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*Original Investigation*

# Where Is Buprenorphine Dispensed to Treat Opioid Use Disorders? The Role of Private Offices, Opioid Treatment Programs, and Substance Abuse Treatment Facilities in Urban and Rural Counties

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**Policy Points:**

- Buprenorphine is an effective opioid dependence treatment that has expanded access to care since its 2002 approval, but it can only be prescribed by physicians waivered to treat a limited number of individuals.
- We examined the impact of 2006 legislation that increased waivered physician patient limits from 30 to 100 on buprenorphine use, and found that 100-patient-waivered physicians were significantly associated with growth in buprenorphine use, with no such relationship for 30-patient-waivered physicians.
- Policies relaxing patient limits may be more effective in increasing buprenorphine use than alternatives such as opening new substance abuse treatment facilities or increasing the overall number of waivered physicians.

**Context:** Opioid use disorders are a significant public health problem. In 2002, the FDA approved buprenorphine as an opioid use disorder treatment when

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prescribed by waivered physicians who were limited to treating 30 patients at a time. In 2006, federal legislation raised this number to 100 patients. Although federal legislators are considering increasing these limits further and expanding prescribing privileges to nonphysicians, little information is available regarding the impact of such changes on buprenorphine use. We therefore examined the impact of the 2006 legislation—as well as the association between urban and rural waivered physicians, opioid treatment programs, and substance abuse treatment facilities—on buprenorphine distributed per capita over the past decade.

**Methods:** Using 2004-2011 state-level data on buprenorphine dispensed and county-level data on the number of buprenorphine-waivered physicians and substance abuse treatment facilities using buprenorphine, we estimated a multivariate ordinary least squares regression model with state fixed effects of a state's annual total buprenorphine dispensed per capita as a function of the state's number of buprenorphine providers.

**Findings:** The amount of buprenorphine dispensed has been increasing at a greater rate than the number of buprenorphine providers. The number of physicians waivered to treat 100 patients with buprenorphine in both rural and urban settings was significantly associated with increased amounts of buprenorphine dispensed per capita. There was no significant association in the growth of buprenorphine distributed and the number of physicians with 30-patient waivers.

**Conclusions:** The greater amounts of buprenorphine dispensed are consistent with the potentially greater use of opioid agonists for opioid use disorder treatment, though they also make their misuse more likely. The changes after the 2006 legislation suggest that policies focused on increasing the number of patients that a single waivered physician could safely and effectively treat could be more effective in increasing buprenorphine use than would alternatives such as opening new substance abuse treatment facilities or raising the overall number of waivered physicians.

**Keywords:** opioid-related disorders, health policy, substance abuse treatment, buprenorphine.

In the United States, opioid use disorders are a significant public health problem, estimated to affect more than 2 million individuals.[1] Opioid overdoses are one of the leading causes of deaths by injury in the United States,[2] and in 2009, the annual societal costs of prescription and illicit opioid abuse, including lost productivity and health care costs, were estimated to be $55.7 billion.[3] The opioid agonist

medications methadone and buprenorphine are effective treatments,[4-15] and their more widespread use could substantially mitigate the negative health and societal effects of opioid use disorder.[16] Most individuals who might benefit from these medications, however, do not receive them,[17,18] which is the reason for the recent efforts to expand their use.[16]

Opioid treatment programs, the only licensed providers of methadone, are located predominantly in urban areas[19,20] and usually require patients to take methadone at a clinic, which is difficult for many individuals. The Drug Addiction Treatment Act of 2000 (DATA2000) allowed Schedule III-V medications approved by the US Food and Drug Administration (FDA), such as buprenorphine opioid agonists available as buprenorphine or buprenorphine/naloxone formulations (hereafter referred to as "buprenorphine") to be prescribed for the treatment of opioid dependence, a move that was welcomed as an opportunity to increase access to opioid agonist therapy.[18,21] Under DATA2000, physicians (hereafter referred to as "waivered physicians") who completed an approved course or who had a board certification in addiction medicine or addiction psychiatry were waivered from the special registration requirements in the Controlled Substances Act. Accordingly, they were permitted to prescribe medications such as buprenorphine for up to 30 patients at any one time. The Office of National Drug Control Policy Reauthorization Act of 2006 modified the restrictions to grant approval for treating up to 100 patients at a time to office-based physicians who had been waivered for at least a year, who were currently treating patients with buprenorphine, and who had applied for the higher patient limit. Office-based buprenorphine treatment by waivered physicians, by physicians working in non-methadone-dispensing substance abuse treatment facilities, or by opioid treatment programs[22] could provide access to opioid agonist therapy for patients who would not or could not routinely attend opioid treatment programs for geographical, ideological, or practical considerations.[12,23]

Since buprenorphine's approval, its availability from an increasing number of waivered physicians and substance abuse treatment facilities[21,24-32] has raised the number of individuals receiving buprenorphine[19,33-38] and often for the longer durations associated with improved outcomes.[39] We are unaware, however, of studies examining the relative impact of waivered physicians vis-à-vis treatment facilities regarding the overall amount of buprenorphine being dispensed across treatment systems and payers, or to what extent the distribution of

buprenorphine to patients may be influenced by the number of patients a physician is allowed to treat at one time with buprenorphine.

Policymakers are again considering facilitating access to buprenorphine by means of legislation (Recovery Enhancement for Addiction Treatment Act of 2015) that would increase the number of patients that a waivered physician could treat with buprenorphine and allow prescribing by nonphysicians registered with the Drug Enforcement Administration (DEA). In this article, we examine the influence of the 2006 legislation between 2004 and 2011, specifically the relationship between the amount of buprenorphine that each state dispenses annually per capita and the number of physicians waivered to treat up to 100 patients at a time with buprenorphine, the number of physicians waivered to treat up to 30 patients at a time with buprenorphine, the number of methadone-dispensing opioid treatment programs treating individuals receiving buprenorphine, and the number of non-methadone-dispensing substance abuse treatment facilities treating individuals receiving buprenorphine (all these are per capita). Given recent findings that suggest substantial rural-urban differences in the distribution of waivered physicians[40] and opioid agonist treatment patterns,[33] we hypothesized that the amount of buprenorphine dispensed by providers in urban and rural counties would be significantly different.

## Methods

### *Data and Variables*

We used the DEA's Automation of Reports and Consolidated Orders System (ARCOS) data to obtain the number of grams of buprenorphine dispensed in each state for each year from 2004 to 2011. We found the number of waivered physicians in each state, and whether they were waivered to treat up to 30 or 100 patients, from the Substance Abuse and Mental Health Services Administration's Buprenorphine Waiver Notification System, which contains information about all buprenorphine-waivered physicians. Buprenorphine-waivered physicians who were permitted to prescribe buprenorphine for up to 100 patients at a time were categorized as 100-patient-waivered physicians, and physicians permitted to prescribe buprenorphine for up to 30 patients at a time were categorized as 30-patient-waivered physicians.

We used the National Survey of Substance Abuse Treatment Services (N-SSATS), an annual survey of all substance abuse treatment facilities in the United States, to identify methadone-dispensing opioid treatment programs and non-methadone-dispensing substance abuse treatment facilities in each state treating patients with buprenorphine. In 2007, the N-SSATS collected information about buprenorphine use from opioid treatment programs but not from substance abuse treatment facilities. Therefore, we used data on buprenorphine provision in substance abuse treatment facilities from the 2004-2006 and 2008-2011 N-SSATS to impute substance abuse treatment facilities' use of buprenorphine in 2007. We consulted the Rural-Urban Continuum Codes[41] (RUCC) from the Area Resource File (ARF) to categorize the urbanization of all counties containing a buprenorphine provider (waivered physician, opioid treatment programs, or substance abuse treatment facilities). Providers in non-metro counties not adjacent to a metro area, non-metro counties with fewer than 2,500 residents, and rural counties were identified as rural providers; providers located in metro counties or non-metro/nonrural counties adjacent to a metro county were categorized as urban providers. The RAND Institutional Review Board approved the study.

### *Analysis*

We first calculated the number of urban and rural 100-patient-waivered physicians, 30-patient-waivered physicians, opioid treatment programs, and substance abuse treatment facilities in each state and year from 2004 through 2011 and matched this to information regarding the total grams of buprenorphine dispensed in each state and year. Using the state-year as the unit of analysis, we specified a multivariate weighted ordinary least squares regression model of a state's annual total buprenorphine dispensed per 10,000 state residents (hereafter referred to as "per capita") as a function of the state's number of buprenorphine providers per capita, by type of provider (100-patient-waivered physicians, 30-patient-waivered physicians, opioid treatment programs, and substance abuse treatment facilities) per capita. We normalized the data by 10,000 state residents to account for the fact that the population totals by state differed substantially. We estimated weighted least squares with state-level population weights to account for possible differences in the variance of the error terms (heteroskedasticity) across states that might be caused by state-level population size. The state's annual total

buprenorphine dispensed is the sum of buprenorphine dispensed across all providers in that year. By exploiting the variation in the number of buprenorphine providers over time and within states, we used the model to estimate the amount of buprenorphine that each provider type contributed to the total.

The substantial differences in the availability of opioid treatment programs and substance abuse treatment facilities by urban-rural status suggest that the role of 100-patient-waivered physicians and 30-patient-waivered physicians may be different in these settings. Accordingly, we specified the model with interactions of provider type by urban-rural status. We excluded rural opioid treatment programs and rural substance abuse treatment facilities, however, because there were very few such facilities, their estimates were imprecise, and they affected neither the substantive nor the statistical significance of other included variables. Because buprenorphine was approved in 2002 and its use grew substantially thereafter, we allowed for time trends by admitting a set of time indicator main effects as well as time indicator interactions with each provider-type variable. Thus, the intensities of treatment are estimated separately for each year in the study period. We also included state indicators to account for time-invariant, idiosyncratic differences across states. To verify the robustness of our analytic approach, we estimated several different alternative models, including models with and without normalization for state population size, weighted and unweighted by the state's population size, and GEE models with various assumptions about the correlation structures or the error terms. We found that the main results were substantively unchanged and were very robust for alternative specifications and modeling assumptions.

## Results

From 2004 to 2011, the number of all types of buprenorphine providers rose with the substantial increase in buprenorphine dispensed over that period. The total number of waivered physicians (Table 1) also went up dramatically, from 3,293 waivered physicians in 2004 to 20,410 waivered physicians in 2011. Over that period, there was a slightly greater percentage increase in the number of waivered physicians in rural counties compared with those in urban counties, with 27.1 waivered physicians in urban counties for each waivered physician in a rural county

**Table 1.** Annual Amount of Buprenorphine Dispensed and Number of Buprenorphine Providers by Type

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|
| Grams of buprenorphine dispensed | 70,331 | 158,017 | 288,740 | 507,586 | 884,202 | 1,224,986 | 1,491,653 | 1,705,958 |
| Total 100-patient-waivered physicians | 0 | 0 | 0 | 2,132 | 2,756 | 3,678 | 4,597 | 5,403 |
| Urban 100-patient-waivered physicians | 0 | 0 | 0 | 2,060 | 2,647 | 3,514 | 4,385 | 5,137 |
| Rural 100-patient-waivered physicians | 0 | 0 | 0 | 72 | 109 | 164 | 212 | 266 |
| Total 30-patient-waivered physicians | 3,293 | 5,549 | 8,068 | 8,639 | 11,140 | 12,349 | 13,665 | 15,007 |
| Urban 30-patient-waivered physicians | 3,176 | 5,337 | 7,762 | 8,281 | 10,667 | 11,841 | 13,108 | 14,421 |
| Rural 30-patient-waivered physicians | 117 | 212 | 306 | 358 | 473 | 508 | 557 | 586 |
| Total opioid treatment programs with patients receiving buprenorphine | 71 | 117 | 213 | 230 | 311 | 390 | 332 | 348 |
| Urban opioid treatment programs with patients receiving buprenorphine | 62 | 101 | 189 | 207 | 285 | 357 | 304 | 320 |
| Rural opioid treatment programs with patients receiving buprenorphine | 9 | 16 | 24 | 23 | 26 | 33 | 28 | 28 |
| Total substance abuse treatment facilities with patients receiving buprenorphine | 246 | 389 | 517 | 686 | 838 | 1,026 | 1,101 | 1,241 |
| Urban substance abuse treatment facilities with patients receiving buprenorphine | 221 | 353 | 464 | 620 | 762 | 918 | 994 | 1,123 |
| Rural substance abuse treatment facilities with patients receiving buprenorphine | 25 | 36 | 53 | 66 | 76 | 103 | 107 | 118 |

in 2004, decreasing to 23.0 waivered physicians in urban counties for each waivered physician in a rural county in 2011. The number of opioid treatment programs and substance abuse treatment facilities treating patients with buprenorphine also rose during that period, and by 2011, 30.7% of opioid treatment programs ($n = 348$) and 11.6% of substance abuse treatment facilities ($n = 1{,}241$) provided buprenorphine.

In contrast to waivered physicians, however, the increase in the number of opioid treatment programs and substance abuse treatment facilities providing buprenorphine was greater in urban than in rural counties. In 2004, 6.9 opioid treatment programs in urban counties provided buprenorphine for each rural opioid treatment program, and 8.8 substance abuse treatment facilities in urban counties provided buprenorphine for each rural substance abuse treatment facility. By 2011, the number of opioid treatment programs in urban counties providing buprenorphine had risen to 11.4 for each opioid treatment program in a rural county, and the number of substance abuse treatment facilities in urban counties providing buprenorphine had risen to 9.5 for each substance abuse treatment facility in a rural county. Therefore, despite the overall increase in the number of buprenorphine providers, there were relatively few rural providers in 2011, with a total of 118 buprenorphine-providing substance abuse treatment facilities, 28 buprenorphine-providing opioid treatment programs, and 852 waivered physicians in the nation's 1,231 rural counties. As Table 2 shows, the mean number of 30-patient-waivered physicians per capita is much higher than the number of 100-patient-waivered physicians per capita, buprenorphine-providing opioid treatment programs per capita, and buprenorphine-providing substance abuse treatment facilities per capita.

In a multivariate regression examining the amount of buprenorphine dispensed (in grams per capita per year), we found that 100-patient-waivered physicians had a greater positive impact than did 30-patient-waivered physicians, opioid treatment programs, or substance abuse treatment facilities. Since the 2006 legislation first allowing 100-patient-waivered physicians, urban 100-patient-waivered physicians per capita have been significantly ($p < 0.001$, 2007-2011, inclusive) associated with greater amounts of buprenorphine per capita dispensed, with each additional urban 100-patient-waivered physician per capita associated with an additional 211 grams of buprenorphine dispensed per capita in 2007, rising to an additional 400 grams of buprenorphine dispensed

**Table 2.** Summary Statistics of Buprenorphine Dispensed and Buprenorphine Providers per 10,000 Population During the Study Period (2004-2011)

| | Mean | SD | Min | Max |
|---|---|---|---|---|
| Buprenorphine dispensed per 10K population (grams) | 31.05 | 37.75 | 0.14 | 226.55 |
| Urban 100-patient-waivered physicians per 10K population | 0.073 | 0.095 | 0.000 | 0.527 |
| Rural 100-patient-waivered physicians per 10K population | 0.008 | 0.023 | 0.000 | 0.224 |
| Urban 30-patient-waivered physicians per 10K population | 0.305 | 0.263 | 0.014 | 1.437 |
| Rural 30-patient-waivered physicians per 10K population | 0.042 | 0.095 | 0.000 | 0.692 |
| Urban opioid treatment programs with patients receiving buprenorphine per 10K population | 0.008 | 0.011 | 0.000 | 0.085 |
| Rural opioid treatment programs with patients receiving buprenorphine per 10K population | 0.002 | 0.007 | 0.000 | 0.080 |
| Urban substance abuse treatment facilities with patients receiving buprenorphine per 10K population | 0.021 | 0.029 | 0.000 | 0.233 |
| Rural substance abuse treatment facilities with patients receiving buprenorphine per 10K population | 0.007 | 0.020 | 0.000 | 0.161 |

per capita in 2011 (Table 3). Rural 100-patient-waivered physicians were also significantly associated ($p < 0.05$, 2008-2011) with higher amounts of buprenorphine per capita being dispensed within a state. In the case of rural counties, each additional 100-patient-waivered physician per capita was associated with an additional 501 grams of additional buprenorphine per capita dispensed in 2011.

The relationship between 30-patient-waivered physicians and buprenorphine per capita dispensed was substantially different from that observed for the 100-patient-waivered physicians, suggesting that 30-patient-waivered physicians are not as important as contributors to the growth in the distribution of buprenorphine. The number of rural 30-patient-waivered physicians per capita was significantly associated with more buprenorphine per capita dispensed in 2006, 2009, and

Table 3. Association Between Buprenorphine Dispensed and Buprenorphine Provider Type per 10,000 Residents

| | Estimated Marginal Effect of Number of Providers of Each Type on Grams of Buprenorphine per Capita Dispensed | 95% Confidence Interval |
|---|---|---|
| Urban 100-patient-waivered physicians per capita | | |
| 2007 | 211.2 | (130.28, 292.1)*** |
| 2008 | 360.06 | (288.10, 432.0)*** |
| 2009 | 380.37 | (328.86, 431.9)*** |
| 2010 | 415.55 | (370.54, 460.6)*** |
| 2011 | 400.11 | (363.00, 437.2)*** |
| Rural 100-patient-waivered physicians per capita | | |
| 2007 | 494.12 | (−11.62, 999.9) |
| 2008 | 474.01 | (79.64, 868.4)* |
| 2009 | 472.61 | (273.18, 672.0)*** |
| 2010 | 516.33 | (331.08, 701.6)*** |
| 2011 | 501.33 | (337.75, 664.9)*** |
| Urban 30-patient-waivered physicians per capita | | |
| 2004 | 7.17 | (-55.36, 69.7) |
| 2005 | 26.89 | (−12.91, 66.7) |
| 2006 | 38.28 | (9.90, 66.7)** |
| 2007 | 4.33 | (−27.94, 36.6) |
| 2008 | −17.78 | (−44.94, 9.4) |
| 2009 | −25.37 | (−49.13, −1.6)* |
| 2010 | −45.06 | (−68.12, −22.0)*** |
| 2011 | −44.83 | (−65.12, −24.5)*** |
| Rural 30-patient-waivered physicians per capita | | |
| 2004 | 153.6 | (−74.34, 381.5) |
| 2005 | 106.14 | (−26.06, 238.4) |
| 2006 | 107.6 | (6.79, 208.4)* |

*Continued*

Table 3. *Continued*

| | Estimated Marginal Effect of Number of Providers of Each Type on Grams of Buprenorphine per Capita Dispensed | 95% Confidence Interval |
|---|---|---|
| 2007 | 77.48 | (−52.36, 207.3) |
| 2008 | 117.21 | (−1.34, 235.8) |
| 2009 | 127.49 | (34.37, 220.6)** |
| 2010 | 118.59 | (24.47, 212.7)* |
| 2011 | 44.13 | (−54.82, 143.1) |
| Urban opioid treatment programs with patients receiving buprenorphine per capita | | |
| 2004 | 9.41 | (−444.26, 463.1) |
| 2005 | −65.08 | (−656.31, 526.1) |
| 2006 | −267.53 | (−753.29, 218.2) |
| 2007 | −84.57 | (−382.60, 213.5) |
| 2008 | −119.62 | (−427.60, 188.4) |
| 2009 | −26.45 | (−323.00, 270.1) |
| 2010 | 160.82 | (−173.53, 495.2) |
| 2011 | 32.62 | (−271.95, 337.2) |
| Urban substance abuse treatment facilities with patients receiving buprenorphine per capita | | |
| 2004 | −28.13 | (−410.25, 354.0) |
| 2005 | −41.19 | (−320.63, 238.3) |
| 2006 | 2.05 | (−218.24, 222.3) |
| 2007 | −25.73 | (−189.37, 137.9) |
| 2008 | 15.7 | (−126.13, 157.5) |
| 2009 | 16.26 | (−113.96, 146.5) |
| 2010 | 13.58 | (−94.80, 122.0) |
| 2011 | −20.78 | (−126.96, 85.4) |

*Continued*

Table 3. *Continued*

| | Estimated Marginal Effect of Number of Providers of Each Type on Grams of Buprenorphine per Capita Dispensed | 95% Confidence Interval |
|---|---|---|
| Year | | |
| 2005 | −0.75 | (−4.94, 3.5) |
| 2006 | −0.9 | (−5.25, 3.5) |
| 2007 | −0.95 | (−5.63, 3.7) |
| 2008 | 0 | (−4.84, 4.8) |
| 2009 | 0.15 | (−4.77, 5.1) |
| 2010 | −0.47 | (−5.41, 4.5) |
| 2011 | 3.65 | (−1.27, 8.6) |

Dependent variable: grams of buprenorphine per capita per state.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

2010 ($p < 0.05$ in each year) (Table 3). The number of urban 30-patient-waivered physicians per capita was significantly associated with more buprenorphine being dispensed in 2006 ($p < 0.01$) and with modest reductions in buprenorphine per capita dispensed in 2009-2011 ($p < 0.05$ in each year) (Table 3). Neither buprenorphine-dispensing urban opioid treatment programs per capita nor buprenorphine-dispensing urban non-methadone-dispensing substance abuse treatment facilities per capita were significantly associated with the amount of buprenorphine per capita dispensed.

## Discussion

The amount of buprenorphine dispensed and the number of buprenorphine providers of all types rose substantially between 2004 and 2011, consistent with a range of studies finding an increase in buprenorphine-waivered providers, substance abuse treatment facilities using buprenorphine, and patients receiving buprenorphine.[19,25] Our findings, however, suggest that the greatest impact on the amount of

buprenorphine being dispensed came from waivered physicians able to treat up to 100 patients with buprenorphine. The 2006 legislation allowing appropriately waivered physicians to treat more patients appears to have contributed to a substantial increase in the use of buprenorphine, which is encouraging at a time when a recent spike in heroin and illicit prescription opioid painkiller use[42] has reinforced the importance of facilitating access to effective opioid agonist therapies.[4,43,44] At the same time, more widely available buprenorphine can also have significant downsides, including medical emergencies due to ingestion by children,[45-48] diversion, and illicit use.[49-52] More research is needed to better understand the relationship between greater access to buprenorphine, greater engagement in appropriate opioid agonist treatment, and a higher number of negative consequences associated with the more widespread availability of buprenorphine.

For the years following the 2006 legislation, we found that 100-patient-waivered physicians were significantly associated with greater amounts of buprenorphine per capita dispensed. Because the recommended daily dose of buprenorphine for treating opioid use disorders is 16mg/day, with a maximum of 24mg/day[53] (5.8 to 8.8 grams per year), our findings indicate that 24 (in 2007) to 45 (in 2011) additional patients received buprenorphine treatment per 100-patient-waivered urban physician, assuming these physicians prescribed on the higher end of the daily dosage and individuals were treated for an entire year. For rural areas, assuming that waivered physicians prescribed on the higher end of the recommended daily dosage, our findings indicate that 57 additional patients received buprenorphine treatment per 100-patient-waivered rural physician. The number of additional patients receiving buprenorphine treatment could feasibly be even higher if average patient daily dosages were lower or the duration of treatment were shorter, although we should note that a longer duration of treatment has been associated with improved clinical outcomes in individuals receiving buprenorphine.[54]

In contrast, despite the substantial increase in the number of 30-patient-waivered physicians in both urban and rural areas, our findings regarding the relationship between 30-patient-waivered physicians and the amount of buprenorphine dispensed in recent years suggest that many of the physicians waivered to treat 30 patients may actually be treating few or no patients with buprenorphine, which is consistent with earlier research findings.[36,55-57] A variety of factors extending beyond the

DEA certification process could influence a physician's decision about whether to treat patients with buprenorphine. Some physicians may obtain waivers as part of their residency or fellowship training experience, particularly in urban areas in which these programs are predominantly located, but do not plan to provide buprenorphine after training completion. Physicians may be less likely to prescribe buprenorphine owing to the increased scrutiny of the DEA in the auditing of medical records,[58,59] the importance of closely monitoring patients for potential relapse or diversion of medication,[60] and the stigma associated with treating individuals with opioid use disorders,[61] as well as patients' own histories and readiness for treatment.

State policies with respect to buprenorphine are complex,[62] as some state Medicaid programs may be implementing policies intended to enhance access to buprenorphine[63] while simultaneously implementing policies limiting the duration or dosage of buprenorphine treatment.[19] Low insurance reimbursement rates for services associated with buprenorphine prescribing, such as office visits and urine drug screens, may also discourage some physicians from prescribing buprenorphine and encourage other physicians to accept cash in addition to or instead of insurance for buprenorphine treatment. Accepting cash allows physicians to expand treatment to uninsured individuals or those preferring not to have an insurance record of their treatment; such practices, however, have been associated with poorer quality care.[64]

Some combination of these factors, and the likelihood that many of the most active buprenorphine-prescribing physicians sought approval to treat 100 patients, may help explain our finding a statistically significant negative association in 2009-2011 between the number of urban 30-patient-waivered physicians and the amount of buprenorphine dispensed. To enhance policymakers' and payers' ability to more effectively and efficiently increase office-based physicians' appropriate use of buprenorphine, we need more research to better understand the complex influences on waivered physicians' decisions regarding the number of patients to treat with buprenorphine, as well as the factors that help physicians do so safely and effectively.

We found that the number of methadone-dispensing urban opioid treatment programs and non-methadone-dispensing substance abuse treatment facilities dispensing buprenorphine per capita was not associated with significantly more buprenorphine per capita dispensed. Many substance abuse treatment facilities have historically had a

nonmedication bias,[65] and even in locations in which such facilities have started to use buprenorphine, there may be a continued reluctance to use opioid agonist medications with more than a few patients. Perhaps some individuals who can easily access an opioid treatment program prefer the support and additional structure that come with receiving their methadone daily at an opioid treatment program rather than receiving a prescription for buprenorphine. Some patients with greater opioid dependence may also feel more comfortable taking methadone and may have better clinical outcomes.[4] Or opioid treatment programs may be more inclined to provide methadone rather than buprenorphine because their infrastructure and business model may rely on the services associated with dispensing methadone to a sufficient number of individuals.

Our findings must be considered in the context of our study's limitations. Most important, even though we documented substantial growth in the number of all types of buprenorphine providers and the grams of buprenorphine dispensed, we were unable to assess the clinical impact of more providers or more grams of buprenorphine dispensed. Specifically, we do not know the mean number of individuals receiving buprenorphine for opioid use disorders for any of the provider types, the buprenorphine dosages that these individuals receive, or the duration of their buprenorphine treatment, nor do we know which waivered and credentialed physicians are not prescribing buprenorphine.[24,34,55] We can speculate that the greater amounts of dispensed buprenorphine are likely associated with the treatment of more individuals for longer periods and that those physicians who have sought a waiver to treat up to 100 patients are likely treating more individuals than are physicians waivered to treat 30 patients. But further research is needed to better understand the number of individuals that each type of buprenorphine provider is actually treating, as well as the nature and quality of that treatment.

We sought to translate grams of buprenorphine into the potential number of individuals treated with buprenorphine in a year to provide a greater clinical context for our analysis and findings, as we are aware that because of the tremendous variation in how buprenorphine is used, the calculation would be, at best, a rough guide. We recognize that most patients likely receive daily dosages of less than 24 milligrams and that the duration of treatment for most is less than 365 days.[66,67] For that reason, our estimate of the number of additional patients represented by the greater number of grams of buprenorphine dispensed is probably

quite conservative. We also do not know to what extent the dispensed buprenorphine is being used for purposes other than the treatment of opioid use disorders, such as for treatment of pain or detoxification, or is being diverted for illicit use.

Despite these limitations, our findings offer important information about the dispensation of buprenorphine in recent years, clearly demonstrating that the amount of buprenorphine being dispensed has grown more rapidly than the number of buprenorphine providers in recent years, as well as showing substantial differences among different types of providers in the amount of buprenorphine per capita dispensed. Our finding regarding the impact of earlier legislation that relaxed the cap on the number of patients who can be treated concurrently by a waivered physician, which resulted in approximately 25% of waivered physicians being able to treat up to 100 patients, is particularly timely in light of recent data showing that approximately 10% of all waivered physicians in one state are concurrently treating 80 or more Medicaid patients with buprenorphine.[57]

While there have been efforts to increase the number of waivered physicians, our findings suggest that one alternative might be to focus on increasing the number of patients that a single waivered physician could safely and effectively treat. This might involve modifications to the process of assessing the physicians' knowledge and competency before allowing them to treat up to 100 patients, enhancing reimbursement for more frequent group sessions, offering medical-home approaches to treatment and to point-of-care urine drug testing, enabling either mental health or medical health practitioners to be colocated where buprenorphine is prescribed, providing mentoring systems and/or access to a "champion" to assist in difficult patient care situations, offering more advanced training in buprenorphine care, and facilitating access to and collaboration with more advanced addiction specialty services.[36] Given that at least some physicians waivered to treat up to 100 patients appear to be practicing at or near their patient limit,[57] these changes might also involve further relaxation in patient limits. Such a policy change would apply primarily to physicians practicing at or near the cap and would work only if such physicians were interested and able to safely and effectively treat more patients. Such efforts might have a disproportionately positive impact in rural communities that are often without a methadone-dispensing opioid treatment program, in which the number of waivered physicians plays a more significant role in

access to opioid agonist treatment.[68] While facilitating greater access to effective pharmacotherapy for opioid use disorder is only one component of an effective response to the public health challenges posed by illicit opioid use, it is a particularly important one to pursue at a time when health care reforms and mental health and substance abuse parity efforts present an opportunity for many more individuals to take advantage of such effective treatment for a pressing public health issue.

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