (5 percent).

Figure 1 illustrates the monthly mean number of MMT counts from the six-month period prior to enrollment to two years after enrollment, and fit with a penalized B-spline. Although there is substantial variance month to month, the mean number of treatments by month from enrollment show an overall decline over time and throughout the first two years in a housing program.

The results from model 1 (Table 2) indicate that the mean number MMTs is associated with a significant small decrease, 0.05 times smaller, in the time period after housing enrollment compared to the time before enrollment (RR = 0.95). Having a chronic health condition is associated with a significant increase in mean methadone counts (RR = 1.29). Having a disabling condition has a non-significant positive association with mean methadone maintenance treatments (RR = 1.22).

When stratifying the model by the six-month period before enrollment into a housing program and the two-year period following enrollment, we evaluated the association between the number of methadone treatment counts and the change in month. In the period prior to enrollment, for every increase in month, the number of MMTs also increases (RR = 1.02). Having a chronic health condition is associated with a non-significant increase in mean monthly methadone treatment counts (RR = 1.13). Similarly, having a disabling condition is associated with a non-significant increase of monthly MMTs (RR=1.27). In the 2-year period after enrollment, an increase in one month is associated with a significant decrease in MMT counts (RR= 0.99). Having a chronic health condition (RR = 1.23) and a disabling condition (RR = 1.03) are both non-significantly associated with an increase in monthly MMT counts.

# Discussion

This study focused on permanent housing funded through the Allegheny County Department of Human Services. We aimed to address the role of entering permanent housing on opioid dependence through measuring changes in MMT. Several analyses showed that the number of methadone maintenance treatments decreased after entry into permanent housing. We found a significant decrease in MMTs from the six-month period prior to enrollment, to the two-year period after enrollment. In addition to this, we found that the monthly rate of MMT was increasing in the six months before housing enrollment, and decreasing throughout the two-year period following. The results also suggested a relationship between opioid dependence and other factors such as having a reported chronic health or disabling condition. Both were associated with an increase in the overall and monthly MMT counts.

Our findings do not suggest that individuals who are addicted to opioids will stop drug use after entering permanent housing, as the decreases that we observed were modest. However, the results do suggest that addiction may be handled more effectively once a person is stably housed, and they may continue to better handle addiction throughout their enrollment period. Methadone is intended to help opioid addiction and is used to reduce illicit opioid use (SAMHSA, 2015). Reductions in opioid use can be influenced to the methadone treatment itself. In addition to the increase in MMTs observed in the period prior to housing enrollment, we do not consider the methadone to have a differential effect on the change in its rates in the time periods before and after the intervention, and therefore not considered a confounding effect in this analysis. MMT is also a long-term treatment that is not expected to confer short term results, as treatment can commonly last decades and up to a lifetime (Goldstein & Herrera, 1995). It is more appropriately regarded as a measure of opioid dependence in this particular setting, acting as an opioid substitution.

Similar to our results, homeless adults in Housing First programs with case management services show a larger decrease in drug use than homeless adults with standard community case (Cherner, Aubry, Sylvestre, Boyd, & Pettey, 2017). The Collaborative Initiative to Help End Chronic Homelessness (CICH) is an initiative developed by The US Interagency Council on Homelessness and The Department of Housing and Urban Development to tackle the issue of chronic homelessness by funding the support of integrated permanent housing and treatment services. In a review of client outcomes, they found that substance use treatment costs and substance use treatment visits decreased from baseline to twelve months, and reported drug use decreased initially from baseline to three months, but increased from three months to twelve months (U.S. Department of Health and Human Services, U.S. Department of Veteran Affairs, & U.S. Department of Housing and Urban Development, 2007). Similarly, we found a decrease in MMT after entry into housing. However, in our study, this overall trend continued throughout the two-year time period during enrollment.

However, the trend of decreasing substance abuse after entry into permanent housing has not been observed in other studies. In a study observing homeless adults in an integrated permanent supportive housing and co-occurring disorder treatment, substance abuse did not change from baseline to study completion at twelve months (Smelson et al., 2016). Another longitudinal study found no changes in substance use among the participants over their first year of permanent supportive housing (Rhoades et al., 2018). Conflicting results are possibly due to differing methods in study design. Both of these studies relied on self-reported data about substance abuse, which has been shown to be invalid in some scenarios. A study (Rendon, Livingston, Suzuki, Hill, & Walters, 2017) evaluating the agreement between self-reported substance use and biological testing in permanent supportive housing enrollees found that agreement between methods was 47% for amphetamines, methamphetamines, and PCP, 44% for cocaine, and 70% for marijuana. Self-reported drug use is most likely going to be underreported, which can occur at baseline and at follow-up times. Other differences can be due to our study focusing on opioid related use rather than overall substance use, which may capture different populations among adults in permanent housing.

This study brings a unique approach to evaluating the relationship between opioid use and permanent supportive housing by evaluating the opioid dependence prior to housing enrollment and into long-term enrollment. Our approach may rely on a proxy measure for opioid dependence, but provides more accurate data since self-reported drug use is likely to be inaccurate. The differences in the results of our study compared to those obtained by others that relied on self-reported measures highlight the importance of integrating databases across various fields of services. Connecting data from these sources can provide comprehensive explanations to research questions and improve the validity of studies.

Housing services have been found to have strong associations with many aspects of health. Homeless populations face adverse weather and conditions, lack the means for basic sanitation, lack privacy, have less opportunity for social interactions, and are subject to many other hurdles that can affect health. Receiving stable housing can help to mitigate these challenges that can result in poor health outcomes. The association between housing and substance abuse has been documented throughout this study. In addition to this, homeless adults who obtained housing visit emergency departments less frequently, perceive better health, report less depression, and are less likely to have a drug or alcohol use problem (Brown et al., 2015). For HIV-positive homeless people, being stably housed compared to intensive care management is associated with a stronger immunity and lower viral load (Buchanan, Kee, Sadowski, & Garcia, 2009).

One limitation of this study was that the use of drug treatment services at any time point was not collected or used in this study, which limits the validity of the associations that we observed. This can possibly play a role in the decrease of MMT after housing enrollment since supportive services become available. Other factors related to a person enrolling into permanent housing such as employment change or access to public assistance could also affect our results. Variation in geographic location of permanent housing placement can potentially cause differences in opioid use given that particular parts of Allegheny County experience a greater burden of the opioid crisis than others (Allegheny County Department of Human Services, 2016). Adherence to MMT is concerning for this analysis. Although this is unmeasured here, a study examining the differences in adherence to MMT between unhoused homeless and stably housed individuals found no difference (Parpouchi, Moniruzzaman, Rezansoff, Russolillo, & Somers, 2017). Other limitations arise from the use of medical claims data. One of these limitations is the inability to distinguish between the type of opioid that is being abused, which could affect addiction differently. Methadone is primarily used for heroin addiction (Anderson & Kearney, 2000), but we do not assume opioid type for this analysis. Another limitation is that medical claims data does not capture homeless individuals that have insurance or other forms of medical assistance. This can be a source of selection bias, and limits the generalizability of the study results.

# Conclusion

Opioid misuse has affected the US population for decades, and is common among homeless populations. Our study aimed to evaluate the change in opioid dependence when homeless individuals entered into permanent housing. We found a small decrease in opioid dependence after enrollment into housing, which supported out initial hypothesis. Despite its limitations, this study provides evidence that stable long-term housing can have an effect on opioid dependence. This analysis of homeless adults in Allegheny County suggests that opioid dependence can decrease and addiction can potentially be improved once an individual enters permanent housing and throughout enrollment. This also demonstrated the importance of connecting data sources to better understand the relationships between health and housing.

This study provides findings that are significant for the field of public health. Our findings lend support for not requiring abstinence for homeless or unstably housed individuals to be able to receive housing, which is a model that has not been universally supported. Considering the evidence presented in this study and others, receiving stable housing can be beneficial for homeless individuals that have a substance abuse problem. While the homeless population may be only a fraction of those affected by the current opioid epidemic, they are an extremely vulnerable population. This study offers support for an intervention that can provide relief to opioid addiction for the homeless.

Future work should focus on the long-term effects of housing on opioid addiction, and develop more accurate methods of assessing addiction. While our study offers support for this idea, its limitations point out the necessity for a better method of assessing changes in addiction to better assess the role that housing plays for homeless people with opioid addiction.

**Appendix A Tables**

Table 1. Descriptive Characteristics of Study Participants

|  |  |  |
| --- | --- | --- |
| Characteristic |  | Value n (%) |
| Sex |  |  |
| Male |  | 94 (32) |
| Female |  | 196 (67) |
| Race |  |  |
| White |  | 239 (81) |
| Black/African-American |  | 43 (15) |
| Other |  | 8 (4) |
| Age |  | 36.4 ± 10.6 |
| Housing Type |  |  |
| Permanent Supportive Housing |  | 231 (79) |
| Rapid Rehousing |  | 62 (21) |
| Chronic Health Condition |  | 125 (44) |
| Veteran |  | 16 (5) |
| First Time Homelessness |  | 222 (76) |

Table 2. Results of Negative Binomial Regression Models

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model 1 | | | | | | | | | | |
| Parameter | Estimate (Relative Risk) | Standard Error | P-Value |  | |  | |  | |  |
| Intercept | 7.70 | 1.11 | <.0001 |  | |  | |  | |  |
| Time Period (0=before enrollment, 1=after enrollment) | 0.95 | 1.01 | <.0001 |  | |  | |  | |  |
| Chronic Health Condition (0=no, 1=yes) | 1.29 | 1.11 | 0.0144 |  | |  | |  | |  |
| Disabling Condition (0=no, 1=yes) | 1.22 | 1.12 | 0.0853 |  | |  | |  | |  |
| Model 2 | | | | | | | | | | |
| 6 months before enrollment | | | | 2 years after enrollment | | | | | | |
| Parameter | Estimate (RR) | Standard Error | P-Value | Parameter | Estimate (RR) | | Standard Error | | P-Value | |
| Intercept | 9.13 | 1.15 | <0.0001 | Intercept | 2.23 | | 1.13 | | <0.0001 | |
| Month | 1.02 | 1.00 | 0.0007 | Month | 0.99 | | 1.00 | | <0.0001 | |
| Chronic Health Condition (0=no, 1=yes) | 1.13 | 1.15 | 0.2863 | Chronic Health Condition | 1.23 | | 1.11 | | 0.0540 | |
| Disabling Condition (0=no, 1=yes) | 1.27 | 1.15 | 0.0766 | Disabling Condition | 1.03 | | 1.15 | | 0.8290 | |

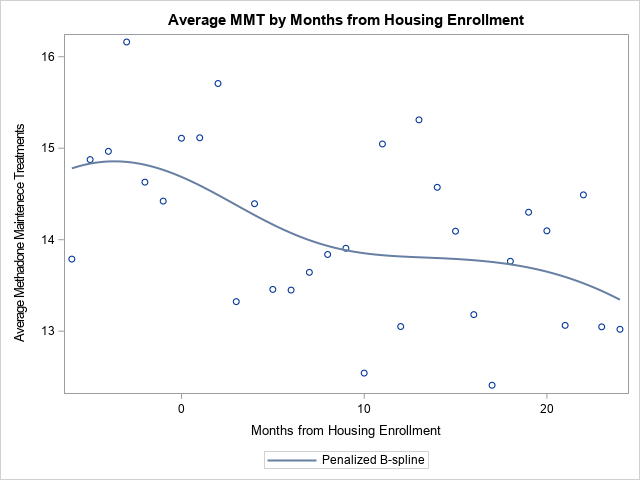
**Appendix B Figures**

Figure 1. Average Number of Methadone Maintenance Treatment by Months from Enrollment in Permanent Housing

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