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U.S. trends in the supply of providers with a waiver to prescribe buprenorphine for opioid use disorder in 2016 and 2018

Robin Ghertner

Office of the Assistant Secretary for Planning and Evaluation, US Department of Health and Human Services, 200 Independence Ave, SW, Washington, DC, 20201, United States

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ABSTRACT

Background: Healthcare providers can receive waivers to prescribe buprenorphine for opioid use disorder, an evidence-based medication. The United States federal government has undertaken numerous recent efforts to expand access to waivers. This study describes national trends in the U.S. in 2016 and 2018, geospatial characteristics of waivered providers, and the association of county characteristics with patient treatment capacity.
Methods: Administrative data were drawn for all U.S. counties in 2016 and 2018 for waivered providers, as well as characteristics of counties that may indicate disparities in provider availability. Descriptive statistics were estimated to identify changes across the two years, and how community characteristics correlated with treatment capacity. Measures of geospatial heterogeneity were used to identify spatial clustering.
Results: Nationally the number of waivered providers increased by 175% between 2016 and 2018, and patient capacity increased by 211%. In 2018, 65% of counties had at least one provider, an increase from 54.9% in 2016. Rural counties continued to have relatively fewer providers than metropolitan counties. In both years, counties with higher indicators of the opioid crisis had greater treatment capacity on average. Certain disparities continued to persist in 2018 in terms of patient capacity, as counties in metropolitan areas, those with lower poverty rates and those more physicians per capita had higher capacity on average.
Conclusions: The availability of waivered providers to prescribe buprenorphine increased from 2016 to 2018, while disparities persisted. More research is needed to understand how changes in availability of waivered prescribers impact population health.

1. Introduction

The opioid crisis continues to impact the United States, with overdose deaths involving opioids rising from 42,249 in 2016 to 47,600 in 2017 (Scholl et al., 2019). One of the most prominent approaches to combating the crisis has been to increase the availability of buprenorphine for opioid use disorder (OUD). Buprenorphine is one of the three medications approved by the U.S. Food and Drug Administration to treat OUD, and research studies (Connery, 2015) and practice guidelines (Bruneau et al., 2018; Center for Substance Abuse Treatment, 2018; Kampman, 2015) have established it as one of the primary components of evidence-based treatment.

Among the principal challenges to increasing the availability of buprenorphine (c.f. Haffajee et al., 2018) has been restrictions on who can prescribe buprenorphine for OUD, and the number of patients to whom they can concurrently prescribe. There have been numerous calls from the field for increasing the number of prescribers (c.f. Molfenter et al., 2019), and the U.S. federal government has undertaken various efforts to expand access to buprenorphine for OUD. These efforts create the need for more research to understand how the availability of providers of buprenorphine for OUD has changed in the past few years, the goal of this study.

Prior to 2016, only physicians with waivers authorized by the Drug Addiction Treatment Act of 2000 (DATA) could prescribe buprenorphine for OUD, with patient limits at a maximum of 100. In 2016, a federal regulation (42 CFR Part 8 Subpart F) expanded these limits, allowing providers to increase their patient limit to 275. The Comprehensive Addiction and Recovery Act of 2016 (CARA) permitted nurse practitioners and physician assistants to prescribe as part of a pilot until 2021. The passed SUPPORT for Patients and Communities Act of 2018 further expanded access, by making the nurse practitioner and physician assistant pilot permanent, and allowing other mid-level practitioners to obtain waivers until October 1, 2023. These practitioners include clinical nurse specialists, certified registered nurse anesthetists, and certified nurse midwives (Dabrowska et al., 2018). In addition, federal agencies have used their discretionary authority to

E-mail address: robin.ghertner@hhs.gov.

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expand access to buprenorphine treatment through grants and other promotion efforts, such as $8 million in funding from the Health Resources and Services Administration to increase DATA waivers for practitioners in rural community health centers in 2019 (Health Resources and Services Administration, 2019).

Although historically the treatment capacity of opioid agonist therapy (including buprenorphine) has not matched the need for such treatment (Jones et al., 2015), researchers have generally found an increase in the supply of waivered prescribers both nationally and locally over the past number of years (Dick et al., 2015). Knudsen et al. (2017) found that the availability has increased faster in states with relatively higher prescription opioid mortality.

While research has established that the number of providers has increased, there may be disparities in the alignment of provider availability and need. Jones et al. (2018) found substantial imbalances between opioid mortality and the availability of waivered providers listed on a public treatment locator maintained by the Substance Abuse and Mental Health Services Administration (SAMHSA) in 846 counties between 2013 and 2015. In particular, there was relatively higher opioid mortality and lower provider access in Southern, Midwestern, and Western regions of the country. In addition, research has found that rural counties in general are less likely to have waivered providers. In 2012, rural counties were much less likely to have a physician with a DATA waiver than were other counties. Over 80% of small and remote counties lacked a provider, and the majority of these counties were in the middle of the country (Texas northward to North Dakota and Montana) (Rosenblatt et al., 2015). In 2017, rural counties saw increased treatment availability, though 71.5% of small and remote rural counties still lacked a DATA-waivered provider relative to 23.2% in urban counties (Andrilla et al., 2018b).

A few studies have documented the extent to which non-physicians have received waivers. Andrilla et al. (2018b) found that in 2017, 3534 nurse practitioners and 912 physicians assistants had obtained a waiver. In addition, urban counties were more likely than rural counties to have non-physicians with waivers. Most recently, Spetz et al. (2019) found that by September 2018 the number of waivered mid-level practitioners had more than doubled, to 7280 nurse practitioners and 1913 physicians assistants with waivers.

This study has three broad objectives. First, to describe national trends in waivered providers in 2016 and 2018. Second, to understand the geospatial characteristics of providers. Understanding the extent to which providers cluster geographically, particularly if this clustering is independent of provider and county characteristics, is important as policymakers and advocates seek to ensure adequate coverage of treatment. The third objective is to identify the association of county characteristics with the availability of providers. Identifying the extent to which county characteristics associate with treatment availability is important to understanding the risk of disparities, and can help target resources. This study focuses on county characteristics that have been found related to overdose mortality and treatment disparities, and are generally considered social determinants of health by researchers.

2. Materials and methods

2.1. Data sources

This study uses records of civilian and military providers with waivers to prescribe buprenorphine for OUD, drawn from administrative records from the Center for Substance Abuse Treatment at SAMHSA. Data were collected at two points in time, July 2016 and November 2018. The number of providers is fluid throughout the year, as they gain or lose their waiver (e.g. fail to renew). For simplicity, this report discusses the providers as if they were active during the year of data collection, but it is possible that the exact number of providers at any point during those specific years was different. The data from SAMHSA include the practice address of providers, whether the provider is a doctor, nurse practitioner, or physicians assistant, and the patient limit for the waiver. Provider addresses were geocoded and mapped to counties, allowing spatial analysis and matching to county characteristics.

A county's urbanicity was classified using urban influence codes, created by the Economic Research Service in the U.S. Department of Agriculture for 2013 (Economic Research Service, 2013). Large metropolitan counties are defined as being in a metropolitan area of 1 million or more residents. Small metropolitan counties are defined as being in a metropolitan area of less than 1 million residents. Micropolitan counties are non-metropolitan labor-market areas centered on urban clusters of 10,000–49,999 residents. Rural counties are defined as all remaining non-metropolitan categories.

All other data points used in the analysis were collected for 2016. Data for 2018 were not available at the time of analysis for many of the variables. Measures for the age and racial/ethnic makeup of counties come from the Surveillance, Epidemiology, and End Results Program (National Cancer Institute, 2018). Measures of poverty rates come from the U.S. Census Bureau's Small Area Income and Poverty Estimates (Bell et al., 2016). Unemployment rates were drawn from the Local Area Unemployment Statistics program at the U.S. Bureau of Labor Statistics (Bureau of Labor Statistics, 2019), employment-population ratio is from the Census Bureau's County Business Patterns (US Census Bureau, 2019a), and supplemental security income (SSI) receipt comes from the Social Security Administration (Social Security Administration, 2019). The percent of a county's population without insurance was drawn from the Census Bureau's Small Area Health Insurance Estimates (US Census Bureau, 2019b), and data on per capita primary care physicians come from the American Medical Association Physician Masterfile.

Age-adjusted drug overdose death rates come from small area estimates from the National Center for Health Statistics at the Centers for Disease Control and Prevention (CDC) (Rossen et al., 2014). Data on prescription drug rates come from CDC estimates using data from the IQVIA Xponent database (Centers for Disease Control and Prevention, 2018). Xponent includes a sample of approximately 50,000 retail pharmacies dispensing nearly 90% of all retail prescriptions in the U.S.

2.2. Study sample

This study uses two separate units of analysis: unique DATA-waivered providers, and counties in the U.S. For analysis of DATA-waivered providers, the sample includes all waivered providers, including 32,129 for 2016 and 56,403 for 2018.

For analysis focusing on geographic distribution of providers, the unit of analysis was the county, and the sample contains all 3141 counties in the U.S. in 2016 and 2018, excluding territories. In this sample, provider records were aggregated to the county level. Data for 2018 include all practice locations listed in a provider's waiver. Multiple locations were collapsed at the county level, so if a provider had more than one practice in a county, those practices were counted once. For providers with locations in separate counties, the provider was included in each of those counties.

For analysis of county characteristics associated with provider availability, the sample was restricted to counties with data reported for all county characteristics. Due to missing data, the final sample size for analysis looking at county characteristics was 2,962, out of the total of 3141.

2.3. Methods

When comparing the availability of waivered providers across counties, this study defined a county's patient capacity as the sum of the patient limits of all waivered providers practicing in the county. Patient capacity rate was defined as the total patient capacity divided by the total county population. When a provider had multiple locations in a county, that provider was only counted once. However, when a provider had practices in multiple counties, their total patient limit was attributed to each county they practice in. As a result, analyses on provider locations may not accurately reflect the total capacity. However, there is no way to identify the proportion of a provider's patient limit attributed to each practice. National analyses do not suffer this limitation, as unique providers were tabulated, rather than their practice locations.

Most of the analysis in this study was comprised of bivariate tabulations or summary statistics. Moran's I was used to identify spatial dependency among counties with waivered providers, (Kelejian and Prucha, 2001). Moran's I is measured from -1 to 1, where values close to 1 indicate positive spatial dependency or autocorrelation, meaning a given county is as likely to have a similar level of a given variable as nearby counties. Values close to -1 indicate negative dependency, meaning a given county is likely to have a different level of a given variable than nearby counties. A value close to 0 indicates near-absence of spatial dependency.

This study estimated both unadjusted and adjusted Moran's I. Unadjusted Moran's I was estimated on two variables: the patient capacity rate per 1000 people and the per capita number of waivered providers. Adjusted statistics were estimated for these same measures by calculating Moran's I on the residuals of a linear regression model accounting for county racial/ethnic makeup, population, urbanicity, unemployment, and drug overdose deaths, as well as state fixed effects. Unadjusted Moran's I describes the actual spatial dependency of provider statistics. Adjusted Moran's I identifies the extent of spatial dependency independent of other factors that may also correlate spatially with provider statistics, thereby confounding the actual spatial dependency of the measures of interest.

In analyses of community characteristics, separate multiple regression models were run for 2016 and 2018, with the county as the unit of analysis. County patient capacity was the outcome variable, regressed on several county-level variables that have been found in the research to be related to prescribing, overdose prevalence, and presence of treatment. These characteristics were grouped into demographic, economic, and substance use indicators, and described in Section 2.1. In addition, state fixed effects were included, as states differ greatly in their policies, funding, and institutional and cultural dynamics, which likely influence provider decisions to obtain a DATA waiver. Because patient capacity is a non-negative integer with positive skew, Poisson regression models were used with robust standard errors, and the population was included as an exposure variable. Coefficients are reported as incidence rate ratios, and all continuous variables were measured in either logarithms or as percentages. Differences in coefficient estimates across years were compared using Wald chi-squared tests.

3. Results

3.1. National trends in providers

Table 1 reports summary statistics of available provider characteristics. Between the two years, the number of DATA-waivered providers increased nationally by 175%, from 32,129 in 2016 to 56,403 in 2018. By 2018, 47.7% of waivered providers did not have waivers in 2016.

The total patient capacity for waivered providers increased by 211%, from 1.69 million in 2016 to 3.58 million in 2018. This was due to both an increase in the number of waivered providers as well as an increase in the number of patients providers could serve. Though the proportion of waivered providers with 30 patient limit was higher in 2018, the number of providers with waivers over 30 patients increased by 5142.

Table 1
Characteristics of DATA Waivered Providers in 2016 and 2018.

	2016	2018
Total Providers	32,129	56,403
Total Patient Limit	1,693,690	3,576,730
Provider Limit		
30	67.6%	72.4%
100	32.5%	19.6%
275	0.0%	8.1%
Public listing	55.5%	56.9%
Number of practices under waiver		
1	n.a.	90.0%
2	n.a.	8.5%
3 or more	n.a.	1.5%
Number of providers with a waiver in practice		
1	54.3%	42.1%
2 to 5	32.8%	35.6%
6 to 10	6.6%	10.4%
Over 10	6.2%	11.9%
Provider type		
MD/DO	100.0%	82.5%
NP	0.0%	13.9%
PA	0.0%	3.6%
Mean years with a waiver (SD)	6.4 (3.8)	4.9 (4.8)

Note: Unit of analysis is the unique provider with a waiver. Data for 2016 do not contain multiple practice locations for providers.

The proportion of providers opting to be publicly listed was not substantially different across the two years (17,840 or 56% in 2016, and 32,121 or 57% in 2018). Most waivered providers were in practices with five or fewer waivered providers. Over 90% of waivered providers in 2018 practiced in a single location, with 1.4% practicing at three or more locations.

In 2018, 13.9% of all waivered providers (7858) were nurse practitioners, and 3.6% (2032) were physician assistants. Prior to the passage of CARA, nurse practitioners and physician assistants were not permitted to receive waivers, thus 100% of all waiver providers in 2016 were physicians.

The data show a couple of important differences between waivered physicians and mid-level practitioners. In 2018, waivered physicians were more likely to practice in metropolitan areas than were mid-level practitioners: 60.8% of waivered physicians were in large metropolitan areas, compared with 52.7% of mid-level practitioners. There were only minor differences in the proportion practicing in rural areas: 3.1% of waivered physicians and 4.7% of mid-level providers were in rural counties. In 6.5% of practices, mid-level practitioners were the sole waivered provider.

Twenty percent of providers with waivers in 2016 had increased their patient limit by 2018. Table 2 reports patient limits for waivered-providers in 2018, by their patient limit in 2016. Among providers with 100-patient waivers in 2016, 35.9% had increased their limit to 275 by 2018.

Table 2
Patient Limit for Waivered-Providers in 2016 and 2018.

	Patient Limit in 2016		
Patient Limit in 2018	No waiver in 2016	30	100
30	88.5%	79.9%	0.0%
100	10.6%	10.1%	57.7%
275	0.9%	2.6%	35.9%
No waiver in 2018	.	7.5%	6.4%
Total	100.0%	100.0%	100.0%
N	26,558	21,703	10,427

Table 3
Waivered Providers and Patient Capacity for Counties, by Urbanicity, 2016 and 2018.

	With a Waivered Provider		Average Providers Per Capita		Average Patient Capacity Rate	
	2016	2018	2016	2018	2016	2018
All Counties	54.9%	65.0%	0.06	0.12	3.17	8.34
Large Metropolitan	81.3%	87.7%	0.08	0.15	4.12	10.96
Small Metropolitan	73.4%	79.5%	0.07	0.14	4.06	10.62
Micropolitan	68.5%	79.4%	0.06	0.13	3.29	9.39
Rural	29.6%	42.7%	0.04	0.09	2.30	5.71

Note: Unit of analysis is the county. N = 3141.

3.2. Geographic distribution of waivered providers

Between 2016 and 2018, more counties had waivered providers, and there was a general increase in patient capacity, reflected across the country. As seen in Table 3, in 2016, 54.9% of all counties in the U.S. had at least one waivered provider. In 2018 the percentage increased to 65%. Both the average number of waivered providers and treatment capacity more than doubled.

Counties of all urbanicities saw increased coverage between 2016 and 2018. While rural counties continued to see lower coverage of waivered providers in 2018, these areas also saw the biggest increase in counties with at least one waivered provider, increasing by 13.1 percentage points, or by 44%. Counties of all types in general saw a comparable percent increase in patient capacity and provider rates.

Figs. 1 and 2 show county patient capacity rates for 2016 and 2018, respectively. In 2016, 67 counties had total capacity for 20 or more patients per 1000, while in 2018 that number increased to 363. By 2018, most counties in the New England, and pockets of Appalachia and the Northwest, had capacity of at least 20 patients per 1000. Coverage was more varied in other parts of the country.

Both figures suggest that counties were spatially clustered based on their patient capacity. That is, counties with higher per capita patient capacity were more likely to be nearby other counties with higher capacity, and vice versa. This was indeed the case, though the degree of spatial dependency was relatively small. Table 4 reports unadjusted and adjusted global Moran's I for all counties in the U.S., using three measures. Unadjusted measures exhibit statistically significant clustering, and the degree of clustering did not change substantively between 2016 and 2018. In general, the patient capacity rate exhibited the lowest degree of spatial clustering.

After adjusting for various county characteristics, all measures of clustering in both years approach zero. These characteristics include county racial/ethnic makeup, population and urbanicity, poverty, unemployment, drug overdose death rates, and the county's state. This suggests that whatever clustering exists is likely due to these characteristics, rather than any other spatial process or dependency unique to providers.

3.3. County characteristics associated with county patient capacity

Several county characteristics were substantively predictive of a county's patient capacity for buprenorphine treatment. These relationships remained stable between 2016 and 2018 despite increases in treatment capacity nationwide. As Table 5 shows, large metropolitan counties on average had higher patient capacity rates.[1] In particular, in both years, rural counties had 20 percent lower capacity rates than large metro counties. When accounting for other characteristics, race/ethnic and age makeup of counties had a small and statistically significant negative relationship with capacity. Larger shares of the population that were non-White (including Hispanic) predicted lower capacity, and larger shares of working age adults (18–65) predicted higher capacity. For example, a 1 point increase in the percentage of the population that is Hispanic predicted less than a 1 percent decrease in capacity rate.

Counties with better economic circumstances (as measured by poverty and unemployment rates) tended to have higher capacity. On the other hand, counties with a larger uninsured populations or a larger population receiving SSI had higher capacity. For example, a 1 point increase in the percent uninsured predicted a 1 percent increase in patient capacity. Unsurprisingly, the number of primary care physicians per capita had a large positive relationship with capacity.

In 2016, a 1 percent increase in the drug overdose death rate predicted a 50 percent increase in patient capacity. A 1 percent increase in the prescription opioid rate predicted a 26 percent increase in capacity.

None of the estimates from models had a statistically significant difference across 2016 and 2018.

4. Discussion

This study identifies increases in the availability of providers with a DATA waiver to prescribe buprenorphine for opioid use disorder from 2016 to 2018. These increases were experienced in counties across all urbanicities. Changes in federal statute in 2016 permitted nurse practitioners and physician assistants to receive waivers, and by November 2018, these types of providers made up nearly 18% of all waivered providers, a finding consistent with other research (Spetz et al., 2019). Numerous policy changes took place between 2016 and 2018 at the federal, state, and local levels, including efforts by advocacy groups and private foundations, and this study was not designed to identify the unique effect of any specific one of these. This is an area of future study, as that information can directly influence ongoing policy decisions at the federal and state levels.

While visually it appears that counties cluster geographically based on their patient capacity, formal measures show limited spatial clustering. This study's estimate of Moran's I is nearly identical to Jones et al. (2018), which estimated a Moran's I of 0.272 in 2017 (compared to 0.274 for 2016 in this study). However, when accounting for county characteristics also associated with capacity, clustering nearly disappeared, suggesting that generally provider-specific characteristics do not account for the geographic distribution of treatment capacity. This should be encouraging for policymakers and advocates promoting the use of buprenorphine for OUD.

This analysis identifies similar national regional clustering as did analyses by other researchers (Andrilla et al., 2018b, 2018a; Jones et al., 2018), with greater concentrations in the Northeast, parts of Appalachia, and the West Coast. In particular, the persistently lower relative capacity in rural areas supports findings from a number of research studies (Andrilla et al., 2018a; Jones et al., 2018; Rosenblatt et al., 2015).

Counties with higher indicators of the opioid crisis—including drug overdose death rates and opioid prescriptions rates—were more likely to have greater patient capacity, as measured by the total number of patients that providers can treat in a given county. This suggests that providers might be targeting areas of greatest need, though more work is needed to study how much patient need factors into provider decisions to obtain a waiver, and subsequently obtain higher patient limits.

Finally, despite the overall increase in the availability of buprenorphine treatment across the country, certain disparities continued to persist in 2018. After accounting for other characteristics, rural counties continued to have lower patient capacity, by 20 percent on average, than metropolitan counties, despite increasing overall national capacity. Counties with higher rates of physicians per capita and lower poverty rates had greater patient capacity on average. Even after

[1] Descriptive statistics for the regression modeling can be found in Appendix Table A.1.

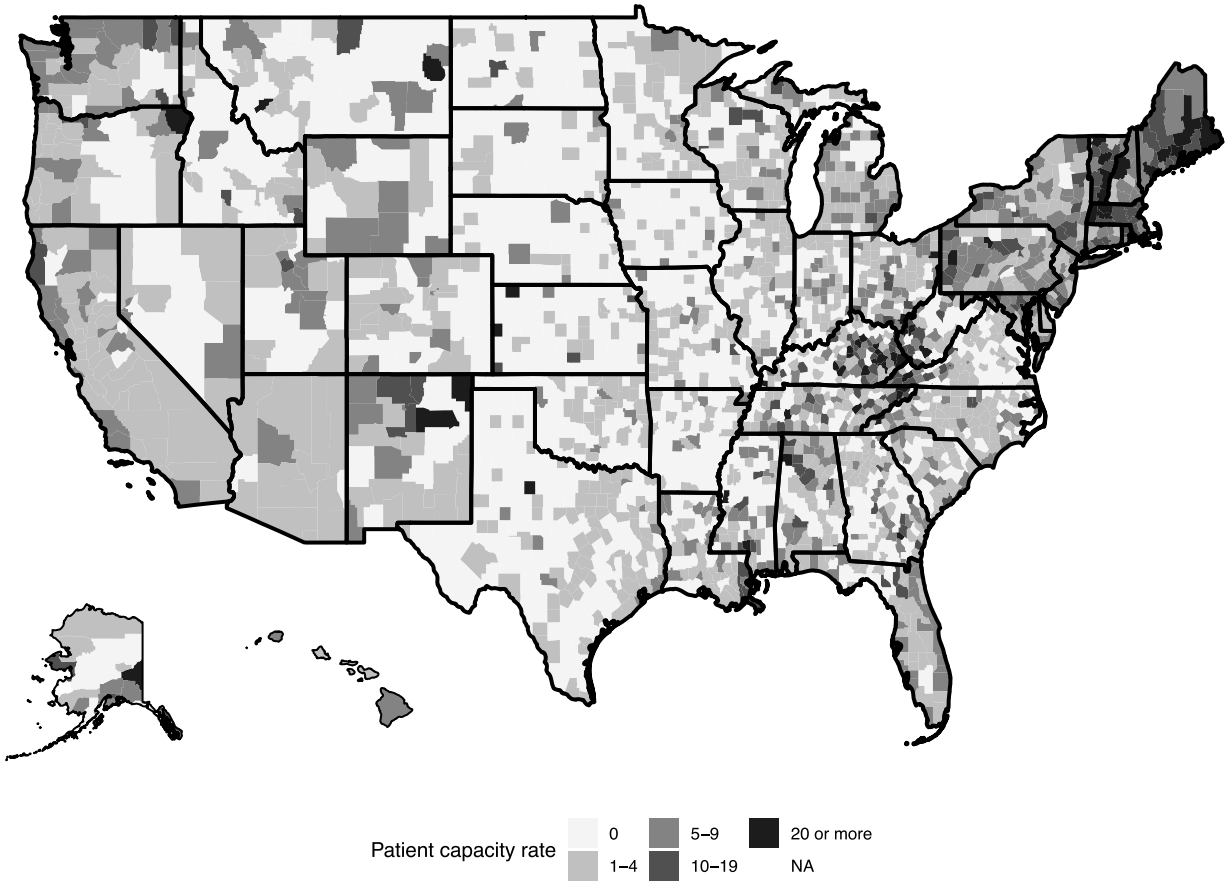

Fig. 1. Patient Capacity Rate, 2016.

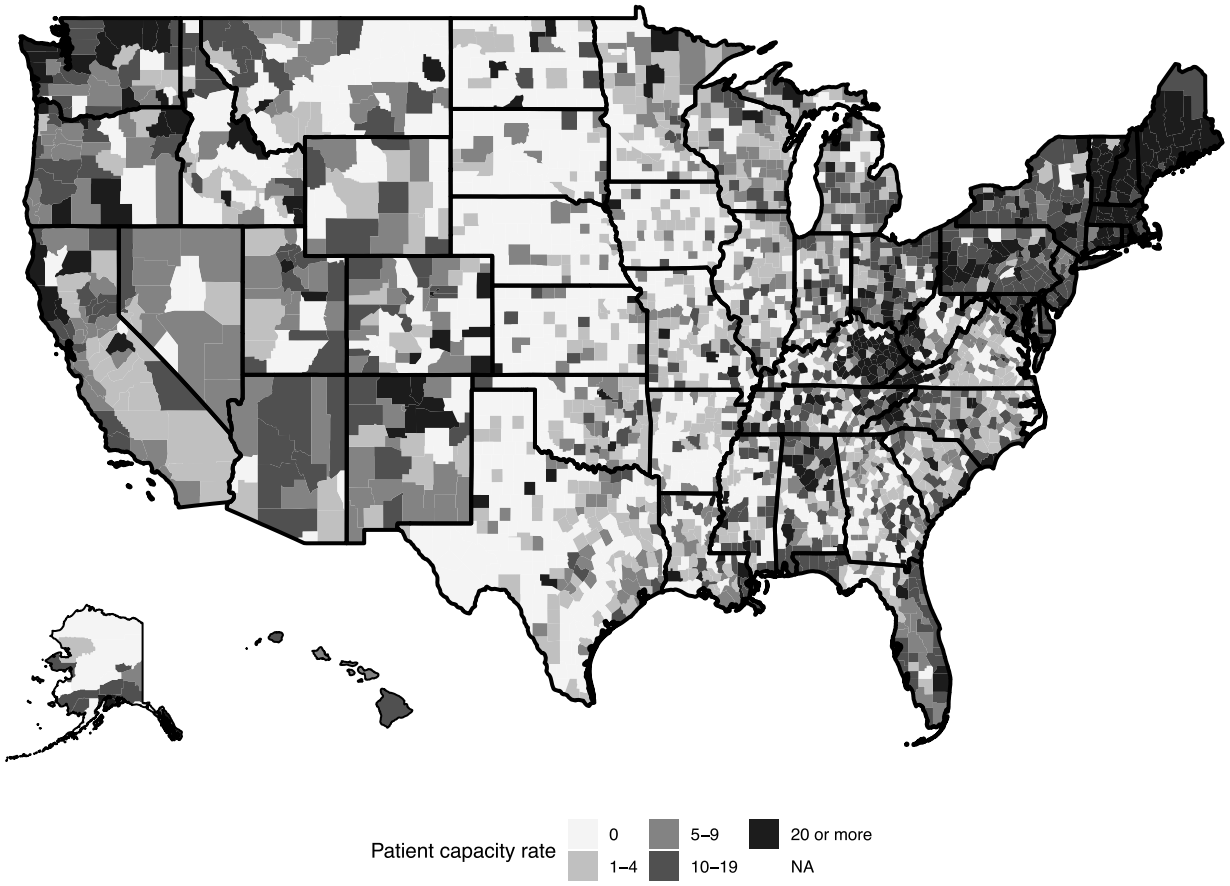

Fig. 2. Patient Capacity Rate, 2018.

Table 4
Moran's I Spatial Clustering Statistic for Counties with Waivered Providers, 2016 and 2018.

	2016	2018
Unadjusted		
Provider presence	0.267*	0.267*
Providers per capita	0.274*	0.384*
Patient capacity rate	0.300*	0.339*
Adjusted		
Provider presence	0.013	0.016
Providers per capita	0.047*	0.107*
Patient capacity rate	0.077*	0.093*

Note.
* statistically significant, $p < 0.01$.

Table 5
Characteristics Predicting County Patient Capacity, Regression Results.

	2016	2018
Small Metropolitan	0.968*(0.002)	0.971*(0.001)
Micropolitan	0.851*(0.004)	0.896*(0.002)
Rural	0.803*(0.005)	0.790*(0.003)
Black (percentage)	1.000 (0.000)	0.998*(0.000)
Hispanic (percentage)	0.998*(0.000)	0.995*(0.000)
Other Minority (percentage)	0.996*(0.000)	0.994*(0.000)
Age over 65 (percentage)	0.963*(0.000)	0.962*(0.000)
Age 0 to 17 (percentage)	0.919*(0.000)	0.926*(0.000)
Poverty (percentage)	0.987*(0.000)	0.991*(0.000)
Unemployment (percentage)	0.994*(0.001)	0.988*(0.001)
SSI (percentage)	1.085*(0.001)	1.084*(0.001)
Uninsured (percentage)	1.012*(0.001)	1.010*(0.000)
Physicians Rate (log)	1.984*(0.005)	1.913*(0.003)
Overdose Death Rate (log)	1.490*(0.004)	1.584*(0.003)
Prescription Opioids Rate (log)	1.262*(0.005)	1.361*(0.003)
Constant	0.001*(0.000)	0.001*(0.000)

Note: N = 2970. Coefficients are incidence rate ratios. Data for all measures are for 2016.
* statistically significant $p < 0.01$. State effects suppressed. Descriptive statistics are shown in Appendix Table A.1.

accounting for substance use indicators and health coverage, counties with higher unemployment and poverty rates had lower patient capacity. This finding points to the need for more work to increase treatment access for vulnerable populations, to the extent that these factors correlate with the need for treatment or greater barriers to accessing treatment.

There are several important limitations to this study. The presence of DATA-waivered providers does not mean that buprenorphine is actually prescribed for OUD. Providers in a county may serve patients from other counties as well, and this analysis does not reflect the role of providers in neighboring counties. Data for 2016 do not contain multiple practice locations for waivered providers, and as a result may under-report the presence of providers. However, data from 2018 suggest there is minimal bias in the estimates of provider availability in counties. In 2018, 90% of providers with multiple practice locations had those locations within a single county. Further, only 32 counties (1.5% of the total sample) had a single provider where this provider had practices across multiple counties.

This analysis does not reflect causal relationships and no results should be interpreted to mean the presence of DATA-waivered providers is caused by, or causes, any county-level factor. Data for covariates were not available for 2018, which limited the ability to conduct longitudinal analysis identifying the relationship between changes in county characteristics and provider capacity.

The data in this study cannot identify how much buprenorphine has been prescribed, who prescribes it, who receives the prescriptions, nor what happens to the buprenorphine following the prescription. While research shows that increases in providers with waivers, and increased patient limits, predict higher prescribing rates (Stein et al., 2015; Wen et al., 2018), not all providers with a DATA waiver actually prescribe buprenorphine for OUD, or prescribe at their patient limit (Andrilla et al., 2018a; Jones and McCance-Katz, 2018; Parran et al., 2017; Thomas et al., 2017). While researchers have identified specific barriers to prescribing and approaches to overcome those (c.f. Andrilla et al., 2019; Huhn and Dunn, 2017), further research should examine these barriers in greater depth, and what policies can be implemented to reduce them.

Additionally, research is needed to understand the extent to which increases in capacity for buprenorphine lead to reductions in opioid-related mortality, morbidity, and other risk indicators associated with the opioid epidemic. While buprenorphine for OUD is generally accepted as an evidence-based practice, there may be unintended consequences to increasing its availability, including diversion (Li et al., 2016; Lofwall and Walsh, 2014). Research has pointed to the potential for diversion as a reason providers do not prescribe buprenorphine (Andrilla et al., 2019; Huhn and Dunn, 2017; Lin et al., 2018; Molfenter et al., 2019). At the same time, research finds that many individuals who lack access to treatment use buprenorphine without a prescription to self-treat their addiction and deal with withdrawal symptoms (Carroll et al., 2018; Cicero et al., 2018; Kenney et al., 2017). Although there is substantial clinical evidence of buprenorphine's effectiveness in addressing OUD, we need to understand better how changing the supply of buprenorphine influences population health.

Contributors

Robin Ghertner planned and conducted the analysis.

Role of funding

Nothing declared.

Declaration of Competing Interest

No conflict declared.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2019.06.029.

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