State-level Influences on Buprenorphine Volume

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Abstract
Research Objective: Buprenorphine is a medication used to treat opioid addiction. Physicians are required to have special Drug Enforcement Agency certification to prescribe buprenorphine. Although it is more accessible and potentially safer than methadone, the leading opioid addiction treatment modality, there appear to be state-to-state variations in rates of buprenorphine adoption and use. The purpose of this study was to identify state-level influences on the volume of buprenorphine prescribed, using a limited set of supply and demand measures. Study Design: We developed a database using data on buprenorphine prescribing and factors hypothesized to influence variations in prescribing obtained from the Drug Enforcement Agency, the Substance Abuse and Mental Health Services Administration, the National Conference of State Legislatures, and other sources. All data were from 2005-2008. Factors included the prevalence of past-year use of heroin and/or prescription analgesics, the number of certified buprenorphine prescribers per 10,000 users, the number of opioid treatment programs (OTPs) per 100,000 users, total state spending for substance abuse treatment and prevention, and Medicaid coverage of buprenorphine. Linear regression models were constructed with the log of the cumulative grams of buprenorphine distributed in each state in 2008 per 1000 users as the dependent variable. Population Studied: 50 states and the District of Columbia. Principal Findings: The mean prevalence of past-year opioid use was approximately 5%. From 2005 to 2009, the mean amount of buprenorphine per 1000 users increased from 13g to 97g per year. In 2008, the population-adjusted amount of buprenorphine prescribed was highest in Vermont, Maine, and Massachusetts, and lowest in South Dakota, Iowa, and Kansas. The supply of certified physicians per 10,000 users was highest in Vermont, Maine, and the District of Columbia and lowest in Arkansas, Iowa, and Idaho. The number of OTPs per 100,000 users was highest in DC, Maryland, and Rhode Island, whereas 4 states had none (Wyoming, North Dakota, Montana,
South Dakota). In unadjusted bivariate analyses, higher numbers of physicians and of OTPs were significantly associated with higher buprenorphine volume. In multivariate analyses, only the supply of physicians remained significantly associated. Conclusions: Buprenorphine use has increased rapidly over the past 5 years. After accounting for variations in state-level epidemiology of opioid use, buprenorphine volume in 2008 was highest in Vermont, Maine, and Massachusetts. Physician supply was significantly associated with greater buprenorphine use, whereas the level of state spending on substance abuse treatment and Medicaid coverage did not appear to predict buprenorphine volume. Implications for Policy, Delivery or Practice: Buprenorphine utilization is closely tied to the supply of certified buprenorphine prescribers. Reasons for the wide variation in prescriber supply across states are unclear and require further study. State policies, as reflected in per capita spending or Medicaid coverage, do not appear to affect buprenorphine utilization directly, but may do so indirectly by influencing the supply of certified physicians. States wishing to increase access to buprenorphine may be able to do so by encouraging more physicians to seek certification and by facilitating training to achieve certification. Changes in federal drug control policy, which limits the number of buprenorphine patients per prescriber, could also increase access.
**Introduction**

Buprenorphine is an opioid partial agonist used to treat addiction to heroin and other opiates, such as oxycodone. Although buprenorphine has been shown to have favorable outcomes in terms of relapse prevention, costs, and criminal behavior, states differ widely in the amount of buprenorphine prescribed to opioid abusers. The purpose of this study was to identify state-level influences on the volume of buprenorphine prescribed. Although surveys of state agency directors and individual prescribers have been conducted, little is known about state-level policy and other factors that might influence buprenorphine prescribing patterns.

Factors hypothesized to influence state-level differences in buprenorphine prescribing patterns include:

- **Demand** – Demand for buprenorphine is influenced by the epidemiology of opioid abuse (which varies from state to state), Medicaid coverage, and state funding for substance abuse treatment.
  - **Medicaid coverage** – Medicaid coverage of substance abuse treatment and medication such as buprenorphine varies considerably by state and by whether or not the state's Medicaid plan uses managed care/HMO arrangements. Coverage of buprenorphine under Medicaid benefits is decided on a state-by-state basis, as are rules about prior authorization and medical necessity. State Medicaid programs administered by HMOs may have an additional level of formulary and treatment authorization that affects whether or not buprenorphine and related treatments are covered.
  - **State funding for substance abuse treatment** – A state's generosity in terms of how well-funded its substance abuse treatment programs are in relation to need
may be an indicator of access to opioid dependence treatment. A more generous substance abuse treatment program may also lead directly to more opioid treatment facilities and programs.

- **Supply of office-based prescribers** – The Federal government requires that physicians must either be certified addiction specialists or take a 1-day training course in order to receive a special Drug Enforcement Agency (DEA) prescriber number. In addition, physicians may have no more than 100 patients taking buprenorphine at any one time (until 2006, the limit was 30). The statute governing these waivers is known as DATA, after the Drug Addiction Treatment Act of 2000 which allowed office-based treatment for opioid addiction. There are large state-to-state variations in the availability of DATA-certified physicians.

- **Supply of clinics** – Opioid treatment programs (OTPs) are, in most states, the only setting in which methadone is administered and are a potential additional setting for buprenorphine treatment. There are large state-to-state variations in the number of OTPs.

- **Attitudes** – Cultural, religious, and political attitudes may influence whether medication-assisted treatment (MAT) for opioid addiction is stigmatized, marginalized, or ignored. For example, while methadone was initially conceived as an indefinite treatment, the wave of fiscal conservatism that swept over the country in the 1980s led to a policy of short-term treatment. Similarly, beginning with Republican New York Governor Nelson Rockefeller’s harsh drug laws in 1973 and continuing through today, conservatives are traditionally associated with a punitive “War on Drugs” rather than rehabilitation and treatment for drug users.
Methods
The goal of this analysis was to identify possible explanatory variables for state-level differences in buprenorphine distribution in 2008. This study used data from multiple sources, including national surveys and databases and the literature, to compile data on possible predictors. Unadjusted and multivariate-adjusted linear regression analyses were performed to model these state-level predictors.

Data Sources and Measures
The National Survey of Drug Use and Health (NSDUH) was the source of prevalence data by state for the number persons in each state who reported use of either heroin or illicit prescription painkillers ("opioid users") in the previous 12 months; the 2005-2008 state-level estimates were obtained by request to the Office of Applied Statistics (personal communication, 2010). NSDUH is an annual survey, conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA), of approximately 70,000 randomly selected individuals aged 12 and older which provides national and state-level estimates on the use of tobacco products, alcohol, illicit drugs (including non-medical use of prescription drugs) in the US.

The number of DATA-certified physicians in each state in 2008 was taken from the State Profiles report issued by SAMHSA in 2008 and originated with a national database maintained by SAMHSA. That number was adjusted for population size by dividing by the number of opioid users and multiplied by 10,000.

The National Survey of Substance Abuse Treatment Services (N-SSATS), also conducted by SAMHSA, was the source of data on the number of OTPs in 2008, and was obtained from the State Profiles report. That number was adjusted for population size by dividing by the number of opioid users and multiplied by 100,000.
The cumulative annual amount (in grams) of buprenorphine distributed in each state in 2005-2009 was taken from an Automation of Reports and Consolidated Orders System (ARCOS) report issued by the DEA and obtained by request to the Office of Diversion Control (personal communication, 2010). ARCOS is an automated, comprehensive drug reporting system which monitors the flow of DEA-controlled substances from their point of manufacture through commercial distribution channels to the point of sale or distribution at the dispensing/retail level (including hospitals, retail pharmacies, practitioners, mid-level practitioners, and teaching institutions). The number of grams of buprenorphine was adjusted for population size by dividing by the number of opioid users in each state and multiplying by 1000.

Medicaid coverage rules for buprenorphine were obtained from the National Conference of State Legislatures (NCSL) Medication-Assisted Treatment (MAT) project. For that project, NCSL surveyed the single state agency directors, state methadone authorities, and Medicaid directors in the 50 states and the District of Columbia regarding whether their state's Medicaid program 1) offered coverage for buprenorphine in physicians' offices; 2) offered coverage for buprenorphine in OTPs; and 3) covered buprenorphine on the formulary. Additional information, such as whether the program required prior authorization or had time or other limits on treatment, was also collected. Web searches were conducted of state Medicaid websites to fill in missing information for Colorado, the District of Columbia, Minnesota, Mississippi, North Carolina, and Rhode Island. Since the NCSL did not have any information for South Carolina and a web search did not locate any updated information, South Carolina was assumed to have no coverage in 2008 based on data from a study by Ducharme and colleagues, which surveyed state substance abuse agencies about Medicaid coverage rules in 2006. Once data for all states and DC had been collected and analyzed, each state was categorized as 1) no coverage; 2) mixed coverage (e.g.,
coverage in physician offices but not in OTPs); or 3) full coverage. According to the SAMHSA State Profiles report, as of 2008, Montana, North Dakota, South Dakota, and Wyoming did not have any OTPs; in these cases, Medicaid coverage in OTPs was considered not applicable and did not factor into those states' categorization. Initial analyses were conducted using the three-level Medicaid coverage variable; however, for simplicity, the final model used a binary indicator for any Medicaid coverage versus none.

The majority of the estimates for state spending on substance abuse treatment were obtained from a report produced by Columbia University's National Center on Addiction and Substance Abuse (CASA).\textsuperscript{13} Their estimates were obtained by surveying state budget directors for actual expenditures related to substance abuse treatment in 2005, not including Medicaid spending, but including treatment programs related to alcohol, smoking, and illicit drugs. Indiana, Nevada, North Dakota, Rhode Island, Tennessee, and Utah did not participate in the CASA survey. For those states, the source was the amount reported in each state’s FY 2008 Substance Abuse Prevention and Treatment Block Grant Application (Table 4, line 1) for FY 2005 on substance abuse prevention and treatment (excluding primary prevention). The value included amounts States reported from their SAPT Block Grant, other Federal funds, state funds, local funds, and other funds, but excluded Medicaid to be consistent with the CASA estimates (Rick Harwood, personal communication, 2010). Since state budgets vary by population size (in addition to other factors), this measure was adjusted for the size of the substance-abusing population as follows. First, state-level estimates were obtained from NSDUH on the percentage of the population reporting dependence on or abuse of illicit drugs or alcohol in the past year (age 12 and up, average of 2005-06). Next, the number of individuals in each state over the age of 15 was obtained from the US Census's 2005 and 2006 American Community Surveys,\textsuperscript{14, 15} and the
numbers for each year were averaged. Then, the prevalence percentages were applied to the population data from the Census to obtain the average number of substance abusers in 2005-2006. Finally, each state's spending in 2005 was divided by the total number of substance abusers to obtain a per capita spending estimate.

The percentage of voters who self-identified as conservative was taken from a national telephone survey of 160,236 adults, aged 18 and older, conducted by Gallup in January-June 2009. Self-identification was determined by asking, "How would you describe your political views – very conservative, conservative, moderate, liberal, or very liberal?" Those answering "very conservative" or "conservative" were combined.\textsuperscript{16}

**Statistical Analyses**
The outcome measure for this analysis was grams of buprenorphine per 1000 opioid users; because its distribution was non-normal, the data were log-transformed. Descriptive analyses were conducted of the prevalence of opioid use, the number of OTPs per 100,000 opioid users, the number of DATA-certified physicians per 10,000 opioid users, state spending for substance abuse treatment per substance abuser, Medicaid coverage policies, and proportion of individuals self-identifying as conservatives in each state. Linear regression analysis was performed for each covariate individually, followed by a multivariate linear regression model with all potential predictors included. Regression diagnostic tests performed included variance inflation factors (for multicollinearity), skewness and kurtosis, and residuals (for detecting outliers). All analyses were conducted with Stata IC v9 (College Station, TX), with $P<0.05$ considered significant.
Results

Descriptive Analysis
The mean prevalence of past-year opioid use in 2005-2008 was approximately 5%, ranging from 2.9% in South Dakota to 7.6% in Oklahoma (Figure 1, Table 1). In 2008, the amount of buprenorphine prescribed was highest in Vermont, Maine, and Massachusetts, and lowest in South Dakota, Iowa, and Kansas (Figure 2, Table 1). The supply of DATA-certified physicians per 10,000 opioid users was highest in Vermont, Maine, and the District of Columbia and lowest in Arkansas, Iowa, and Idaho (Table 1). The number of certified OTPs per 100,000 users was highest in DC, Maryland, and Rhode Island, whereas 4 states had none (Montana, North Dakota, South Dakota, Wyoming) (Table 1).

Figure 1. Prevalence of past-year opioid use, 2005-2008

Source: NSDUH/personal communication
Figure 2. Grams of buprenorphine per 1000 opioid users, 2008

Alaska

Hawaii

Legend

Grams of Buprenorphine per 1000 Users

- 12.7 - 43.4
- 43.5 - 86.0
- 86.1 - 133.1
- 133.2 - 200.1
- 200.2 - 404.1

Source: DEA/NSDUH

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Min</th>
<th>State</th>
<th>Max</th>
<th>State</th>
<th>Source, Data Yr</th>
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<tbody>
<tr>
<td>Buprenorphine (g)</td>
<td>17,129.6</td>
<td>240.9</td>
<td>SD</td>
<td>69,459.8</td>
<td>PA</td>
<td>DEA, 2008</td>
</tr>
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<td>Buprenorphine (g) per 1000 opioid users</td>
<td>84.6</td>
<td>12.7</td>
<td>SD</td>
<td>404.1</td>
<td>VT</td>
<td>DEA, 2008</td>
</tr>
<tr>
<td>Number of opioid users</td>
<td>241,784</td>
<td>19,000</td>
<td>ND</td>
<td>1,531,000</td>
<td>CA</td>
<td>NSDUH, 2005-08</td>
</tr>
<tr>
<td>Prevalence of past-year opioid use</td>
<td>5.0%</td>
<td>2.9%</td>
<td>SD</td>
<td>7.6%</td>
<td>OK</td>
<td>NSDUH, 2005-08</td>
</tr>
<tr>
<td>Number of DATA-certified physicians</td>
<td>303</td>
<td>11</td>
<td>SD</td>
<td>1,822</td>
<td>NY</td>
<td>SAMHSA, 2008</td>
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<tr>
<td>Number of DATA-certified physicians per 10,000 opioid users</td>
<td>13.9</td>
<td>2.3</td>
<td>AR</td>
<td>66.4</td>
<td>VT</td>
<td>Calculation</td>
</tr>
<tr>
<td>Number of OTPs</td>
<td>23.4</td>
<td>0</td>
<td>*</td>
<td>157</td>
<td>NY</td>
<td>SAMHSA, 2008</td>
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<tr>
<td>Number of OTPs per 100,000 opioid users</td>
<td>10.3</td>
<td>0</td>
<td>*</td>
<td>45</td>
<td>DC</td>
<td>Calculation</td>
</tr>
<tr>
<td>Percentage of conservatives</td>
<td>38.6%</td>
<td>23%</td>
<td>DC</td>
<td>49%</td>
<td>AL</td>
<td>Gallup, 2009</td>
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<tr>
<td>Substance abuse treatment spending per substance abuser</td>
<td>$113.24</td>
<td>$5.26</td>
<td>WI</td>
<td>$745.97</td>
<td>CT</td>
<td>CASA, 2005</td>
</tr>
<tr>
<td>Medicaid coverage, % with any</td>
<td>84%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NCSL, 2008</td>
</tr>
</tbody>
</table>

*MT, ND, SD, WY
Trends in Prescribing

From 2005 to 2009, the mean amount of buprenorphine per 1000 opioid users increased from 13g to 97g. The rate of change was slowest in Vermont (246% increase) and fastest in Oklahoma (4,144% increase), with a mean percentage increase of 976%. The only state that did not see an increase in every year was Louisiana, which started in 2005 with 36.5 g/100 users, decreased in 2006 to 23.5 g/1000 users, then increased from 2007 to 2009.

Figure 3. Population-adjusted trends in buprenorphine prescribing, US mean and selected states, 2005-2009

Regression Analysis

In unadjusted bivariate analyses, the number of physicians and number of OTPs were significantly associated with an increase in amount of buprenorphine prescribed. In multivariate analyses, only the supply of physicians remained significantly associated with buprenorphine volume.
## Table 2. Unadjusted/univariate

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>P value</th>
<th>95% Conf. Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of DATA-certified physicians per 10,000 opioid users</td>
<td>0.047</td>
<td>0.006</td>
<td>&lt;0.001</td>
<td>(0.034 to 0.060)</td>
</tr>
<tr>
<td>Number of OTPs per 100,000 opioid users</td>
<td>0.044</td>
<td>0.010</td>
<td>&lt;0.001</td>
<td>(0.023 to 0.064)</td>
</tr>
<tr>
<td>Percentage of conservatives in state</td>
<td>-0.037</td>
<td>0.019</td>
<td>0.054</td>
<td>(-0.075 to 0.001)</td>
</tr>
<tr>
<td>State spending on substance abuse treatment per substance abuser</td>
<td>0.001</td>
<td>0.001</td>
<td>0.159</td>
<td>(-0.001 to 0.003)</td>
</tr>
<tr>
<td>Any Medicaid coverage (Y/N)</td>
<td>-0.092</td>
<td>0.300</td>
<td>0.760</td>
<td>(-0.695 to 0.511)</td>
</tr>
</tbody>
</table>

## Table 3. Adjusted/multivariate

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>P value</th>
<th>95% Conf. Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of DATA-certified physicians per 10,000 opioid users</td>
<td>0.048</td>
<td>0.010</td>
<td>&lt;0.001</td>
<td>(0.028 to 0.068)</td>
</tr>
<tr>
<td>Number of OTPs per 100,000 opioid users</td>
<td>-0.002</td>
<td>0.013</td>
<td>0.869</td>
<td>(-0.027 to 0.023)</td>
</tr>
</tbody>
</table>

## Discussion

At the state level, the supply of physicians predicts the population-adjusted volume of buprenorphine prescribed in a state. After adjusting for supply and demand, conservative attitudes, substance abuse treatment funding, and Medicaid coverage of buprenorphine do not appear to affect the volume of buprenorphine prescribed.

Given continued waiting lists for buprenorphine treatment, physician supply should be increased in order for more opioid users to have access. Policies that create barriers to physician prescribing, such as caps on the number of patients per prescriber, additional training and certification requirements, and continually changing documentation requirements should be addressed in order to improve access to therapy.

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