Where Do Clients Receive Methadone Treatment? Exploring Bypassing Behaviors in Methadone Treatment Clients: Temporal, Geographic, and Demographic Factors

Abdullah Alibrahim[1,2] (ID), Jeanne C Marsh[3], Hortensia Amaro[4], Yinfei Kong[5], Tenie Khachikian[3] and Erick Guerrero[6]

[1]Industrial & Management Systems Engineering, College of Engineering & Petroleum, Kuwait University, Kuwait, Kuwait. [2]Geo-Health Lab, Dasman Diabetes Institute, Kuwait, Kuwait. [3]Crown Family School of Social Work, Policy, and Practice, University of Chicago, Chicago, IL, USA. [4]Robert Stempel College of Public Health and Social Work and Herbert Wertheim College of Medicine, Florida International University, Miami, FL, USA. [5]College of Business and Economics, California State University Fullerton, Fullerton, CA, USA. [6]I-Lead Institute, Research to End Healthcare Disparities Corp, Los Angeles, CA, USA.

ABSTRACT

BACKGROUND: Few studies have examined where clients receive methadone treatment for opioid use disorder relative to their residences. Commuting time affects access to care, and anecdotal evidence suggests clients often bypass closer methadone providers. This study quantifies (a) bypass patterns in Los Angeles County, (b) gender, age, and ethnoracial differences in bypassing, and (c) links between bypassing and facility attributes.

METHODS: Using retrospective multiyear analysis, we matched opioid treatment episodes with commuting times between clients' ZIP codes and treatment facilities. From 16 972 outpatient episodes (2010-2017), data were paired with Google Maps commuting estimates. The study covered 32 methadone facilities and 8627 unique clients. We determined the difference in driving time (a proxy for commuting time) from the nearest (bypassed) provider to the provider where the client was treated, deriving bypass and extended commute rates. We compared the rates of a scaled bypassing variable across racial, ethnic, and gender groups. We examined rates by grouping and by facility characteristics of the closest provider.

RESULTS: Bypassing occurred in 48.9% of episodes; 21.0% involved extra commute time of 5+ minutes beyond the closest facility. Bypass rates varied significantly across racial, ethnic, and gender groups. Black or African American clients showed higher bypass rates than non-Latino white clients. Latino female clients had lower rates and shorter commutes than Latino male clients ($P < .01$). Larger methadone facilities experienced fewer bypassing and Black clients were found to typically bypass in favor of providers with longer wait times than other groups in the study.

IMPLICATIONS: This is the first study investigating client and facility characteristics relating to methadone treatment bypassing in a major U.S. care system. The results highlight significant bypass rates affecting efficient access. Findings have implications for opioid treatment system design, particularly to improve access to quality care for underserved communities.

KEYWORDS: Methadone, bypass, Geographical Information Systems, disparities, opioid treatment

Introduction

In the United States, the urgent need to facilitate access to medication for opioid use disorder (MOUD) is underscored by the staggering 75 673 opioid-related overdose deaths between April 2020 and April 2021, which comprised approximately 75% of total drug overdose deaths in that period.[1] While many factors contribute to accessing MOUD, this study investigates the phenomenon of bypassing, where clients commute past their nearest treatment provider in favor of one further away. This behavior, which potentially affects clients' response to substance use treatment, is a critical yet underexplored aspect of treatment access, particularly as it relates to methadone programs requiring frequent clinic visits.[2] Clients seeking substance use disorder (SUD) treatment—especially those from racial or ethnic minority groups or of low socioeconomic status—encounter individual, program, and policy barriers to entering treatment.[3-5]

Bypassing a closer methadone provider is the result of a complex interplay of individual, program, and policy factors and may have an impact on clients' response to treatment. Longer commute times to SUD treatment have been associated with poorer treatment outcomes,[6,7] including nearly

20 000 methadone treatment episodes in Los Angeles County (LAC).[8] Nevertheless, it is common for SUD clients to bypass their closest treatment facility for one that is farther away.[9,10] Still, the relationship between provider and client characteristics and higher bypass rates in SUD treatment remains unclear. Therefore, we explore the extent and determinants of bypassing behavior. We consider not only the burden of travel but also the client and facility characteristics that contribute to the rates of this phenomenon in MOUD.

This exploratory study examines how often and why clients bypass their nearest facility—a choice potentially influenced by varied access and systemic factors. Prior research on healthcare bypass in the United States, which has predominantly focused on rural areas, has identified race, socioeconomic status, marital status, and psychiatric diagnosis as factors influencing bypass behavior.[10-14] Patient characteristics found to be negatively associated with bypassing include older age, public insurance, lower socioeconomic status, and ethnic or racial minority status.[14,15] This study extends this inquiry to MOUD and an urban context, where the dynamics of bypassing may differ due to the density of available facilities and the unique urban challenges and opportunities for accessing care.

Studies conducted outside the United States demonstrated that client characteristics positively associated with bypassing included higher socioeconomic status and male gender, whereas those negatively associated with bypassing included older age, ethnic or racial minority status, and lower socioeconomic status.[12,13,15,16] Despite being less likely to exercise choice by bypassing their closest provider in practice, clients who are older, non-White, female, and of lower socioeconomic status tend to place a higher value on having the hypothetical opportunity to choose their provider.[13,17-20]

Regarding the characteristics of programs where clients receive care, studies in the United States suggested that patients prefer larger, urban programs with better reputations and more services and technologies.[14,15,21] Outside the United States, patients also preferred larger facilities and providers with better reputations, as well as those offering specialty care services.[12,15,16]

In light of the limited literature on this topic, this exploratory study is driven by 3 primary research questions: (1) Do LAC methadone treatment clients exhibit temporal and geographic bypassing patterns? (2) Does bypassing occurrence differ by gender, age, race, and ethnicity? (3) Are client bypassing and facility characteristics associated? We used our empirical findings to consider how to expand system and organizational theories, inform public policies, and improve opioid disorder care in underserved communities.

Methods

This retrospective multiyear analysis explored outpatient methadone treatment for opioid use disorder in LAC. We relied on client administrative data from the LAC Participant Reporting System. The data came from a parent study funded by NIDA (R33 DA03563401) that focused on SUD treatment programs that served communities with more than 80% Latino or African American residents in LAC. No sampling was performed, as this analysis examined the full scope of care episodes recorded within the geographic area of interest. The multiyear cross-sectional data included 8627 clients aged 12 or older served by 32 unique methadone treatment programs. All methadone treatment episodes in which the clients' zip codes were available were included in the study; otherwise, the episode was excluded. We analyzed 16 927 outpatient methadone treatment episodes in LAC reported in fiscal years 2012 to 2017, which captured 8627 clients treated between calendar years 2010 and 2017 (1.96 episodes per client on average). We paired each episode with commuting data from Google Maps Distance Matrix Functions from their application programing interface (API). The distance matrix API accepts coordinates (geolocated treatment facilities and clients' zip codes) to generate pairwise travel distance, expected driving time with traffic, and other travel-related estimates, tracing the route from each client's ZIP code (population-weighted centroid) to the treatment facility. Additional details, verification, and analyses of driving time estimates are reported by Alibrahim et al.[8] An episode in which a client received methadone treatment at a facility other than the facility closest to their reported residential ZIP code was considered a case of bypass.

Key variables and methods

Research question 1. For the first research question, we derived 2 key outcome variables at the episode level: bypass (1 = *client bypassed closest methadone treatment*, 0 = *otherwise*) and driving time beyond the bypassed facility (in minutes) for bypassing episodes. The bypass variable was obtained by algorithmically inspecting every episode for closer facilities at the month of the episode. If closer facilities were found, the episode was marked as a bypassing episode (1 = *bypass*, 0 = *otherwise*). If an episode was tagged as a bypassing episode, a secondary variable was calculated to estimate the difference in driving time between the bypassed treatment facility and the facility at which methadone treatment was received. For example, if a client received care at a facility 15 minutes away despite another facility only 5 minutes away, the bypassing time was calculated as 10 minutes.

We aggregated the bypassing variables into 1 multilevel variable for bypass status with 4 categories: no bypass, bypass of less than 5 minutes, bypass of 5 to 10 minutes, and bypass of more than 10 minutes. This created a scaled variable of the commute time of methadone clients beyond their closest facility to receive care. The bypassing categories were created to distinguish bypassing due to the availability of facility options and bypassing that meaningfully changes a client's commuting experience.

We refer to bypass rates or proportions as the number of episodes where clients received care at a facility other than the closest, divided by the total number of episodes within the unit of analysis (eg, ZIP code, ethnic/racial group, gender). Bypass rates or proportions can also be calculated for each bypass category. For instance, the rate of bypassing 5 minutes or more refers to all treatment episodes where clients traveled more than 5 minutes beyond their closest facility, divided by the total number of episodes in the unit of analysis.

We visualized temporal and geographic trends in bypass rates and categories in LAC at the ZIP code level to provide a detailed spatial analysis of bypass behaviors. This approach allows us to explore disparities and identify areas where clients are more likely to bypass their nearest facility, highlighting specific ZIP codes with higher bypass rates. By observing these rates and categories across different ZIP codes, we aim to visibly identify patterns and potential geographic barriers impacting methadone treatment access. Additionally, we superimposed the locations of methadone treatment facilities onto these visualizations to gain an exploratory geographic understanding of bypass behaviors relative to the presence and concentration of facilities. This layered analysis helps identify whether certain areas with high bypass rates coincide with lower facility density or other geographic factors.

Research question 2. For the second research question, we conducted group analyses to compare rates and categories of bypass across age, gender, and racial and ethnic groups in LAC. We statistically compared the proportion of each variable for each bypassing status across the study covariates, including age, gender, and racial and ethnic groups. The age categories used in our analysis were: <25, 25-34, 35-45, 45-54, 55-64, and 65+. The racial and ethnic groups included were White, Black, Latino, and Other. We use chi-square tests of independence and *t*-tests to confirm statistically significant associations between the demographic covariates and bypass categories.

Research question 3. For the third research question, we examined facility-level attributes in bypassing episodes by comparing the characteristics and waiting time of bypassed and accessed facilities. Facility attributes represented the key outcome variables, and bypass status was the key grouping variable. We examined 2 facility attributes: (a) the number of clients served by the facility (in quartiles) as a proxy for the size and resources of the facility and (b) wait time for treatment (in days). Wait times are collected as part of the intake survey when clinical staff assist clients and are obtained by the difference between when treatment is requested and the initiation of treatment (in days).

We then conducted statistical analyses to make inferences about the efficiency of bypassing (ie, whether clients bypassed to avoid long wait times). We ran statistical tests to compare the attributes of bypassed and accessed facilities across bypass categories. We conducted statistical tests to compare the attributes of bypassed and accessed facilities across different bypass categories. The analysis specifically focused on comparing the closest facility that a client bypassed to the facility they ultimately accessed. Intermediate facilities that could exist between the nearest facility and the accessed facility were not analyzed for tractability.

We ran comparisons to determine the associations between the bypassing duration category and the size classification of the closest methadone treatment facility. Chi-square tests of independence were used to confirm if there is an association between the classification of the closest facility and the occurrence of the bypass duration category. Additionally, in bypassing episodes, we compared the waiting times at the closest bypassed facility and the facility a client bypasses to.

Explanatory variables

The independent variables of interest included clients' self-reported sex, measured as a dichotomous variable (1 = *female*, 0 = *male*). The study also examined race and ethnicity, using categories of Latino or Hispanic, Black or African American, non-Latino White, and other. We coded the category "other" to represent clients identifying as American Indian, Asian, or another race and ethnicity because these subgroups were not large enough for separate analysis. Clients also reported demographic and socioeconomic variables, including age, education (completing high school or not), eligibility for Medi-Cal (California's Medicaid program), veteran status, and referral source.

Statistical analyses

Statistical analyses were run using R statistical software to address each aim. Specifically, group comparisons were used to study patterns in bypassing. For instance, *t*-tests and chi-square tests of independence were used to determine if men and women had different average rates of bypassing and bypassing duration categories. A similar approach was used to compare age groups, Medi-Cal clients, and other study covariates. For the study's third aim, we employed group comparisons to infer the difference in attributes between bypassed and accessed facilities.

The dataset utilized in this analysis had an average missing rate of under 10%. To optimize the sample size at each analysis stage, observations were included whenever the pertinent variables were present (pairwise deletion). We performed a missing data analysis using R statistical software to verify that the missing data were distributed randomly using designated packages.[22,23]

Results

The average travel time to treatment facilities in the study sample is 11.32 minutes (95% CI = 11.21, 11.43). Approximately
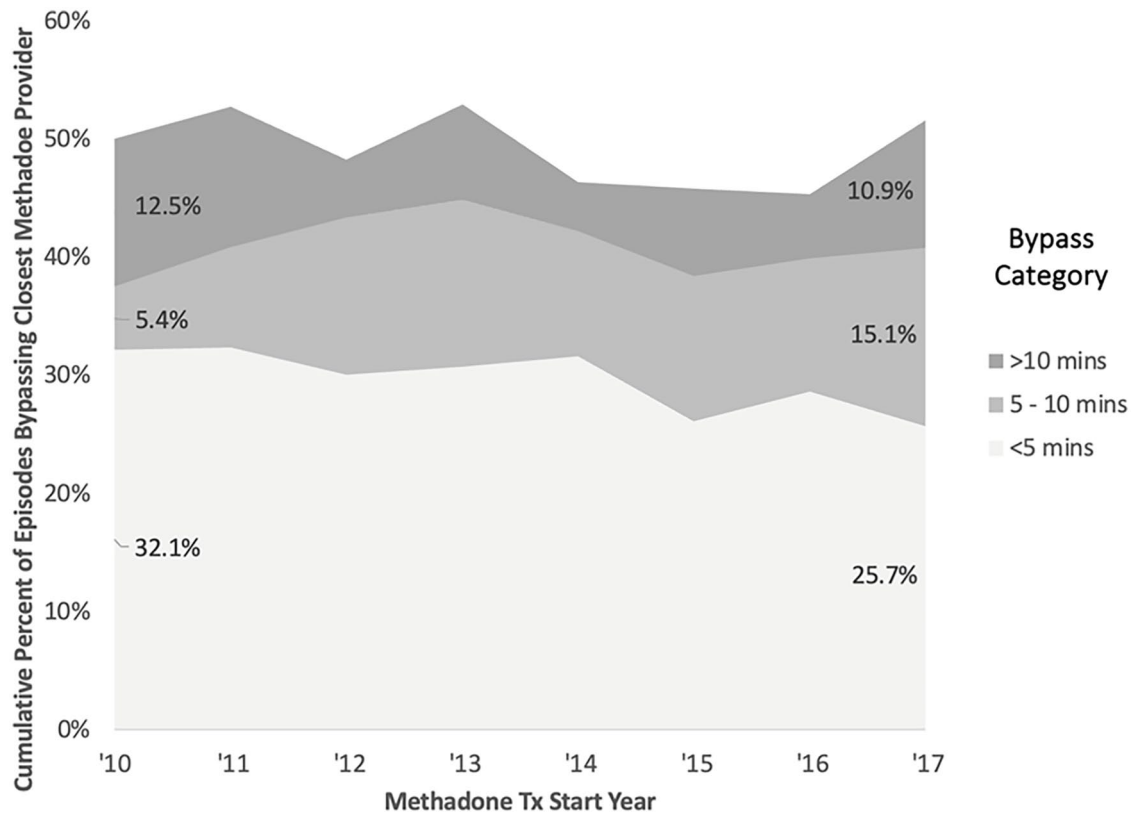
Figure 1. Changes in bypass rates and distribution of driving time beyond the closest methadone facility show a stable overall rate of bypass but an increasing rate of longer commuting times when bypassing.

48.9% of all episodes involved bypassing the closest MOUD provider (8299 out of 16 946), and 21.0% of all episodes involved commuting 5 or more minutes beyond the closest MOUD provider for treatment.

Do LAC methadone treatment clients have temporal and geographic bypassing patterns?

Over time, total bypass rates fluctuated during the study period (2010-2017), but no directional trend was noticeable. However, the rate of bypassing episodes in which clients commuted 5 or more minutes beyond their closest methadone facility significantly increased during the study period. In Figure 1, there is a visible increase in the portion of bypassing episodes in which clients commuted 5 minutes or longer beyond their closest facility in the stacked line graph's darker shades of gray. While we do not conduct statistical analyses, the exploratory visualization depicts a noticeable increase in the occurrence of these episodes. Specifically, of all methadone treatment episodes in 2010, 17.9% bypassed their closest methadone facility and commuted 5 or more minutes beyond the commute time to their closest facility. In 2017, 26.0% of episodes involved the behavior.

Additionally, we observed fluctuations in bypass rates and commute times based on geographic location. Rates of bypass varied widely across the geographic regions of LAC relative to urban centers. In Figure 2 (see left panel), we observed that bypass rates were higher in the central area of LAC, where clients had more nearby MOUD facilities from which to choose, as shown in the darker orange ZIP codes. We also noted that in the peripheries of LAC, bypass was associated with longer commuting time beyond the closest facility, as shown in the darker blue ZIP codes (see Figure 2, right panel), despite lower bypass rates in these ZIP codes. Bypass rates were higher in central LAC, which featured more facility options, but bypassing in the outskirts of LAC was associated with longer commuting times beyond the closest methadone facility. In summary, while bypass rates showed no clear trend over time, longer bypass times became more common, and geographical location influenced these patterns.

Does bypassing occurrence vary by gender and race and ethnicity?

We found multiple covariates linked to bypass, as shown in Table 1 with asterisks. Female clients were more likely to bypass their closest facility for methadone treatment (50.2% of female client episodes and 48.4% of male client episodes bypassed; $P = .027$). Still, female clients were less likely to commute 10 or more minutes beyond the closest facility when bypassing than men (14.3% of bypassing women and 17.2% of bypassing men commuted 10 minutes or more; $P < .001$).
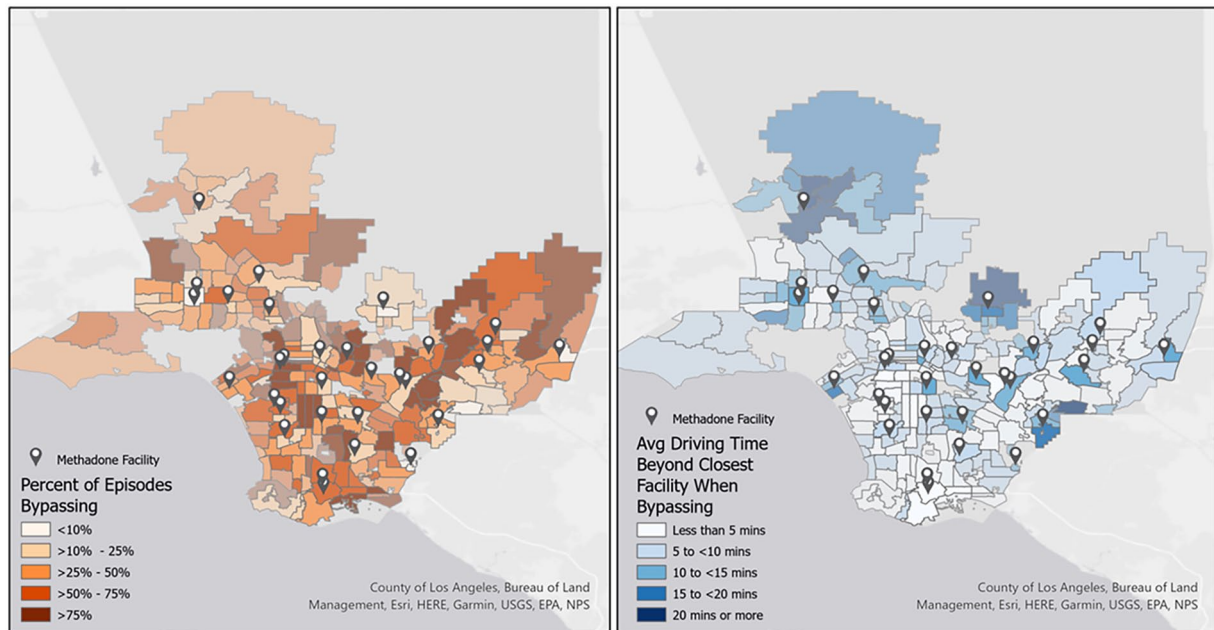
Figure 2. ZIP code-level assessment of bypass rates and time traveled beyond the closest facility when bypassing. Darker ZIP codes denote higher bypass rates in the left panel, whereas dark blue ZIP codes denote longer commutes beyond the closest facility when bypassing. The more transparent a ZIP code, the fewer episodes originated from that ZIP code.

We found no difference in bypass rates by Medi-Cal eligibility, but we detected that Medi-Cal-eligible clients were less likely to travel farther for treatment. Specifically, 15.2% of Medi-Cal-eligible bypassing episodes involved commuting more than 10 minutes beyond the closest facility, whereas 18.2% of Medi-Cal-ineligible bypassing episodes involved similar commutes beyond the closest facility ($P=.001$ of the Pearson chi-square tests of independence between bypass category and Medi-Cal eligibility).

The likelihood of bypassing the nearest methadone clinic visibly increased with the client's age. However, this trend is only observable for clients bypassing within 5 minutes. This trend is visible in the increasing percentage of bypassing individuals by age in Figure 3. Bypassing 5 or more minutes beyond the closest facility remains consistent across age groups in Figure 3.

Figure 4 shows the cumulative and bypass categories by clients' racial and ethnic backgrounds and gender. Episodes involving Black clients had a higher bypassing rate than White or Latino clients, as shown in Table 1 (Bypass rates for Black Clients: 62.9%, White Clients: 46.0%, Latino Clients: 47.5%; $P<.05$). Still, the rates of bypassing 5 or more minutes beyond the closest facility were comparable across all ethnic groups in this analysis. Specifically, the proportions of episodes involving driving 5 or more minutes beyond the closest facility were 20.6% for Black clients, 23.4% for White clients, and 22.5% for Latino clients. Pairwise comparisons showed that these proportions were not significantly different between Black and White clients ($P=.217$), Black and Latino clients ($P=.405$), and White and Latino clients ($P=.543$).

Are client bypassing and facility characteristics associated?

We observed that when the closest treatment facility had a larger capacity (served more clients annually), clients were less likely to bypass it, as indicated in Table 1 and Figure 5. Figure 5 shows that a smaller proportion of bypassing occurs when the closest facility is larger ($P<.05$; chi-square test of independence between bypass duration category and closest treatment facility size classification). On the other hand, more bypassing incidents occur when the closest facility is categorized as small or smallest. In our investigation of the link between bypass categories and wait times for treatment initiation at facilities, we discovered that most clients chose to bypass facilities with longer wait times. This preference for facilities with longer wait times was more pronounced among Black clients, as shown in Figure 6. The upward-sloping line in Figure 6 suggests that clients who bypassed their closest facility experienced longer wait times. Longer bypass categories were more frequent when the closest facility's wait time was shorter. Bypassing clients generally favored facilities with longer wait times, as evident in the upward-sloping lines that signify facilities that were bypassed to have longer wait times in days. This preference is statistically significant in Black clients in all bypass categories ($P<.05$) and for White clients bypassing less than 5 minutes ($P<.05$). However, there is an interesting exception: White women who bypassed a distance greater than 10 minutes beyond their closest facility tended to favor facilities with shorter wait times, as evidenced by the downward-sloping blue line in the bottom-right corner of Figure 6.

Table 1. Group-level perspectives of the study covariates based on bypass category.

VARIABLE	STUDY SAMPLE (N = 16 946)	NOT BYPASSING (N = 8647)	BYPASSING (N = 8299)		
			<5 MIN (N = 4739)	5-10 MIN (N = 2213)	>10 MIN (N = 1347)
	N (%)	N (%)	N (%)	N (%)	N (%)
Treatment plan completion[a]	8.70 (8.06, 9.35)	8.67 (7.74, 9.60)	9.81 (8.52, 11.10)	7.04 (5.47, 8.61)	8.06 (6.02, 10.11)
Estimated commute to closest facility*,[b]	8.32 (8.22, 8.41)	8.10 (7.95, 8.25)	8.45 (8.33, 8.58)	9.15 (8.88, 9.41)	7.88 (7.51, 8.25)
Gender*					
Female	5381/16 944 (31.76)	2680/8646 (31.00)	1602/4738 (33.81)	714/2213 (32.26)	385/1347 (28.58)
Male	11 563/16 944 (68.24)	5966/8646 (69.00)	3136/4738 (66.19)	1499/2213 (67.74)	962/1347 (71.42)
Medi-Cal eligible*					
Yes	11 065 (65.30)	5603 (64.80)	3216 (67.86)	1414 (63.90)	832 (61.77)
No	5881 (34.70)	3044 (35.20)	1523 (32.14)	799 (36.10)	515 (38.23)
Age group*					
<25	1062/16 546 (6.42)	568/6461 (6.71)	255/4603 (5.54)	146/2179 (6.70)	93/1303 (7.14)
25-34	4128 /16 546 (24.95)	2230/6461 (26.36)	1014/4603 (22.03)	533/2179 (24.46)	351/1303 (26.94)
35-45	3067/16 546 (18.54)	1600/6461 (18.91)	777/4603 (16.88)	420/2179 (19.27)	270/1303 (20.72)
45-54	3937/16 546 (23.79)	2020/6461 (23.87)	1135/4603 (24.66)	501/2179 (22.99)	281/1303 (21.57)
55-64	3486/16 546 (21.07)	1679/6461 (19.84)	1119/4603 (24.31)	459/2179 (21.06)	229/1303 (17.57)
65+	866/16 546 (5.23)	364/6461 (4.30)	303/4603 (6.58)	120/2179 (5.51)	79/1303 (6.06)
Race*					
White	7220/16 732 (43.15)	3901/8563 (45.56)	1927/4671 (41.25)	830/2178 (38.11)	562/1320 (42.58)
Black	1948/16 732 (11.64)	723/8563 (8.44)	824/4671 (17.64)	255/2178 (11.71)	146/1320 (11.06)
Latino	6898/16 732 (41.23)	3621/8563 (42.29)	1728/4671 (36.99)	1003/2178 (46.05)	546/1320 (41.36)
Other	666/16 732 (3.98)	318/8563 (3.71)	192/4671 (4.11)	90/2178 (4.13)	66/1320 (5.00)
Education[c]					
Completed high school	5413/7723 (70.09)	2737/3896 (70.25)	1516/2146 (70.64)	734/1048 (70.04)	426/633 (67.30)
Did not complete high school	2310/7723 (29.91)	1159/3896 (29.75)	630/2146 (29.36)	314/1048 (29.96)	207/633 (32.70)
Veteran*					
Yes	620 (3.66)	316 (3.65)	199 (4.20)	67 (3.03)	38 (2.82)
No	16 326 (96.34)	8331 (96.35)	4540 (95.80)	2146 (96.97)	1309 (97.18)
Referral source*					
Self	16 506 (97.40)	8440 (97.61)	4643 (97.97)	2143 (96.84)	1280 (95.03)
Court	41 (0.24)	15 (0.17)	20 (0.42)	5 (0.23)	1 (0.07)
Other	399 (2.35)	192 (2.22)	76 (1.60)	65 (2.94)	66 (4.90)

(Continued)

Table 1. (Continued)

VARIABLE	STUDY SAMPLE (N = 16 946)	NOT BYPASSING (N = 8647)	BYPASSING (N = 8299)		
			<5 MIN (N = 4739)	5-10 MIN (N = 2213)	>10 MIN (N = 1347)
	N (%)	N (%)	N (%)	N (%)	N (%)
Closest facility size*					
First quartile (largest)	8460/16 732 (50.56)	4152/8563 (48.49)	2717/4671 (58.17)	886/2178 (40.68)	705/1320 (53.41)
Second quartile	4260/16 732 (25.46)	2253/8563 (26.31)	915/4671 (19.59)	816/2178 (37.47)	276/1320 (20.91)
Third quartile	2890/16 732 (17.27)	1482/8563 (17.31)	794/4671 (17.00)	366/2178 (16.80)	248/1320 (18.79)
Fourth quartile (smallest)	1122/16 732 (6.71)	676/8563 (7.89)	245/4671 (5.25)	110/2178 (5.05)	91/1320 (6.89)

[a]Values reflect average percentages with 95% confidence intervals in parentheses.
[b]Values reflect average minutes with 95% confidence intervals in parentheses.
[c]Values after the slash represent the sample size for this variable due to missingness.
*P < .05 in the chi-square test between covariate and the 4-level bypass variable (no bypass, <5 minute bypass, 5-10 minute bypass, 10+ minute bypass).
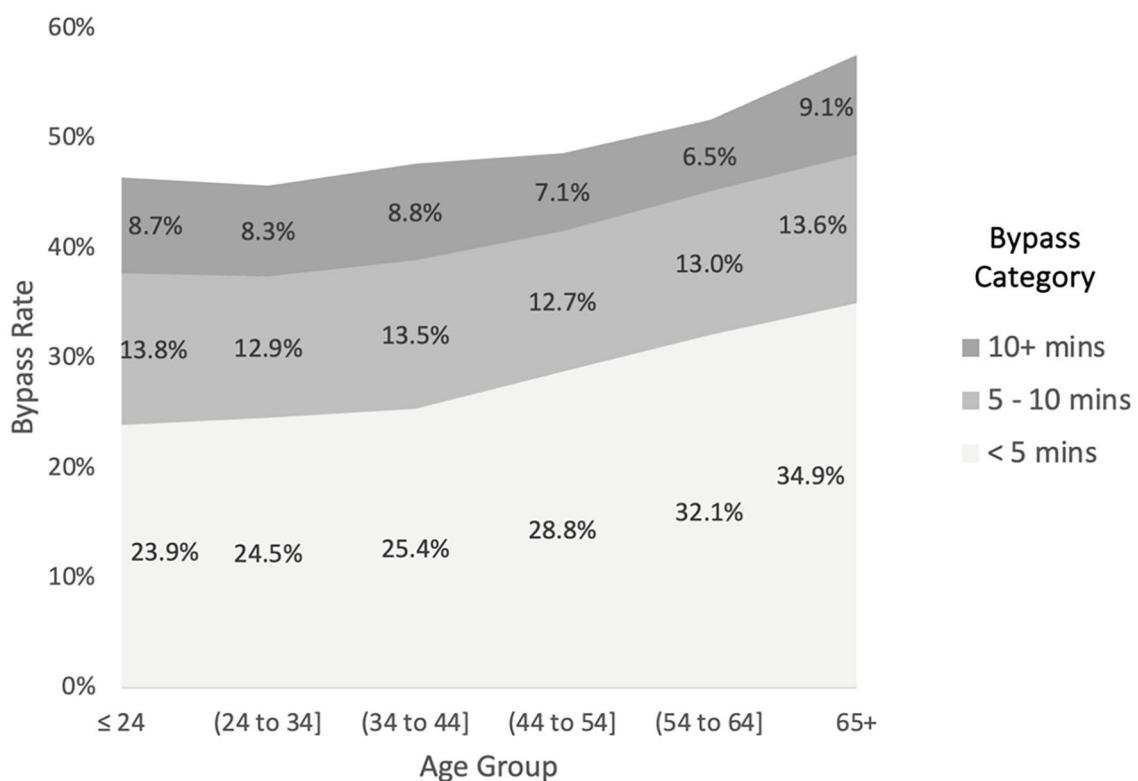

Figure 3. Comparison of bypass categories based on clients' age group. Bypassing less than 5 minutes visibly increased as clients' age increased. Longer bypass categories appear consistent across different age groups.

Discussion

The current study explored research questions related to temporal and geographic bypassing patterns, gender and ethnoracial differences in bypassing occurrence, and associations between client bypassing and facility characteristics. Using a large, system-level analysis capturing episodes from a multiyear, multicenter dataset and leveraging the latest geographic information system techniques, we identified significant temporal, geographic, and demographic associations between bypassing and the characteristics of methadone providers. Our
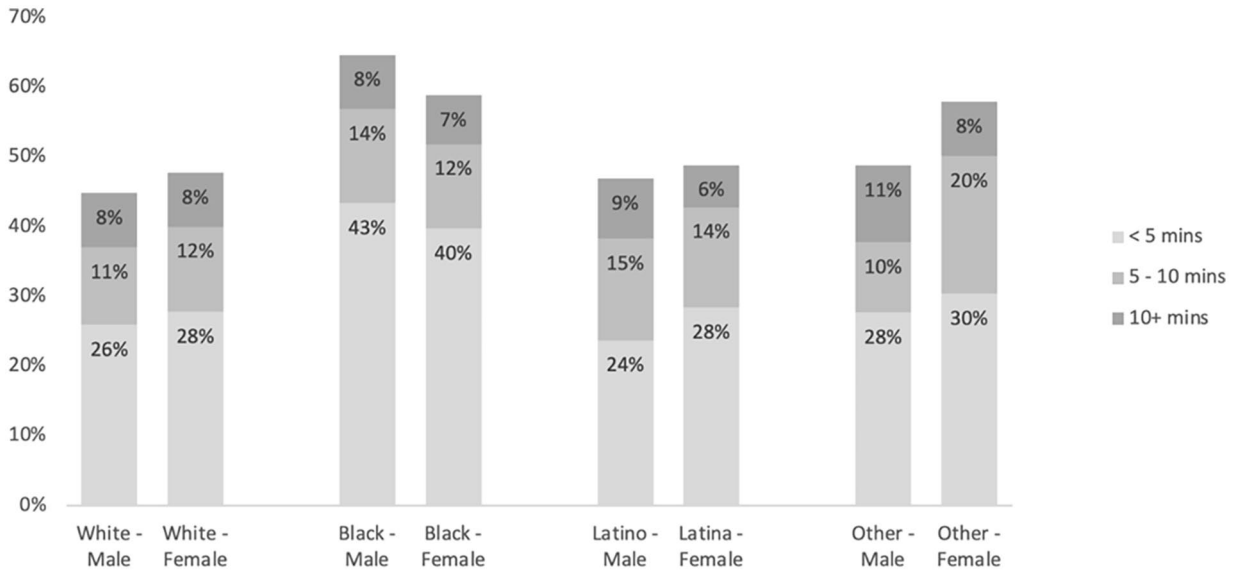
Figure 4. A comparison of bypass categories based on clients' racial and ethnic backgrounds.
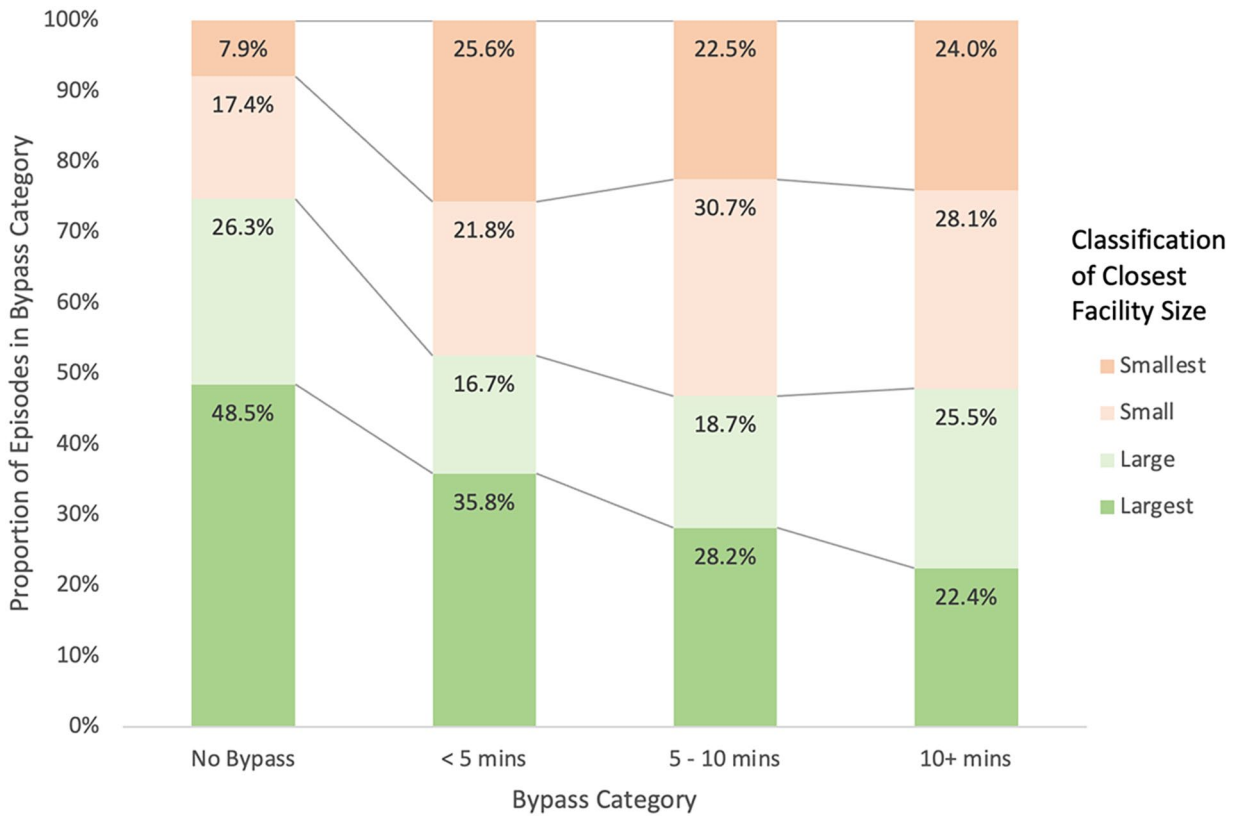

Figure 5. A comparison of bypass categories based on the closest methadone facility size. We notice here that bypassing farther is more likely when the closest facility is below the median size by volume of episodes.

findings shed light on previously unexplored nuances in methadone treatment-seeking behaviors, offering valuable insights for health policymakers.

The observed increase in the rate of more extended bypass (5-plus minutes beyond closest facility) during the study period is a notable finding. Albeit conjectural, this finding may suggest increased preferences based on the perceived quality of care, effectiveness, responsiveness, and system factors. The social stigma of attending community care, whereby participants' privacy and confidentiality may be breached, is also a potential driver of bypass.

We also observed geographic patterns of bypass. Bypass was more likely when more providers were close to one another, for example, in urban centers. The peripheries of LAC featured fewer methadone providers to choose from and bypass was less likely. But when bypass occurred in these remoter areas, the
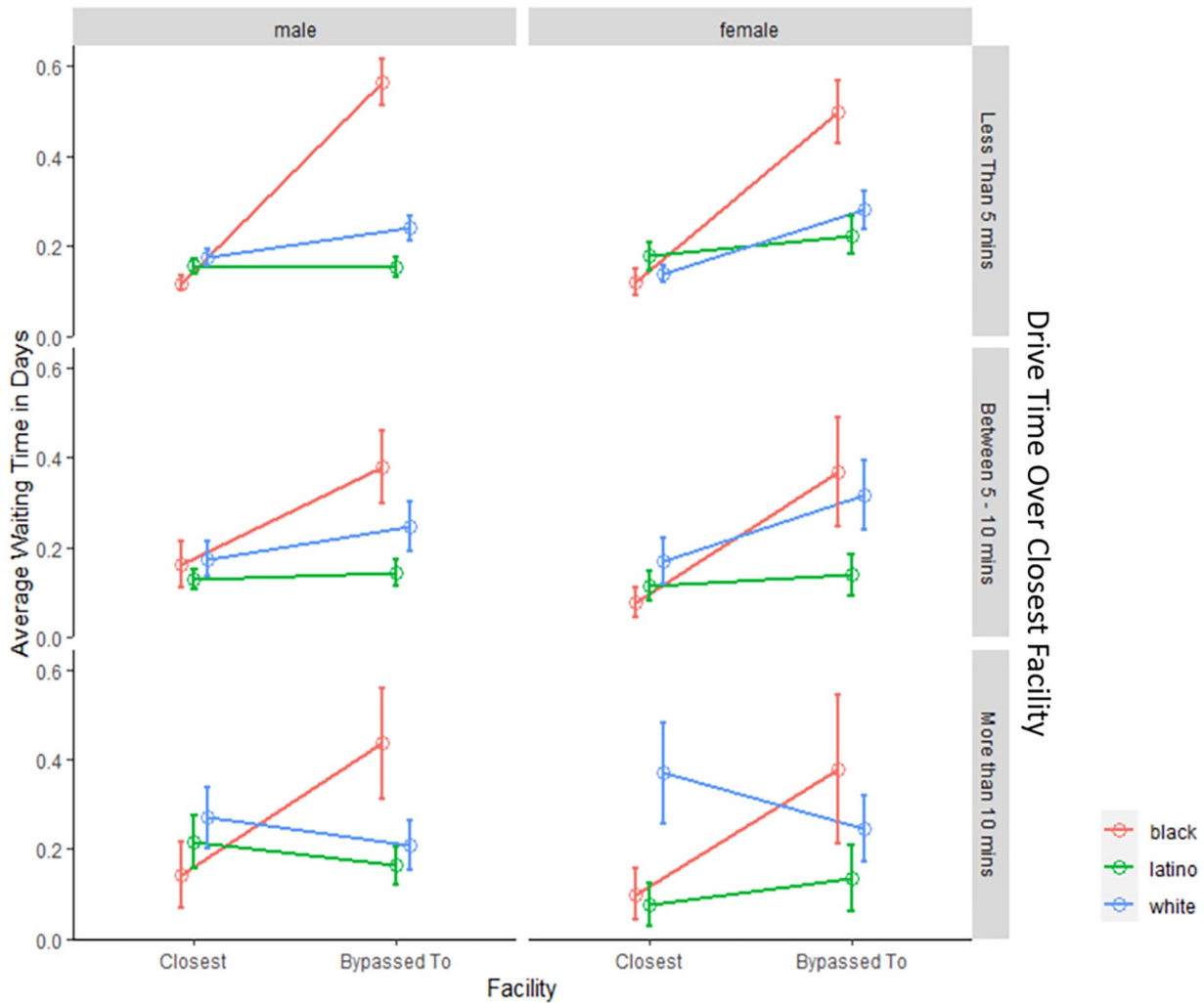
Figure 6. A comparison of waiting times in bypassing episodes comparing the closest facility to the facility that was bypassed to. The analysis is done by bypass category, gender, and Ethnic and Racial characteristics.

average commuting time beyond the closest provider was significantly higher. In a market economy for health care services, this dynamic of bypassing options when they are close together is not surprising. But the key reasons for bypassing 1 or more nearby providers remain unclear.

We also found that client age, gender, and ethnoracial characteristics were associated with varying degrees of bypass of nearby methadone treatment providers. This is the first known study to identify differences based on these demographic characteristics. Older clients were more likely to bypass, but their bypass was associated with less than 5 minutes of commuting beyond their closest facility. Black and Latino clients were more likely to bypass 5 or more minutes beyond their closest facility. We found that Latina women were more likely to bypass by 5 or more minutes compared to women overall. Black men also bypassed more than their ethnoracial counterparts. These findings show how historically vulnerable subgroups (older adults, non-White clients, and women) were more likely to bypass their closest provider. This finding highlights factors that may influence this bypass

disparity, such as patient choice, systemic drivers, and available resources in minority communities.

A final significant finding shows increased bypass toward facilities with longer wait times to initiate treatment. The bypass occurs in favor of larger methadone treatment providers, which also reported longer wait times. The literature on gender and ethnic differences in bypass for methadone treatment is scarce. Our reported estimates represent a first look at differences and patterns in these behaviors. It is possible that vulnerable clients who bypassed may favor care in larger and more reputable facilities despite a longer wait to access care. This finding adds nuance to emerging findings regarding the capacity of larger programs to improve access to care. Larger providers may have more capacity to deliver quality care, but they may have quickly increased service demand and might not respond as effectively as providers in minority communities. From a system effectiveness perspective, the opioid treatment system may need a diversity of providers based on size, location, and cultural and linguistic responsiveness to address the service needs of vulnerable populations effectively.

Conclusion

Our study's analysis uncovered significant differences in bypass associated with gender, race, and proximity to larger methadone treatment providers through a novel approach of geo-enabling readily available administrative data. However, findings should be interpreted based on study limitations, mainly related to the data analyzed. The data did not allow us to determine the specific home address of clients. We relied on ZIP codes to abide by privacy and confidentiality guidelines. We could not determine the specific reason for bypassing. We assumed that clients opted to commute farther to access the facility recorded for measurable reasons. The data also only showed clients who completed 1 treatment episode in each year of available data. The data did not allow us to track clients across years. However, the data showed that most clients reported their first treatment episode. Finally, the geographic information system methods applied to these administrative and Google Maps data showed estimates based on approximate locations.

Despite limitations in the implemented approach, these estimates are the first reported values reflecting clients' bypass behaviors when seeking methadone treatment. These findings call for further exploring the link between bypass and treatment outcomes (ie, completion of treatment plan) to inform optimal expansion policies through creating more local methadone providers or investing in the service capacity of existing providers. Findings suggest that clients' receipt of methadone treatment reflects an inefficient use of the nearest treatment provider, which may offer a shorter wait time. Examining this inefficiency is crucial as service expansion policies and community engagement efforts are considered at the state level.

Findings have significant implications for expanding systems, organizational theories, and public health policies. As federal entities such as the National Institutes of Health, Centers for Disease Control and Prevention, and Substance Abuse and Mental Health Services Administration seek to develop structural interventions to abate the opioid epidemic amid recovery from the COVID-19 pandemic, it is critical to develop conceptual models to explain health care system responses to threatening health conditions.[24-26]

This is one of few emerging studies highlighting the dire need for treatment provider presence and increased client access to MOUD treatment in one of the largest treatment systems in the nation. There is increasing concern about the limited number and questionable quality of opioid treatment in the United States. Waiver programs that allowed physicians to prescribe MOUD have failed to reach most opioid users. Policies that are more nuanced in considering the different profiles of opioid users are important. To aid users from those at the early stages of addiction to highly destitute individuals using opioids every day, policies and treatment practices should include highly accessible harm reduction approaches to improve the treatment system's options.

Author Contributions

A.A. conceptualized the study, conducted the analysis, and wrote sections of the manuscript. J.M. contextualized findings and contributed to manuscript writing. H.A. contextualized findings and implications and contributed to manuscript writing. Y.K. provided support with the data, analysis, and statistics. T.K. reviewed the literature, supported the research project, and contributed to the manuscript. E.G. supervised the project, provided the data, and wrote sections of the manuscript. All authors approved the final draft.

Ethics Statement

The Institutional Review Board (IRB) at the University of Chicago reviewed the study protocol and approved this study (IRB18–1657). We confirm that all methods were carried out in accordance with relevant guidelines and regulations. We also confirm that all experimental protocols were approved by the Institutional Review Boards at the University of Chicago and the National Institutes for Health. We confirm that no human experiments were conducted in this study.

Informed Consent Form

The study utilized administrative client data collected by the City of Los Angeles Department of Public Health – Substance Abuse Prevention and Control as part of standard intake and discharge procedures. As such, no specific informed consent was required for this research. The dataset provided was fully de-identified in compliance with privacy and ethical guidelines.

ORCID iD

Abdullah Alibrahim https://orcid.org/0000-0001-6823-2113

Data Availability Statement

The data that support the findings of this study are available from the City of Los Angeles Department of Public Health – Substance Abuse Prevention and Control, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are, however, available from the authors upon reasonable request and with permission of the City of Los Angeles Department of Public Health – Substance Abuse Prevention

and Control. Distance-related data used to supplement previously described data is available in the Google Developer Services with the Distance Matrix API, https://developers.google.com/maps/documentation/distance-matrix/overview.

REFERENCES

1. National Centers for Health Statistics. *Drug Overdose Deaths in the U.S. Top 100,000 Annually*. Published online 2021. https://www.cdc.gov/nchs/press-room/nchs_press_releases/2021/20211117.htm
2. Substance Abuse and Mental Health Services Administration. *The Opioid Crisis and the Black/African American Population: An Urgent Issue*. U.S. Department of Health and Human Services; 2020:30.
3. Goedel WC, Shapiro A, Cerdá M, Tsai JW, Hadland SE, Marshall BDL. Association of racial/ethnic segregation with treatment capacity for opioid use disorder in counties in the United States. *JAMA Network Open*. 2020;3:e203711.
4. Gryczynski J, Jaffe JH, Schwartz RP, et al. Patient perspectives on choosing buprenorphine over methadone in an urban, equal-access system: reasons for choosing buprenorphine. *Am J Addict*. 2013;22:285-291.
5. National Institute on Drug Abuse. Access to Addiction Services Differs by Race and Gender. National Institute on Drug Abuse. July 16, 2019. Accessed May 31, 2021. https://www.drugabuse.gov/about-nida/noras-blog/2019/07/access-to-addiction-services-differs-by-race-gender
6. Amiri S, Lutz RB, McDonell MG, Roll JM, Amram O. Spatial access to opioid treatment program and alcohol and cannabis outlets: analysis of missed doses of methadone during the first, second, and third 90 days of treatment. *Am J Drug Alcohol Abuse*. 2020;46:78-87.
7. Klinger JL, Karriker-Jaffe KJ, Witbrodt J, Kaskutas LA. Effects of distance to treatment on subsequent alcohol consumption. *Drugs Educ Prev Policy*. 2018;25:173-180.
8. Alibrahim A, Marsh JC, Amaro H, Kong Y, Khachikian T, Guerrero E. Disparities in expected driving time to opioid treatment and treatment completion: findings from an exploratory study. *BMC Health Serv Res*. 2022;22:478.
9. Cole ES, DiDomenico E, Cochran G, et al. The role of primary care in improving access to medication-assisted treatment for rural Medicaid enrollees with opioid use disorder. *J Gen Intern Med*. 2019;34:936-943.
10. Davidson PJ, Bowles JM, Faul M, Gaines TL. Spatial proximity and access to buprenorphine or methadone treatment for opioid use disorder in a sample of people misusing opioids in Southern California. *J Subst Abuse Treat*. 2022; 132:108634.
11. Cookson R, Dawson D. Hospital competition and patient choice in publicly funded health care. In: Jones AM, ed. *The Elgar Companion to Health Economics*. 2nd ed. Edward Elgar Publishing; 2012. Accessed April 11, 2022. https://www.elgaronline.com/view/edcoll/9781849802673/9781849802673.00032.xml
12. Exworthy M, Peckham S. Access, choice and travel: implications for health policy. *Soc Policy Adm*. 2006;40:267-287.
13. Robertson R, Burge P. The impact of patient choice of provider on equity: analysis of a patient survey. *J Health Serv Res Policy*. 2011;16:22-28.
14. Tai WT, Porell FW, Adams EK. Hospital choice of rural Medicare beneficiaries: patient, hospital attributes, and the patient-physician relationship. *Health Serv Res*. 2004;39:1903-1922.
15. Aggarwal A, Lewis D, Mason M, Sullivan R, van der Meulen J. Patient Mobility for elective secondary health care services in response to patient choice policies: a systematic review. *Med Care Res Rev*. 2017;74:379-403.
16. Mosadeghrad AM. Patient choice of a hospital: implications for health policy and management. *Int J Health Care Qual Assur*. 2014;27:152-164.
17. Aalto AM, Elovainio M, Tynkkynen LK, et al. What patients think about choice in healthcare? A study on primary care services in Finland. *Scand J Public Health*. 2018;46:463-470.
18. Anell A, Rosén P, Hjortsberg C. Choice and participation in the health services: a survey of preferences among Swedish residents. *Health Policy*. 1997;40: 157-168.
19. Byrne BE, Faiz OD, Vincent C. Do patients with gastrointestinal cancer want to decide where they have tests and surgery? A questionnaire study of provider choice. *BMJ Qual Saf*. 2016;25:696-703.
20. Protheroe J, Bower P. Choosing, deciding, or participating: what do patients want in primary care? *Br J Gen Pract*. 2008;58:603-604.
21. Escarce JJ, Kapur K. Do patients bypass rural hospitals? Determinants of inpatient hospital choice in rural California. *J Health Care Poor Underserved*. 2009;20:625-644.
22. R Core Team. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing. 2021. Accessed November 1, 2021. https://www.R-project.org/
23. Tierney N, Cook D. Expanding tidy data principles to facilitate missing data exploration, visualization and assessment of imputations. *J Stat Softw*. 2023;105:1-31.
24. Guerrero E. *Science-Based Approaches to Respond to COVID and Other Public Health Threats*. BoD–Books on Demand; 2021.
25. DiMaggio PJ, Powell WW. The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *Am Sociol Rev*. 1983;48: 147-160.
26. Meyer JW, Rowan B. Institutionalized organizations: formal structure as myth and ceremony. *Am J Sociol*. 1977;83:340-363.