HHS Public Access

Author manuscript

J Subst Abuse Treat. Author manuscript; available in PMC 2023 August 29.

Published in final edited form as:

J Subst Abuse Treat. 2022 January ; 132: 108634. doi:10.1016/j.jsat.2021.108634.

Spatial proximity and access to buprenorphine or methadone treatment for opioid use disorder in a sample of people misusing opioids in Southern California

PJ Davidson[a], **JM Bowles**[a,b], **M Faul**[c], **TL Gaines**[a]

[a)]University of California, San Diego, Department of Medicine, 9500 Gilman Dr La Jolla CA 92093-0507 USA

[b)]Centre on Drug Policy Evaluation, Li Ka Shing Knowledge Institute, St. Michael's Hospital, 209 Victoria St. Toronto, Ontario, M5B 3M6, Canada.

[c)]Health Systems and Trauma Systems Branch, Mailstop F-62, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30329, USA.

Abstract

Background: In response to the opioid crisis, over the last 10 years substantial strides have been made to increase the availability of evidence-based treatments for opioid use disorder, in particular buprenorphine maintenance, in the United States. Despite these worthwhile efforts, uptake rates of evidence-based treatment remain relatively low. As part of a broader study of opioid misuse, we examined proximity to evidence-based treatment as a potential barrier to treatment access.

Methods.—In 2017–2018, we surveyed 218 individuals misusing prescription opioids or using street opioids in three Southern Californian counties. Driving distance from place of residence to the closest treatment provider offering buprenorphine or methadone treatment for opioid use disorders was calculated.

Results.—Median distance to providers was 3.8 km (2.4 miles). Seventy one (33%) participants had received some form of treatment in the last 3 months, however only 26 (40%) of these had received buprenorphine or methadone maintenance treatment. Participants receiving treatment at the time of their interview were traveling an average 16.8 km (10.4 miles) to reach treatment, indicating that as a group this population was both willing and able to seek and engage with treatment.

Conclusions.—In the suburban and exurban communities in which our study was based, our findings suggest that simple physical proximity to providers of evidence-based treatment for opioid use disorder is no longer a critical barrier. Other barriers to uptake of buprenorphine or methadone maintenance treatment clearly remain and need to be addressed.

Corresponding author: Davidson, Peter J. pdavidson@ucsd.edu.

Introduction

Over the last 20 years opioid-related overdose has become the single largest cause of unintentional death in the United States (Jalal et al., 2018). One response has been to increase access to evidence-based drug treatment for individuals experiencing opioid use disorder. The two leading evidence-based treatments available in the United States are methadone maintenance and buprenorphine maintenance, referred to collectively as 'medication for opioid use disorder' (MOUD) (Amiri et al., 2021; Compton & Volkow, 2021; Mattick et al., 2014; Substance Abuse and Mental Health Services Administration, 2018; U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, 2018; Volkow et al., 2014). While methadone maintenance is highly regulated at the federal level (with many states adding an additional layer of regulation) and only available from specialist clinics, buprenorphine maintenance has been available in primary care settings since 2002. In response to the opioid crisis, over the last 10 years substantial strides have been made to increase availability of evidence-based MOUD across the United States (Alderks, 2017), in particular buprenorphine maintenance, by addressing access barriers such as physician reluctance to prescribe buprenorphine and lifetime limits on maintenance therapies imposed by insurance (Clark & Baxter, 2013; Volkow et al., 2014). Despite these worthwhile efforts, uptake rates of evidence-based MOUD remain relatively low (National Institutes of Health, 2018; Volkow et al., 2014).

To date, research on improving uptake of these treatments has largely focused on regulatory and resource barriers to access (Clark et al., 2011; Hutchinson et al., 2014; Kresina et al., 2009; MacDonald et al., 2016; Netherland et al., 2009; Walley et al., 2008). A smaller body of work has looked at social barriers to uptake, in particular how the attitudes and opinions of otherwise eligible patients toward evidence-based MOUD might affect uptake (Kelly et al., 2012; Korthuis et al., 2010; Schwartz et al., 2008; Stancliff et al., 2002; Zaller et al., 2009). While methadone maintenance is highly regulated at the federal level (with many states adding an additional layer of regulation) and only available from specialist clinics, buprenorphine maintenance has been available in primary care settings since 2002. In response to the opioid crisis, over the last 10 years substantial strides have been made to increase availability of evidence-based MOUD across the United States (Alderks, 2017), in particular buprenorphine maintenance, by addressing access barriers such as physician reluctance to prescribe buprenorphine and lifetime limits on maintenance therapies imposed by insurance (Andrilla et al., 2019; Ghertner, 2019; Knudsen et al., 2017; Yang et al., 2020) which has corresponded to an increase in clinicians authorized to administer buprenorphine in primary care settings. However despite greater availability, the geographic distribution of evidence-based MOUD remains sub-optimal (C. W. Jones et al., 2018). Clinician density, rurality, demographic composition, and transportation conditions are structural factors contributing to geographic variation in evidence-based MOUD (Drake et al., 2020; Goedel et al., 2020; Haffajee et al., 2019; Rosenblatt et al., 2015). Further, most of these studies have been population-based exploring, county level variations of evidence-based MOUD availability. In this paper, we explore the relationship between spatial proximity to evidence-based MOUD providers and recent uptake of evidence-based MOUD treatment in a sample of people who currently or recently used opioids.

Methods

Setting

Southern California has three counties – Ventura, Orange, and San Diego – largely comprised of suburban/exurban and rural communities, with limited syringe and naloxone distribution services, and high rates of HIV and hepatitis C among people who inject drugs (California Department of Public Health, 2017). In 2016 (immediately prior to commencement of this study) these three counties had higher than state median rates of unintentional opioid-related overdose death (California Department of Public Health, 2020). Model-based estimates of the rate of OUD among persons age 12 or older suggest all three counties had rates at or near the statewide rate of 2.0% in 2019 (Orange County 1.9%, San Diego County 2.1%, Ventura County 2.0%) (Clemens-Cope et al., 2019).

Study Sample Data

As part of a CDC-funded study examining transitions from pharmaceutical opioid misuse to street opioid use/misuse and/or injection drug use in suburban and exurban Southern California, we examined recent engagement with drug treatment of any kind and predictors of such engagement among the study sample.

The study was conducted among a cross-sectional sample of individuals who were misusing opioids at the time of their participation and who resided in one of the three study counties. We defined ‘misuse of opioids’ as either using a non-pharmaceutical opioid such as heroin, or as using pharmaceutical opioids without a prescription, or as using pharmaceutical opioids with a prescription but for purposes other than as prescribed (e.g., to self-treat a condition such as anxiety that opioids are not normally prescribed for, or to get high, or to prevent withdrawal).

Participants were recruited through a combination of street-based recruitment; referral from community-based organizations providing naloxone, syringes, and/or drug treatment; and by snowball sampling in which participants referred other potentially eligible people to the study. Eligibility criteria included being age 14 or older, residing in a study county, and having either a) used pharmaceutical opioids other than as prescribed or obtained without a prescription in the last 12 months, or b) used heroin in the past 30 days, where prior to first heroin use the participant had used pharmaceutical opioids. Interviewer-administered structured surveys were conducted between November 2017 and August 2018 in community settings throughout the three counties. Each survey took approximately 50 minutes to complete and participants were reimbursed $40 in cash immediately following consent procedures and before beginning the interview (to reinforce the message given during consent that participation was voluntary and the participant could stop at any time) No participants left before participating in the interview. The study protocol was approved by the Institutional Review Board of the University of California, San Diego (IRB #161398).

Surveys were conducted by trained interviewers and elicited responses on demographics, lifetime substance use, medical history, overdose history, and involvement with alcohol/drug treatment using a structured question/response format, with open-ended responses possible for questions where the respondent provided an answer not included in our list of possible

responses. Among participants who reported alcohol and/or drug treatment in the past 3 months, additional information was collected that included the form of treatment received, the substance the participant stated led to treatment (e.g., heroin, pharmaceutical opioids, amphetamine, alcohol), primary mode of transportation to reach treatment services, and the name of the treatment facility. We categorized treatment into the following three groups:

Evidence-based MOUD: defined here as buprenorphine maintenance or methadone maintenance treatments for opioid use disorder.

Other MOUD: defined here as either the short term use of buprenorphine or methadone to 'taper' or 'detox', or the use of naltrexone (Vivitrol). These otherwise disparate modalities have been grouped here as all three are sometimes included under the rubric of 'MOUD' but the evidence base for all three are lacking (detox) or still inconsistent (naltrexone) (Fiellin et al., 2014; Gruber et al., 2008; H. E. Jones et al., 2008; Masson et al., 2004; Miotto et al., 1997; Morgan et al., 2018; Ritter, 2002; Sees et al., 2000).

Non-MOUD: defined as any other treatment modality, in this case primarily 12-step or similar self-help groups, but including behavioral therapies and the use of non-opioid medications to reduce withdrawal symptoms.

Finally, participants were asked "Would you be willing to tell me an intersection near where you currently live? I don't want your exact address, just somewhere within 5-minute walk so we can calculate roughly how far you'd have to travel to get to different types of social services like syringe distribution services and drug treatment." Mappable locations were provided by 218 participants out of a total sample of 330 (66%). Missing residential location was due to participants either declining to answer the question, providing imprecise locations such as the name of an entire city, or errors such as naming two parallel rather than intersecting streets. Locations provided were geocoded to obtain a latitude and longitude.

Identifying evidence-based MOUD providers

To identify the physical locations of evidence-based MOUD providers in our study setting, we utilized FindTreatment.gov, a treatment search tool launched by SAMHSA in 2019 (Substance Abuse and Mental Health Services Administration (SAMHSA), 2019), which lists providers and/or healthcare agencies providing substance abuse treatment, including the treatment modalities offered, types of insurance accepted, and other information critical to prospective patients seeking care. The FindTreatment.gov site was used to obtain the addresses of all listed healthcare agencies who were described as providing either buprenorphine maintenance and/or methadone maintenance (i.e., evidence-based MOUD as defined in this paper) to patients with Medi-Cal (California's Medicaid insurance program) in the three study counties and in the adjacent 6 counties. By including providers in adjacent non-study counties, we allow for the fact that the closest provider to a participant might be in a neighboring county, particularly for participants living near county borders. Medi-Cal acceptance was used as a filter to exclude agencies who only provide service to specific limited populations (e.g., veterans) or only to individuals who could afford to pay out of pocket. A total of 61 evidence-based MOUD providers were identified across the three study

counties. Evidence-based MOUD provider locations were then geocoded to obtain latitudes and longitudes.

Distance calculation

For every participant, we used the Google Maps distance-matrix application programming interface (API) (Google Inc, 2019) to algorithmically obtain the distance in kilometers and driving time in minutes following road networks (i.e., as opposed to the shortest distance between the two points) to drive from the residence location provided by the participant to every evidence-based MOUD provider in all 9 counties (the 3 study counties and the 6 adjacent counties).* We then used the same approach and API to obtain the distance and travel time via public transit to each of the evidence-based MOUD providers leaving the start point at 9am on a weekday morning (specifically, on the morning of June 12, 2019, a date approximately midway through our data collection). For each participant, we then algorithmically identified the closest evidence-based MOUD provider traveling by automobile and the closest by public transit (these were predominantly but not universally the same providers). For the following analyses, we used the driving time and public transit time in minutes to the closest evidence-based MOUD provider.

As described below, we also conducted a subset analysis of individuals who reported attending a treatment facility within the past three months and who provided us with the name of that facility. We used the same approach described above to calculate the driving distances and time from these participants' place of residence to the facility they named (only 6 of the 65 who received recent treatment gave public transport as mode of transport to treatment, so public transport times were not used for this analysis).

Statistical Analysis

Descriptive statistics including frequencies, percentages, means and corresponding 95% confidence intervals were calculated for the overall sample and stratified by sample characteristics. A multivariable logistic regression analysis was performed to identify the factors associated with spatial accessibility to evidence-based MOUD providers, where we define 'spatial accessibility' as a binary outcome of having or not having an evidence-based MOUD provider within 2.5 km (1.6 miles)of one's place of residence. This cut-off value was chosen to ensure 'access' meant at least one provider was located within 30 minutes travel time regardless of mode of transport (including walking for otherwise healthy persons; as described in our results nearly one fifth of respondents who had received treatment for drug use in the previous 3 months had walked, bicycled, skate boarded, or used a scooter or other unpowered mode of transportation to reach treatment). The independent variables for the regression analysis were chosen *a priori* based on the literature and included demographics, recent substance use, and receipt of alcohol/drug treatment in the past 3 months (Acevedo et al., 2018; Galea et al., 2004; Perron et al., 2009). Lastly, a subset analysis was conducted among participants who self-reported receiving alcohol/drug treatment in the past 3 months and who were able to provide mappable treatment facility and residential locations (n=65). Among these participants, we compared the distance between

*Code written by the authors for this purpose is available on request.

residential location and the provider where treatment was actually received in the last 3 months; and distance between residential location and the nearest evidence-based MOUD provider via road networks.

Results

Characteristics of the study sample are provided in Table 1. Participants were primarily male (68%), non-Hispanic white (69%), over 26 years old (71%), and had at least a high school education (84%). Nearly half were unstably housed (46%). The majority reported methamphetamine use (64%) and heroin use (61%) in the past 30 days. Over half reported a non-fatal overdose during their lifetime (58%). Most of the participants received treatment for alcohol and/or drug use in their lifetime (86%). One-third of the sample reporting receiving treatment within the past 3 months (33%). Among those who never received treatment (n=31), most (68%, n=21) stated the reason for not doing so was because they did not need treatment (data not shown). The median distance to reach the nearest evidence-based MOUD provider from one's residence was 3.8 km (2.4 miles, interquartile range, IQR: 2.2 −5.1 km).

Average Distance to evidence-based MOUD provider

Demographically, males (4.8 km, 3.0 miles), Hispanic/non-white individuals (5.5 km, 3.4 miles), and those above age 26 years (5.1 km, 3.2 miles) lived further away from an evidence-based MOUD provider compared to females (4.1 km, 2.5 miles), non-Hispanic white individuals (4.4 km, 2.7 miles), and those age 26 and younger (3.8 km, 2.4 miles); although these differences were non-significant (data not shown).

As shown in Figure 1, about half of the participants who received treatment in the past 3 months lived less than 2 km (1.2 miles) from an evidence-based MOUD provider whereas half of those who had not received treatment lived within 2.0–3.99 km (1.2 – 2.5 miles) of an evidence-based MOUD provider. Participants residing furthest from an evidence-based MOUD provider, 8 km (5.0 miles) or more, were more likely to have not (13%) vs. to have (7%) received treatment in the past 3 months.

Predictors of spatial proximity

Table 2 shows the results from our multivariable logistic regression model. Younger age (≤ 26 years), and receiving alcohol/drug treatment in the past 3 months were significantly and positively associated with living within 2.5 km (1.6 miles) of an evidence-based MOUD provider. Past 30 day heroin use was negatively associated with living within 2.5 km (1.6 miles) of an evidence-based MOUD provider.

Subset analysis of treatment recipients

Within the overall sample, a total of n=65 participants received alcohol/drug treatment in the past 3 months and also provided a named treatment facility location that could be identified and mapped (out of 71 participants who self-reported treatment in the past 3 months). Table 3 shows the demographic characteristics of subsample. The majority were male (66.7%), non-Hispanic white (75%), age 26 years and older (56.9%), stably

housed (76.9%), and with at least a high school education (90.8%). The most common form of treatment was evidence-based MOUD (40%) followed by non-MOUD (30.8%) and Other MOUD (29.2%). For nearly one-third of the subsample, the primary mode of transportation to treatment services was bus, rideshare service (e.g., Uber, Lyft) or friends/family (32.3%). Approximately one-fifth of the subsample (18.5%) did not rely on a vehicle but rather walked, bicycled, skate boarded, or used a scooter or other unpowered mode of transportation.

Table 4 shows the average distance and average time traveled to reach the nearest evidence-based MOUD provider versus the provider where treatment was actually received in the past 3 months. Within the subsample, the average distance to the nearest evidence-based MOUD provider was 3.7 km (2.3 miles, 95% CI: 2.4–5.0 km) but participants traveled much farther with an average distance of 16.8 km (10.4 miles, 95% CI: 8.7–24.9 km) to reach the provider where treatment was actually received. Similarly, the average drive time to the nearest evidence-based MOUD provider was 5.4 minutes (95% CI: 4.4–6.4) but participants drove, on average, 25.5 minutes (95% CI: 15.5–35.5) to reach the provider where treatment was actually received. Among the n=26 participants who reported receiving evidence-based MOUD in the past 3 months, the average distance to the evidence-based MOUD provider nearest their residence was 4.0 km (2.5 miles, 95% CI: 2.6–5.5 km). However, these participants (n=26) traveled approximately twice as far with an average of 10.2 km (6.3 miles. 95% CI: 7.2–13.3 km) to reach the facility where evidence-based MOUD was actually received.

Discussion

In this sample of individuals who currently or recently misused opioids, spatial proximity to evidence-based MOUD services was relatively close, with a median driving distance from place of residence to the nearest facility of only 3.8 km (2.4 miles). Despite this, the bulk of our sample had not received any form of treatment in the past 3 months, and of those who had, only 40% received evidence-based MOUD, and almost all of these (25 of 26) received methadone maintenance, with only one individual receiving buprenorphine maintenance.

Our data suggest that in the suburban and exurban communities in which our study was based, our findings suggest that simple physical proximity to providers of evidence-based treatment for opioid use disorder is no longer a critical barrier. However this widespread availability in the study area is relatively new, and prior to the introduction of SAMHSA's FindTreatment.gov site in 2019 (i.e., prior to our study period), simply *finding* a provider may also have been a difficult task for our participants. In addition, demand for evidence-based MOUD may still outstrip supply.

For our study population of individuals whose opioid misuse predominantly involved pharmaceutical opioids and who lived in suburban and exurban communities rather than the urban areas where evidence-based MOUD facilities have historically been more common, lack of knowledge about evidence-based MOUD or lack of exposure to other individuals being treated successfully with evidence-based MOUD may have become a more important barrier to access. In our sample, only one participant reported buprenorphine maintenance

over the past 3 months, despite this being both an accepted gold standard treatment for opioid use disorder and over a decade's effort to expand access to this form of treatment (Mattick et al., 2014; U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, 2018; Volkow et al., 2014). Further, 86% of our sample had sought treatment for their substance use at some point in their lives, and participants receiving treatment at the time of their interview were traveling an average 16.8 km (10.4 miles) to reach treatment, showing that as a group this population was both willing and able to seek and engage with treatment, although the most common form of treatment being accessed remained non-MOUD treatments. The association we found between MOUD treatment proximity and receiving any form of treatment may also be a proxy for diversity of treatment options, or some other unmeasured factor which facilitated entry to treatment. Two possible approaches to improving uptake of evidence-based MOUD could be to provide community-level education campaigns about the efficacy of evidence-based MOUD in communities with high rates of opioid-related morbidity and mortality, and to provide treatment induction at locations where people using opioids already obtain public health and primary health services, such as needle distribution services, emergency rooms, or jails. In communities where this is not logistically or administratively viable, such points of contact should at least provide close integration with such services.

This study has a number of limitations. First, this was not intended as a study of treatment participation, but rather a study of spatial barriers to treatment access in a population currently misusing opioids and hence potentially in need of treatment. One possible reason for the low numbers of people in this sample reporting recently receiving any form of treatment is that to be eligible for this study, participants needed to have misused opioids within the past 12 months, meaning any engagement with treatment would have been relatively recent (46.2% of those reporting receiving treatment in the last 3 months also reported using one or more illicit drugs and/or misusing pharmaceutical opioids in the past 30 days). Individuals actively participating in a form of treatment that was successful for them would hence rarely be eligible, so the lack of people in our sample reporting buprenorphine maintenance in the past 3 months may be a reflection of the efficacy of that treatment modality in this study setting. Second, the location of residence provided by participants who report recent treatment may have changed from when they first engaged with that treatment (particularly for unstably housed participants), and we did not ask how long participants had resided at their current location, meaning in an unknown number of cases our calculation of distance from place of residence to the facility they reported receiving treatment may not be valid.

In summary, access to evidence-based MOUD is a critical part of responding to the substantial increases in opioid-related morbidity and mortality of the past 15 years. While our research suggests that such treatments have become spatially accessible in the suburban and semi-rural communities of Southern California, they were underutilized by the participants in our study. Further, as state agencies continue to focus on expanding access to evidence-based MOUD and reducing unmet treatment needs (California Department of Health Care Services, 2019), our study supports the need for additional research examining other barriers to evidence-based MOUD access and utilization.

Acknowledgments

This study was funded by the US Centers for Disease Control and Prevention grant U01 CE0022778, PI Davidson. Findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention. The authors would also like to thank Greer Hennessy and Elizabeth Copulsky for assistance with manually geocoding participant residence locations and for generating and geocoding the list of evidence-based MOUD providers.

Disclaimer:

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Bibliography

Acevedo A, Panas L, Garnick D, Acevedo-Garcia D, Miles J, Ritter G, & Campbell K. (2018). Disparities in the Treatment of Substance Use Disorders: Does Where You Live Matter? The Journal of Behavioral Health Services & Research, 45(4), 533–549. 10.1007/s11414-018-9586-y [PubMed: 29435862]

Alderks CE (2017). Trends in the Use of Methadone, Buprenorphine, and Extended-release Naltrexone at Substance Abuse Treatment Facilities: 2003–2015 (Update). SAMHSA National Survey of Substance Abuse Treatment Services: The CBHSQ Report. https://www.samhsa.gov/data/sites/default/files/report_3192/ShortReport-3192.html

Amiri S, McDonell MG, Denney JT, Buchwald D, & Amram O. (2021). Disparities in Access to Opioid Treatment Programs and Office-Based Buprenorphine Treatment Across the Rural-Urban and Area Deprivation Continua: A US Nationwide Small Area Analysis. Value in Health, 24(2), 188–195. 10.1016/j.jval.2020.08.2098 [PubMed: 33518025]

Andrilla CHA, Moore TE, Patterson DG, & Larson EH (2019). Geographic Distribution of Providers With a DEA Waiver to Prescribe Buprenorphine for the Treatment of Opioid Use Disorder: A 5-Year Update. The Journal of Rural Health, 35(1), 108–112. 10.1111/jrh.12307 [PubMed: 29923637]

California Department of Health Care Services. (2019). California MAT Expansion Project. http://www.californiamat.org/

California Department of Public Health. (2017). California HIV Surveillance Report—2017 (p. 16).

California Department of Public Health. (2020). EPICenter—Overall Injury Surveillance. http://epicenter.cdph.ca.gov/ReportMenus/CustomTables.aspx

Clark RE, & Baxter JD (2013). Responses of State Medicaid Programs to Buprenorphine Diversion: Doing More Harm Than Good? JAMA Internal Medicine, 173(17), 1571–1572. 10.1001/jamainternmed.2013.9059 [PubMed: 23877740]

Clark RE, Samnaliev M, Baxter JD, & Leung GY (2011). The Evidence Doesn't Justify Steps By State Medicaid Programs To Restrict Opioid Addiction Treatment With Buprenorphine. Health Affairs, 30(8), 1425–1433. 10.1377/hlthaff.2010.0532 [PubMed: 21821560]

Clemens-Cope L, Wissoker DA, Epstein M, & Aarons J. (2019). California County Fact Sheets: Treatment Gaps in Opioid-Agonist Medication Assisted Therapy (OA-MAT) and Estimates of How Many Additional Prescribers Are Needed (p. 67). Urban Institute. https://www.urban.org/sites/default/files/2020/01/31/all_counties.pdf

Compton WM, & Volkow ND (2021). Extended-Release Buprenorphine and Its Evaluation With Patient-Reported Outcomes. JAMA Network Open, 4(5), e219708. 10.1001/jamanetworkopen.2021.9708

Drake C, Donohue JM, Nagy D, Mair C, Kraemer KL, & Wallace DJ (2020). Geographic access to buprenorphine prescribers for patients who use public transit. Journal of Substance Abuse Treatment, 117, 108093. 10.1016/j.jsat.2020.108093

Fiellin DA, Schottenfeld RS, Cutter CJ, Moore BA, Barry DT, & O'Connor PG (2014). Primary Care–Based Buprenorphine Taper vs Maintenance Therapy for Prescription Opioid Dependence: A Randomized Clinical Trial. JAMA Internal Medicine, 174(12), 1947–1954. 10.1001/jamainternmed.2014.5302 [PubMed: 25330017]

Galea S, Nandi A, & Vlahov D. (2004). The social epidemiology of substance use. Epidemiologic Reviews, 26, 36–52. [PubMed: 15234946]

Ghertner R. (2019). U.S. trends in the supply of providers with a waiver to prescribe buprenorphine for opioid use disorder in 2016 and 2018. Drug and Alcohol Dependence, 204, 107527. 10.1016/j.drugalcdep.2019.06.029

Goedel WC, Shapiro A, Cerdá M, Tsai JW, Hadland SE, & Marshall BDL (2020). Association of Racial/Ethnic Segregation With Treatment Capacity for Opioid Use Disorder in Counties in the United States. JAMA Network Open, 3(4), e203711–e203711. 10.1001/jamanetworkopen.2020.3711

Google Inc. (2019). Google Maps Distance Matrix API. Google Maps Distance Matrix API. https://developers.google.com/maps/documentation/distance-matrix/start

Gruber VA, Delucchi KL, Kielstein A, & Batki SL (2008). A randomized trial of 6-month methadone maintenance with standard or minimal counseling versus 21-day methadone detoxification. Drug and Alcohol Dependence, 94(1), 199–206. 10.1016/j.drugalcdep.2007.11.021 [PubMed: 18243585]

Haffajee RL, Lin LA, Bohnert ASB, & Goldstick JE (2019). Characteristics of US Counties With High Opioid Overdose Mortality and Low Capacity to Deliver Medications for Opioid Use Disorder. JAMA Network Open, 2(6), e196373–e196373. 10.1001/jamanetworkopen.2019.6373

Hutchinson E, Catlin M, Andrilla CHA, Baldwin L-M, & Rosenblatt RA (2014). Barriers to Primary Care Physicians Prescribing Buprenorphine. The Annals of Family Medicine, 12(2), 128–133. 10.1370/afm.1595 [PubMed: 24615308]

Jalal H, Buchanich JM, Roberts MS, Balmert LC, Zhang K, & Burke DS (2018). Changing dynamics of the drug overdose epidemic in the United States from 1979 through 2016. Science, 361(6408). 10.1126/science.aau1184

Jones CW, Christman Z, Smith CM, Safferman MR, Salzman M, Baston K, & Haroz R. (2018). Comparison between buprenorphine provider availability and opioid deaths among US counties. Journal of Substance Abuse Treatment, 93, 19–25. 10.1016/j.jsat.2018.07.008 [PubMed: 30126537]

Jones HE, O'Grady KE, Malfi D, & Tuten M. (2008). Methadone Maintenance vs. Methadone Taper During Pregnancy: Maternal and Neonatal Outcomes. The American Journal on Addictions, 17(5), 372–386. 10.1080/10550490802266276 [PubMed: 18770079]

Kelly SM, Brown BS, Katz EC, O'Grady KE, Mitchell SG, King S, & Schwartz RP (2012). A Comparison of Attitudes Toward Opioid Agonist Treatment among Short-Term Buprenorphine Patients. The American Journal of Drug and Alcohol Abuse, 38(3), 233–238. 10.3109/00952990.2011.643983 [PubMed: 22242643]

Knudsen HK, Havens JR, Lofwall MR, Studts JL, & Walsh SL (2017). Buprenorphine physician supply: Relationship with state-level prescription opioid mortality. Drug and Alcohol Dependence, 173, S55–S64. 10.1016/j.drugalcdep.2016.08.642 [PubMed: 28363321]

Korthuis PT, Gregg J, Rogers WE, McCarty D, Nicolaidis C, & Boverman J. (2010). Patients' Reasons for Choosing Office-based Buprenorphine: Preference for Patient-Centered Care. Journal of Addiction Medicine, 4(4), 204–210. 10.1097/ADM.0b013e3181cc9610 [PubMed: 21170143]

Kresina TF, Litwin A, Marion I, Lubran R, & Clark HW (2009). United States Government Oversight and Regulation of Medication Assisted Treatment for the Treatment of Opioid Dependence. Journal of Drug Policy Analysis, 2(1). 10.2202/1941-2851.1007

MacDonald K, Lamb K, Thomas ML, & Khentigan W. (2016). Buprenorphine Maintenance Treatment of Opiate Dependence: Correlations Between Prescriber Beliefs and Practices. Substance Use & Misuse, 51(1), 85–90. 10.3109/10826084.2015.1089905 [PubMed: 26771870]

Masson CL, Barnett PG, Sees KL, Delucchi KL, Rosen A, Wong W, & Hall SM (2004). Cost and cost-effectiveness of standard methadone maintenance treatment compared to enriched 180-day methadone detoxification. Addiction, 99(6), 718–726. 10.1111/j.1360-0443.2004.00728.x [PubMed: 15139870]

Mattick RP, Breen C, Kimber J, & Davoli M. (2014). Buprenorphine maintenance versus placebo or methadone maintenance for opioid dependence. Cochrane Database of Systematic Reviews, 2. 10.1002/14651858.CD002207.pub4

Miotto K, McCann MJ, Rawson RA, Frosch D, & Ling W. (1997). Overdose, suicide attempts and death among a cohort of naltrexone-treated opioid addicts. Drug and Alcohol Dependence, 45(1–2), 131–134. [PubMed: 9179515]

Morgan JR, Schackman BR, Leff JA, Linas BP, & Walley AY (2018). Injectable naltrexone, oral naltrexone, and buprenorphine utilization and discontinuation among individuals treated for opioid use disorder in a United States commercially insured population. Journal of Substance Abuse Treatment, 85, 90–96. 10.1016/j.jsat.2017.07.001 [PubMed: 28733097]

National Institutes of Health. (2018, June 11). HEAL Initiative Research Plan. HEAL Initiative Research Plan. https://heal.nih.gov/about/research-plan

Netherland J, Botsko M, Egan JE, Saxon AJ, Cunningham CO, Finkelstein R, Gourevitch MN, Renner JA, Sohler N, Sullivan LE, Weiss L, & Fiellin DA (2009). Factors affecting willingness to provide buprenorphine treatment. Journal of Substance Abuse Treatment, 36(3), 244–251. 10.1016/j.jsat.2008.06.006 [PubMed: 18715741]

Perron BE, Mowbray OP, Glass JE, Delva J, Vaughn MG, & Howard MO (2009). Differences in service utilization and barriers among Blacks, Hispanics, and Whites with drug use disorders. Substance Abuse Treatment, Prevention, and Policy, 4(1), 3. 10.1186/1747-597X-4-3 [PubMed: 19284669]

Ritter AJ (2002). Naltrexone in the treatment of heroin dependence: Relationship with depression and risk of overdose. Australian and New Zealand Journal of Psychiatry, 36(2), 224–228. 10.1046/j.1440-1614.2002.01012.x [PubMed: 11982544]

Rosenblatt RA, Andrilla CHA, Catlin M, & Larson EH (2015). Geographic and Specialty Distribution of US Physicians Trained to Treat Opioid Use Disorder. The Annals of Family Medicine, 13(1), 23–26. 10.1370/afm.1735 [PubMed: 25583888]

Schwartz RP, Kelly SM, O'Grady KE, Mitchell SG, Peterson JA, Reisinger HS, Agar MH, & Brown BS (2008). Attitudes Toward Buprenorphine and Methadone Among Opioid-Dependent Individuals. The American Journal on Addictions, 17(5), 396–401. 10.1080/10550490802268835 [PubMed: 18770082]

Sees KL, Delucchi KL, Masson C, Rosen A, Clark HW, Robillard H, Banys P, & Hall SM (2000). Methadone Maintenance vs 180-Day Psychosocially Enriched Detoxification for Treatment of Opioid Dependence: A Randomized Controlled Trial. JAMA, 283(10), 1303–1310. 10.1001/jama.283.10.1303 [PubMed: 10714729]

Stancliff S, Elana Myers J, Steiner S, & Drucker E. (2002). Beliefs about methadone in an inner-city methadone clinic. Journal of Urban Health, 79(4), 571–578. 10.1093/jurban/79.4.571 [PubMed: 12468676]

Substance Abuse and Mental Health Services Administration. (2018, February 7). Medication-Assisted Treatment (MAT) [Text]. https://www.samhsa.gov/medication-assisted-treatment

Substance Abuse and Mental Health Services Administration (SAMHSA). (2019). FindTreatment.gov. FindTreatment.Gov. https://findtreatment.gov/

U.S. Department of Health and Human Services (HHS), Office of the Surgeon General. (2018). Facing Addiction in America: The Surgeon General's Spotlight on Opioids (p. 40). Office of the Surgeon General.

Volkow ND, Frieden TR, Hyde PS, & Cha SS (2014). Medication-Assisted Therapies—Tackling the Opioid-Overdose Epidemic. New England Journal of Medicine, 370(22), 2063–2066. 10.1056/NEJMp1402780 [PubMed: 24758595]

Walley AY, Alperen JK, Cheng DM, Botticelli M, Castro-Donlan C, Samet JH, & Alford DP (2008). Office-Based Management of Opioid Dependence with Buprenorphine: Clinical Practices and Barriers. Journal of General Internal Medicine, 23(9), 1393–1398. 10.1007/s11606-008-0686-x [PubMed: 18592319]

Yang JC, Roman-Urrestarazu A, & Brayne C. (2020). Responses among substance abuse treatment providers to the opioid epidemic in the USA: Variations in buprenorphine and methadone treatment by geography, operational, and payment characteristics, 2007–16. PLOS ONE, 15(3), e0229787. 10.1371/journal.pone.0229787

Zaller ND, Bazazi AR, Velazquez L, & Rich JD (2009). Attitudes toward Methadone among Out-of-Treatment Minority Injection Drug Users: Implications for Health Disparities. International

Journal of Environmental Research and Public Health, 6(2), 787–797. 10.3390/ijerph602078 [PubMed: 19440415]

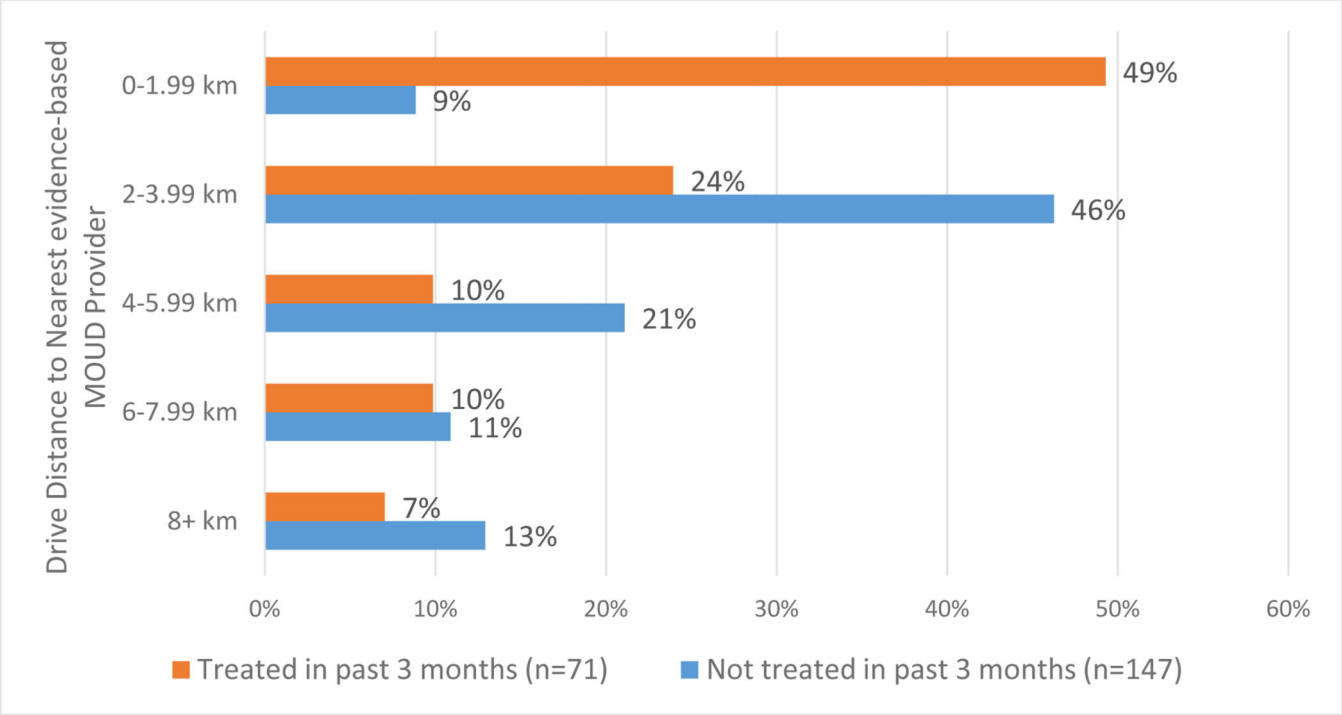

Figure 1:
Drive distance to nearest evidence-based MOUD provider by receipt of alcohol/drug treatment in the past 3 months

Table 1:

Sample characteristics of individuals who currently or recently misused opioids (n=218)

Characteristics	n	%
Male *	147	68%
non-Hispanic white	150	69%
Unstably housed in past 3 months **	100	46%
Education		
Less than HS	35	16%
HS	82	38%
Some college	81	37%
College graduate	20	9%
Age ≤ 26 years	64	29%
Illicit Drug use in past 30 days		
Methamphetamine	139	64%
Powder cocaine	33	15%
Crack cocaine	9	4%
Heroin	133	61%
Prescription Opioids	74	34%
Injected illicit drugs ***	116	53%
Non-fatal overdose in lifetime	127	58%
Self-reported time since last alcohol/drug treatment		
within past 3 months	71	33%
3–6 months ago	13	6%
6–12 months ago	13	6%
more than 12 months ago	90	41%
Never received treatment	31	14%
Distance to nearest evidence-based MOUD provider, kilometers (median, IQR)	3.8	2.2 – 5.1

* Missing gender on N=2

** Unstably housed defined as residing in a street/park/canyon, shelter, hotel, and vehicle

*** Injected drugs that were not under medical supervision included methamphetamine, powder cocaine, crack cocaine, heroin, fentanyl, methadone, and/or other pharmaceutical opioids with 96% injecting heroin alone or heroin and other substances

Table 2:

Multivariable predictors of living within 2.5 km of an evidence-based MOUD provider (n=218)

		95% Confidence Interval		
Variable	**Odds Ratio**	**lower**	**upper**	**p-value**
Males (vs. Female)	0.90	0.40	2.03	0.802
non-Hispanic white	0.70	0.29	1.70	0.435
Unstably housed in past 3 months	0.93	0.35	2.49	0.888
26 years or younger (vs. >26)	3.75	1.72	8.21	0.001
Illicit Drug use in past 30 days				
Methamphetamine	0.71	0.23	2.14	0.539
Powder cocaine	0.42	0.09	2.08	0.288
Crack cocaine	0.56	0.04	7.98	0.667
Heroin	0.28	0.10	0.81	0.019
Prescription Opioids	1.10	0.43	2.79	0.841
Non-fatal overdose in lifetime	1.54	0.69	3.42	0.290
Received alcohol/drug treatment in past 3 months	3.38	1.52	7.52	0.003

* Unstably housed defined as residing in a street/park/canyon, shelter, hotel, and vehicle

Table 3:

Subsample of individuals who currently or recently misused opioids and received treatment for alcohol/drugs in the past 3 months (n=65)

Characteristics	n	%
Male	42	66.7%
non-Hispanic white	48	75.0%
Unstably housed *	15	23.1%
Age ≤ 26 years	28	43.1%
Education		
less HS	6	9.2%
HS	23	35.4%
some college	30	46.2%
college graduate	6	9.2%
Used at least one illicit substance in past 30 days **	30	46.2%
Primary mode of transportation to treatment		
Walk/bike/skateboard/scooter/other	12	18.5%
Bus/rideshare/friends or family	21	32.3%
Treatment Center	20	30.8%
Own vehicle	12	18.5%
Type of treatment		
Non-MOUD	20	30.8%
Other MOUD	19	29.2%
Evidence based MOUD	26	40.0%
Received treatment for following substances		
Opioids only	30	46.2%
Any opioid and non-opioid or non-opioid only ***	35	53.8%

* Unstably housed defined as residing in a street/park/canyon, shelter, hotel, and vehicle

** Illicit substances include methamphetamine, powder cocaine, crack cocaine, heroin, and/or prescription opioids

*** Non-opioid include alcohol, sedatives (benzodiazepines), cocaine, crack cocaine, amphetamines (speed, meth), and cannabis

Table 4:

Comparison of the distance traveled to nearest evidence-based MOUD provider and the facility where treatment was actually received within the subsample (n=65)

Spatial Proximity among those receiving treatment in past 3 months	**mean**	**95% CI**
Drive distance in kilometers (n=65)		
Proximity to nearest evidence-based MOUD	3.7	2.4 – 5.0
Proximity to treatment facility where treatment was actually received	16.8	8.7 – 24.9
Drive time in minutes (n=65)		
Proximity to nearest evidence-based MOUD	5.4	4.4 – 6.4
Proximity to treatment facility where treatment was actually received	25.5	15.5 – 35.5
Spatial Proximity among those receiving evidence-based MOUD in past 3 months	**mean**	**95% CI**
Drive distance in kilometers (n=26)		
Proximity to nearest evidence-based MOUD	4	2.6 – 5.5
Proximity to facility where evidence-based MOUD was actually received	10.2	7.2 – 13.3
Drive time in minutes (n=26)		
Proximity to nearest evidence-based MOUD	5.9	4.8 −7.1
Proximity to facility where evidence-based MOUD was actually received	19.6	11.4 – 27.9

Note: Proximity to treatment is the average drive time and distance between a participant's residence and the treatment center where they reported receiving treatment for drugs/alcohol in past 3 months; Proximity to nearest MOUD is the average drive time and distance between a participant's residence and the nearest MOUD provider identified from SAMHSA's findtreatment.gov treatment locator website