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States' implementation of the Affordable Care Act and the supply of physicians waived to prescribe buprenorphine for opioid dependence

Hannah K. Knudsen^a, Michelle R. Lofwall^b, Jennifer R. Havens^c, and Sharon L. Walsh^d

^aDepartment of Behavioral Science and Center on Drug and Alcohol Research, University of Kentucky, 845 Angliana Avenue, Room 204, Lexington, KY, 40508, USA

^bDepartment of Behavioral Science and Center on Drug and Alcohol Research, University of Kentucky, 845 Angliana Avenue, Room 203 Lexington, KY, 40508, USA.
michelle.lofwall@uky.edu

^cDepartment of Behavioral Science and Center on Drug and Alcohol Research, University of Kentucky, 845 Angliana Avenue, Room 201, Lexington, KY, 40508, USA.
jennifer.havens@uky.edu

^dDepartment of Behavioral Science and Center on Drug and Alcohol Research, University of Kentucky, 845 Angliana Avenue, Room 202, Lexington, KY, 40508, USA. sharon.walsh@uky.edu

Abstract

Background—Although the Affordable Care Act (ACA) is anticipated to affect substance use disorder (SUD) treatment, its impact on the supply of physicians waived to treat opioid dependence with buprenorphine has not been considered. This study examined whether states more supportive of ACA, meaning those that had opted to expand Medicaid and establish a state-based health insurance exchange, experienced greater growth in physician supply than less supportive states.

Methods—Buprenorphine physician supply, including total physician supply, supply of 30-patient physicians, and supply of 100-patient physicians per 100,000 state residents, was measured

Corresponding author. hannah.knudsen@uky.edu.

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from June 2013 to May 2015. State characteristics were drawn from multiple secondary sources, with states categorized as ACA-supportive, ACA-hybrid (where states either expanded Medicaid or established a state-based exchange), or ACA-resistant (where states took neither action). Mixed effects regression was used to estimate state-level growth curves to test whether rates of growth varied by states' approaches to implementing ACA.

Results—The supply of waived physicians grew significantly over the two-year period. Rates of growth were significantly lower in ACA-hybrid and ACA-resistant states relative to growth in ACA-supportive states. Average buprenorphine physician supply at baseline varied by region, the percentage of residents covered by Medicaid, and the supply of specialty SUD treatment programs.

Conclusions—This study found a positive impact of the ACA on growth in the supply of buprenorphine-waivered physicians in US states. Future research should address whether the ACA affects the number of patients receiving buprenorphine, Medicaid spending, and the quality of treatment services delivered.

Keywords

Affordable Care Act; buprenorphine; physician supply; Medicaid expansion; health insurance exchanges

1. INTRODUCTION

The passage of the Patient Protection and Affordable Care Act (ACA) has been heralded as the most significant change to affect the US health system in decades (Buck, 2011; Garfield et al., 2010), although its implementation remains contested (Bagley et al., 2015; Jost, 2014). One of its central goals is to reduce the number of uninsured individuals (Buck, 2011; Holahan and Headen, 2010), which may affect the strategic decisions in health care settings regarding service offerings. This study examines ACA's impact on the supply of physicians holding the waiver to prescribe buprenorphine to patients with opioid dependence.

1.1. Key components of the Affordable Care Act

The ACA includes multiple mechanisms for expanding insurance coverage, including the Medicaid expansion, implementation of insurance exchanges, and a requirement that all Americans purchase health insurance. It authorized the expansion of Medicaid coverage to individuals with incomes under 138% of the federal poverty line (Price and Eibner, 2013). This expansion extended coverage to adults previously excluded from Medicaid in many states while standardizing the income threshold (Hill et al., 2014; Kaiser Commission on Medicaid and the Uninsured, 2014). A subsequent Supreme Court ruling (National Federation of Independent Business v. Sebelius) gave states discretion over accepting or declining Medicaid expansion. As of mid-2015, 29 states and the District of Columbia are expanding Medicaid (Henry J. Kaiser Family Foundation, 2015).

State governments have faced decisions about structuring exchanges for selling subsidized health insurance (Blumenthal and Collins, 2014; Gluck, 2014). Some states have established state-based marketplace exchanges, while others have partnered with the federal government

to build exchanges (Buttorff et al., 2015). Others have declined to take action, resulting in their residents being channeled toward the federal exchange at Healthcare.gov (Nadash and Day, 2014).

For substance use disorder (SUD) treatment, ACA has heightened significance with its inclusion of treatment as an essential health benefit and extension of parity to health plans (Beronio et al., 2014; Garfield and Druss, 2012; Pating et al., 2012). Historically, SUDs were not conditions that qualified individuals for Medicaid's disability benefits (Buck, 2011), and state Medicaid programs varied in their SUD coverage (Andrews, 2014). Individuals with SUDs may particularly benefit from ACA, especially in Medicaid expansion states. More generous benefits combined with more insured individuals are potentially significant economic forces that may encourage health providers to deliver SUD services (McLellan and Woodworth, 2014; Roy III and Miller, 2012). Greater delivery, and consequently greater spending, has been projected through 2020, with an increasing share of SUD treatment spending for office-based physicians (Mark et al., 2014).

If ACA encourages more physicians to offer office-based SUD treatment, such as buprenorphine/naloxone (e.g., Suboxone®, Zubsolv®) for opioid dependence, greater integration of SUD treatment into mainstream health care will be achieved (Pating et al., 2012). Such integration would be a notable accomplishment given the historical segregation of SUD treatment to agencies outside of the traditional health care system (McLellan and Woodworth, 2014; Roman et al., 2011). Moreover, expanding buprenorphine treatment would address significant public health problems associated with opioid dependence, such as premature mortality, disruption of families, medical spending for hospitalization and emergency care, and legal costs (Mechanic, 2014; Paulozzi and Xi, 2008; Volkow et al., 2014).

1.2. The ACA and buprenorphine treatment

Health reform may have diverse impacts on SUD treatment because the US treatment system spans numerous settings, such as federally licensed opioid treatment programs (OTPs), non-OTP specialty SUD facilities, hospitals, federally qualified health centers, and physician offices. How states implement ACA, specifically Medicaid expansion and health insurance exchanges, may have implications for the supply of physicians who are waived to prescribe buprenorphine. Physician supply refers to the number of physicians in a geographic area, such as a state, that has been adjusted for population (Cooper, 2009).

ACA's impact on the supply of buprenorphine physicians can be assessed because of the regulatory system enacted under the US Drug Addiction Treatment Act (DATA) of 2000. Under DATA 2000, physicians who intend to treat opioid-dependent patients with buprenorphine must apply for a waiver to do so (Center for Substance Abuse Treatment, 2004; Ling and Smith, 2002; West et al., 2004). In their first year, physicians may only treat up to 30 patients at any given time. After the first year, physicians may submit additional documentation requesting to treat up to 100 patients concurrently (Substance Abuse and Mental Health Services Administration, 2009). The Controlled Substances Act (CSA) Active Registrants database delineates the physicians holding the buprenorphine waiver.

Four recent studies have examined buprenorphine physician supply, but none have measured the impact of ACA. Two studies examined correlations between state policies and county-level physician supply from 2008 to 2011 (Stein et al., 2015) and growth in the supply from 2002 to 2011 (Dick et al., 2015). A third study drew upon cross-sectional data from July 2012 and mapped physician supply in US counties by rural-urban status and region, finding greater supply on the East and West Coasts (Rosenblatt et al., 2015). Finally, a cross-sectional analysis of buprenorphine physician supply in December, 2013 found substantial regional variation as well as correlations with the supply of substance abuse treatment facilities, the percentage of the population covered by Medicaid, and the rate of opioid overdose deaths (Knudsen, 2015).

It is hypothesized that states that are more supportive of implementing ACA, as indicated by decisions to both expand Medicaid and to establish a state-based insurance exchange, will experience greater growth in buprenorphine-physician supply than less supportive states. By integrating state-level data from multiple sources, this study examines buprenorphine physician supply from June, 2013 to May, 2015.

2. METHODS

2.1. Study design

This observational study prospectively examined growth in the supply of waived physicians using US states as the unit of analysis. Information regarding waived physicians was purchased while other variables were drawn from published data.

2.2. Outcome variables

Three state-level outcomes were measured on a monthly basis using DEA's CSA Active Registrants database: total waived physician supply, 30-patient physician supply, and 100-patient physician supply. Total buprenorphine physician supply was defined as the number of waived civilian physicians per 100,000 residents. Civilian physicians holding the waiver were extracted and counted for all 50 states and the District of Columbia. For the monthly counts from June to December, 2013, each count was divided by the state's population as of July 1, 2013 (United States Census Bureau, 2015b) and multiplied by 100,000. A similar procedure was applied to counts from January, 2014 to May, 2015 using state population on July 1, 2014 as the denominator. Monthly variables also tracked the supplies of physicians holding the 30-patient and 100-patient waivers.

2.3. Independent variables

The primary independent variables were time (0=June, 2013 to 23=May, 2015) and a typology of ACA implementation. States were categorized into one of three mutually exclusive groups--ACA-supportive states, ACA-hybrid states, or ACA-resistant states—based on state decisions regarding Medicaid expansion and insurance exchanges as of May, 2013 (Henry J. Kaiser Family Foundation, 2013a, b). ACA-supportive states opted to both expand Medicaid and establish a state-based exchange. ACA-hybrid states expanded Medicaid or established a state-based exchange, but not both; nearly all hybrid states expanded Medicaid. ACA-resistant states declined the Medicaid expansion and declined to

establish a state-based exchange. These categories allowed for the testing of differential rates of growth using interaction terms (i.e., month-by-group).

2.4. Control variables

Time-invariant measures of state characteristics served as control variables. Region was measured using the US Census Bureau's (2015a) four categories of Northeast, Midwest, South, and West. Insurance coverage was measured by the percentage of the state population who were uninsured and the percentage covered by Medicaid. These measures represented averages for 2012–2013 that were published by the Henry J. Kaiser Family Foundation (2014). Treatment supply was measured by the number of OTPs offering methadone maintenance and the number of substance abuse treatment facilities per 100,000 residents in mid-2013 using the SAMHSA's Treatment Locator (Substance Abuse and Mental Health Services Administration, 2013). Three indicators addressed treatment demand as measured by the state's opioid problem: (1) rates of past-year opioid abuse or dependence (including heroin and prescription opioids) per 1,000 residents aged 12 and older, from National Survey on Drug Use and Health (NSDUH) data averaged from 2009–2012 (Jones et al., 2015); the summed rates of high-dose and extended-release opioid pain relievers prescribed per 100 residents in 2012 (Paulozzi et al., 2014); and (3) the rate of opioid overdose deaths per 100,000 residents in 2013. The overdose variable drew upon the Centers for Disease Control and Prevention's WONDER database (2015) using search parameters similar to Bachhuber and colleagues (2014); it included intentional and unintentional deaths (International Statistical Classification of Diseases, 10th revision [ICD-10], codes X40–X44, X60–X64, and Y10–Y14) where heroin or other opioids were coded (T40.0–T40.4). Finally, the supply of non-waivered civilian physicians per 100,000 residents was measured using the June 2013 CSA database.

2.5. Statistical Analysis

All analyses were conducted using *Stata 13.1* (StataCorp, College Station, TX). Descriptive statistics were calculated for state characteristics. Paired *t*-tests compared the initial and final values of buprenorphine physician supply preliminary tests of growth. State characteristics were compared across the ACA typology using Fisher's exact chi-square tests or one-way analysis of variance (ANOVA), depending on the level of measurement.

Analyses of waived physician supply were estimated using growth curve models (i.e., mixed effects regression), which are appropriate for analyzing panel longitudinal data and have several key advantages (Rabe-Hesketh and Skrondal, 2012). First, growth curve models allow for the estimation of within-subject change (in this case, states) over time, with each state having its own growth curve. It allows for consideration of the associations between state-level variables and the intercept (i.e., starting point of the trajectory). Most importantly, these models allow for interactions to ascertain whether the rate of growth differs between the three groups in the typology of ACA implementation. Mixed effects regression was implemented by the “mixed” command (StataCorp, 2013) with an unstructured covariance matrix using maximum likelihood estimation.

3. RESULTS

In June, 2013, the average state had 7.7 waived physicians per 100,000 residents, which significantly increased to 9.2 in May, 2015, an increase of 19.5% (Table 1). The average supplies of physicians holding the 30-patient and 100-patient waivers also significantly increased. State characteristics are presented in Table 2.

Average total waived supply by the ACA typology across the 24-month period is presented in Figure 1. ACA-supportive states had more waived physicians than ACA-hybrid states (with Bonferroni correction, $p=.016$ at baseline, $p=.013$ at 24 months; see Table 3) and ACA-resistant states ($p=.005$ at baseline, $p=.003$ at 24 months). Similar differences were observed for 30-patient physician supply.

State characteristics were examined by the typology of ACA implementation (Table 3). Region was associated with the ACA typology. The ACA-supportive category was largely comprised of Western and Northeastern states. Southern states were most prevalent in the ACA-resistant category, while Midwestern states were the most prevalent in the ACA-hybrid category. ACA-supportive states had more OTPs than ACA-resistant states (with Bonferroni correction, $p=.009$); the remaining pairwise comparisons were not significant.

The three mixed effects regression models appear in Table 4. As seen in Column 1, the positive coefficient for month indicated significant growth in total buprenorphine physician supply over the study period for ACA-supportive states. The two interaction terms were statistically significant and negative in direction, indicating that both ACA-hybrid states and ACA-resistant states experienced a significantly lower rate of growth when compared to ACA-supportive states. The main coefficients for the ACA typology represent associations between these variables and the intercept (i.e., starting point in the growth curve) after accounting for the other state characteristics. The differences in the intercepts by the ACA typology were not statistically significant in this multivariate model. This model was re-estimated with ACA-resistant states as the reference group to allow for the comparison of ACA-hybrid and ACA-resistant states (not shown); differences in the intercepts and rates of growth for these two groups were not statistically significant.

The remaining coefficients represent associations between the control variables and the intercept (i.e., baseline) for total waived physician supply. There were significant differences based on region, with states in the Midwest, South, and West having significantly smaller supplies at baseline than states in the Northeast. While the percentage of uninsured individuals was not significant, the percentage of state residents covered by Medicaid was positively associated with total waived physician supply. Both measures of treatment supply were positively correlated with waived physician supply. Measures of treatment demand and the supply of non-waivered physicians were not significant.

The second and third columns of Table 4 present models of the supplies of 100-patient and 30-patient physicians, respectively. Significant positive growth in both outcomes occurred over the study period in ACA-supportive states. Consistent with Model 1, the intercepts for these two outcomes were not correlated with the ACA typology. The interaction terms revealed a key distinction. Growth in physicians waived to treat 100 patients in ACA-

resistant and ACA-hybrid states were not different from the growth rate in ACA-supportive states. For 30-patient physician supply, both ACA-hybrid and ACA-resistant states experienced slower rates of growth than ACA-supportive states.

There were some differences in the associations between the other state characteristics and the intercepts (i.e., baseline levels) for 100-patient waiver supply and 30-patient waiver supply (Table 4, Columns 2 and 3). While all three regions had lower supplies of physicians holding the 100-patient waiver than the Northeast region at baseline, the difference for states in the West versus Northeast was not significant for 30-patient physician supply. The fatal opioid overdose rate was positively associated with the intercept for 100-patient supply, but was not significantly associated with 30-patient supply. The associations between the remaining state characteristics and the intercepts for these two outcomes mirrored the model of total waived physician supply.

4. DISCUSSION

This prospective observational study of US states found that rates of growth in the supply of buprenorphine-waivered physicians differed by state-level approaches to implementing the Affordable Care Act (ACA). Compared to states that made an early commitment to both expand Medicaid and establish a state-based insurance exchange, states declining both of these actions and states that only embraced one of these actions experienced significantly slower rates of growth in their total supply of waived physicians.

Separate models for the supplies of 30-patient versus 100-patient waived physicians revealed these differential rates of growth were limited to the supply of 30-patient physicians. It may take longer for a difference in 100-patient waivers to be observed, given that physicians must have been treating patients for at least a year and must certify a need for treating more patients to obtain it. The study team will monitor the monthly supply of waived physicians for the next three years, allowing for an extended examination of whether ACA implementation continues to have differential impact on the supplies of physicians holding the two types of waivers. The supply of 100-patient physicians is particularly critical in terms of expanding access to treatment for patients. A recent analysis showed that the supply of 100-patient physicians is positively correlated with state-level measures of the actual grams of buprenorphine prescribed (Stein et al., in press). It is not clear how many 100-patient physicians are needed to address the ongoing public health crisis related to untreated opioid dependence. This is an area worthy of future research. Nonetheless, the entry of more physicians through the 30-patient waiver is an important first step to increasing treatment access.

The differential growth between ACA-supportive and ACA-hybrid states in total supply and 30-patient supply points to the importance of both state-based exchanges and the Medicaid expansion. Nearly all ACA-hybrid states expanded Medicaid, and Medicaid expansion has significantly reduced the uninsured rate (Sommers et al., 2015a). Why might a state-based exchange matter above and beyond the Medicaid expansion? While state-based exchanges and the federal exchange all offer mechanisms for purchasing insurance, states establishing their own exchanges were required to meet several provisions, including plans for marketing

and outreach to consumers as well as plans for funding the exchanges in the future (Krinn et al., 2015).

These provisions may be important mechanisms for key outcomes, such as insurance enrollment. In a survey conducted in late 2014 among low-income adults in Kentucky (ACA-supportive in our study), Arkansas (ACA-hybrid), and Texas (ACA-resistant), enrollment in health insurance through Medicaid or an exchange was examined (Sommers et al., 2015b). Enrollment was significantly greater for Kentucky respondents relative to Texas, but there was no difference between Texas and Arkansas. In supplemental analyses (available by request), we applied our ACA typology to state-level data, collated by Scott (2014), on newly enrolled individuals in Medicaid and private insurance during ACA's first open enrollment period. ACA-supportive states had significantly more newly enrolled individuals in Medicaid per 100,000 residents, a greater percentage of the estimated eligible population newly enrolled in Medicaid, and a greater percentage of the estimated eligible population newly enrolled in private insurance than ACA-hybrid states and ACA-resistant states. There were no differences between ACA-hybrid states and ACA-resistant states. Taken together, these analyses provide some evidence that combining Medicaid expansion with a state-based exchange may have different impacts than Medicaid expansion alone. An important direction for future research is whether differences in insurance enrollment serve as mediators that explain the observed differences in growth of buprenorphine physician supply by the ACA typology. Another important consideration is whether states' pre-ACA income eligibility thresholds moderate ACA's impact, such that states where the Medicaid eligibility thresholds were more stringent may see a greater impact.

The positive correlation between Medicaid coverage and buprenorphine physician supply at baseline is consistent with prior work (Knudsen, 2015; Stein et al., 2015). This association may seem paradoxical given Medicaid's association with poverty. However, higher rates of Medicaid coverage actually reflect greater state investments in population health; states have historically had discretion over inclusion of childless adults in their Medicaid programs. Furthermore, all state Medicaid programs provide at least some coverage for buprenorphine (Rinaldo and Rinaldo, 2013). For these reasons, greater Medicaid coverage may represent an economic resource that can support a greater supply of waived physicians. Although the uninsured rate was not correlated with baseline physician supply, this null finding may reflect its collinearity with Medicaid coverage (i.e., if Medicaid coverage is higher, the uninsured rate is lower). Future research should examine whether greater growth in the percentage of residents covered by Medicaid, particularly in expansion states, is positively correlated with growth in buprenorphine physician supply.

The supply of specialty SUD treatment and OTPs were positively associated with all three outcomes at baseline. Several interpretations are possible. First, it may be that the greater supply of specialty treatment is indicative of a more resource-rich environment where state and county governments have invested more financial resources into the treatment system, which may extend to buprenorphine treatment. Greater treatment supply may also occur in states with leadership who understand that opioid dependence is a complicated chronic relapsing medical disorder (rather than a moral flaw), and that highly effective medication-assisted treatments decrease morbidity and mortality when made available (McLellan et al.,

2000). It may be that physicians are more likely to obtain the waiver when they know there are other physicians with experience treating opioid dependence from whom they can seek advice or expert consultation. More physicians may seek the waiver when there are more treatment programs available to deliver more intensive counseling or to which they can refer patients who need the greater structure that is typical of OTPs.

The rate of fatal overdoses was only associated with the baseline supply of physicians waived to treat 100 patients, while the other opioid measures of treatment demand were not significant. It may be that the overdose rate is the very public face of the opioid epidemic, as evidenced by the significant amount of mass media coverage devoted to it. This visibility may prompt physicians to respond to this public health crisis. In contrast, data on the state-level prevalence of opioid use disorders has not been widely disseminated. While the NSDUH has asked about heroin use and non-medical prescription opioid use for years, its reports of prevalence of drug abuse have not included those statistics; it was only with the recent publication by Jones and colleagues (2015) that our team was able to integrate such a measure into our analysis. Furthermore, while these data and our measure of high-dose/extended-release opioid prescriptions were collected in years preceding our baseline measure of waived physician supply, both publications appeared in print after our baseline; this may partly explain the null findings.

4.1 Limitations

A number of limitations must be noted. First, this is an observational study that cannot establish causality. Second, it was conducted over a limited time period. It is unknown whether the time-by-ACA typology interactions will persist over time. Third, there are inherent challenges in drawing on secondary data regarding state characteristics, including lags in measures being published and differential timing of measurement. Few state characteristics are published on a monthly basis, so we lack independent variables that are measured in parallel with the supply of waived physicians. In particular, the time lag from the publication of state-level measures of opioid problem severity from federal data, (e.g., National Survey on Drug Use and Health), poses an analytical challenge for researchers as well as policymakers who seek to use current data to inform policy decisions. Fourth, it is unknown whether these findings about ACA would generalize to other medications that can be prescribed in office settings (e.g., oral or extended release naltrexone).

An additional limitation that warrants further discussion is the significance of the measure of waived physician supply. Although the waiver is a necessary condition for offering buprenorphine, many waived physicians are not actually treating any patients (Arfken et al., 2010). The present study cannot speak to whether these states' actions are increasing the number of patients receiving buprenorphine or shifting how patients pay for treatment. Historically, many patients have paid for SUD treatment out-of-pocket, likely due to complex issues of stigma and varying coverage for SUD treatment services within insurance plans. The study team is fielding a national survey of buprenorphine-waivered prescribers that will examine whether state-level ACA implementation is associated with physicians' reports of the size of their buprenorphine caseloads and how patients pay for treatment.

A final caveat is that these findings reflect the unique context of the US health care system and regulation of buprenorphine. Other countries have approached buprenorphine differently. In France and England, any physician may prescribe buprenorphine to treat patients with opioid dependence (Auriacombe et al., 2004; Fatseas and Auriacombe, 2007; Strang et al., 2007). Other countries, such as Italy, have concentrated their efforts toward diffusing buprenorphine through the specialty treatment sector (Carrieri et al., 2006), while others, such as Australia, have strongly supported the role of community pharmacists in delivering buprenorphine treatment (Nielsen et al., 2007).

Even the US approach may evolve. Introduced in May 2015, Senate bill 1455 and House resolution 2536, the “Recovery Enhancement for Addiction Treatment,” or TREAT Act, would increase the first year limit to 100 patients and allow unlimited patients after the first year. Furthermore, it would allow physician assistants and nurse practitioners meeting specific training or licensure requirements to prescribe buprenorphine. It is uncertain whether the TREAT Act will become law, but it would further modify the treatment landscape. Importantly, legislation at the state-level also may impact buprenorphine treatment provider supply. For instance, Kentucky recently passed several pieces of legislation around buprenorphine treatment that may limit physician supply and discourage future growth (Hinkle, 2015).

4.2. Conclusions

As health services researchers grapple with the multiple complex effects of the Affordable Care Act, this study documented an impact of ACA on the total supply of physicians waived to prescribe buprenorphine. States that were more supportive of ACA, as evidenced by expanding Medicaid and establishing a state-based insurance exchange, experienced greater growth in total buprenorphine physician supply. However, many research questions remain in terms of ACA's impacts on the number of patients receiving buprenorphine, Medicaid spending on buprenorphine, and treatment quality.

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Highlights

The impact of the Affordable Care Act (ACA) on the supply of buprenorphine-waivered physicians was examined.

There was significant growth in physician supply from June, 2013 to May, 2015.

States that were more supportive of ACA experienced greater growth in waived physicians.

Less growth was observed in states that were less supportive of ACA.

Figure 1.
Average total buprenorphine-waivered physician supply by ACA typology, June 2013 to May 2015

Table 1

Change in the supply of waived physicians per 100,000 residents, June 2013 and May 2015

	June 2013 Mean (SD)	May 2015 Mean (SD)	<i>t</i>
Total waived physician supply	7.7 (5.0)	9.2 (6.0)	<i>t</i> =−9.057, df=50, <i>p</i> <.001
100-patient waived physician supply	2.2 (1.5)	3.1 (2.1)	<i>t</i> =−9.023, df=50, <i>p</i> <.001
30-patient waived physician supply	5.4 (3.7)	6.1 (4.2)	<i>t</i> =−6.663, df=50, <i>p</i> <.001

Table 2

Descriptive statistics of state characteristics (N=51)

	Mean (SD) or % (N)
Typology of Affordable Care Act implementation	
ACA-supportive states	31.4% (16)
ACA-hybrid states	21.6% (11)
ACA-resistant states	47.1% (24)
Region	
Northeastern states	17.7% (9)
Midwestern states	23.5% (12)
Southern states	35.3% (18)
Western states	23.5% (12)
% Uninsured residents	14.2 (4.1)
% Medicaid-insured residents	16.0 (3.8)
Number of opioid treatment programs per 100,000 residents	0.4 (0.3)
Number of substance abuse treatment facilities per 100,000 residents	4.7 (2.3)
Number of individuals, aged 12 or older, with past-year opioid abuse or dependence, per 1,000 residents	8.5 (2.8)
High-dose and extended-release opioid prescriptions per 100 residents	16.5 (5.2)
Opioid-related overdose deaths per 100,000 residents	8.6 (4.5)
Overall non-waivered physician supply per 100,000 residents	206.5 (57.4)

Table 3

State characteristics by typology of Affordable Care Act (ACA) implementation

	ACA-supportive states, Mean (SD) or % (N)	ACA-hybrid states, Mean (SD) or % (N)	ACA-resistant states, Mean (SD) or % (N)	F or χ^2
Total waived physician supply, June 2013	11.0 (5.8)	5.9 (3.1)	6.2 (4.0)	$F_{2,48}=6.60, p=.003$
Total waived physician supply, May 2015	13.4 (7.0)	7.2 (3.8)	7.3 (4.6)	$F_{2,48}=7.72, p=.002$
100-patient waived physician supply, June 2013	2.9 (1.6)	1.9 (1.3)	1.9 (1.4)	$F_{2,48}=2.24, p=.12$
100-patient waived physician supply, May 2015	3.9 (2.4)	2.7 (1.9)	2.7 (1.9)	$F_{2,48}=1.79, p=.18$
30-patient waived physician supply, June 2013	8.2 (4.4)	4.0 (2.0)	4.3 (2.7)	$F_{2,48}=8.37, p=.001$
30-patient waived physician supply, May 2015	9.5 (5.0)	4.5 (2.1)	4.6 (2.9)	$F_{2,48}=10.51, p<.001$
Region				$\chi^2=13.86, df=50, p=.036$
Northeastern states	31.3% (5)	9.1% (1)	12.5% (3)	
Midwestern states	6.3% (1)	45.5% (5)	25.0% (6)	
Southern states	18.8% (3)	27.3% (3)	50.0% (12)	
Western states	43.8% (7)	18.2% (2)	12.5% (3)	
% Uninsured residents	12.7 (5.2)	13.8 (2.9)	15.4 (3.5)	$F_{2,48}=2.23, p=.12$
% Medicaid-insured residents	17.7 (4.5)	15.7 (2.9)	15.0 (3.4)	$F_{2,48}=2.63, p=.08$
Number of opioid treatment programs per 100,000 residents	0.5 (0.3)	0.3 (0.2)	0.3 (0.2)	$F_{2,48}=5.24, p=.01$
Number of substance use disorder treatment facilities per 100,000 residents	5.2 (1.5)	4.3 (1.5)	4.5 (3.0)	$F_{2,48}=0.70, p=.50$
Number of individuals, aged 12 or older, with past-year opioid abuse or dependence, per 1,000 residents	8.8 (3.0)	9.1 (3.2)	8.1 (2.4)	$F_{2,48}=0.65, p=.53$
High-dose and extended-release opioid prescriptions per 100 residents	17.5 (4.0)	16.0 (6.4)	16.1 (5.4)	$F_{2,48}=0.38, p=.68$
Opioid-related overdose deaths per 100,000 residents	10.0 (3.7)	9.2 (6.9)	7.3 (3.4)	$F_{2,48}=1.96, p=.15$
Overall non-waivered physician supply per 100,000 residents	233.2 (80.0)	197.3 (37.9)	192.9 (40.5)	$F_{2,48}=2.73, p=.08$

Notes. Overall tests of significance based on chi-square tests (with Fisher's exact test) or one-way analysis of variance tests depending on the level of measurement.

Table 4

Growth curve model estimates of supply of buprenorphine waived physicians on time, ACA implementation, and other state characteristics: Total supply, 100-patient waiver supply, and 30-patient waiver supply

	Model 1: Total Supply Coefficient (95% CI)	Model 2: 100-Patient Supply Coefficient (95% CI)	Model 3: 30-Patient Supply Coefficient (95% CI)
Month (i.e., growth in ACA-supportive states)	.101 *** (.080, .123)	.044 *** (.030, .058)	.057 *** (.045, .070)
Month by ACA-hybrid states interaction (i.e., difference in growth relative to ACA-supportive states)	-.046 ** (-.080, -.013)	-.009 (-.031, .014)	-.037 *** (-.056, -.018)
Month by ACA-resistant states interaction (i.e., difference in growth relative to ACA-supportive states)	-.054 *** (-.082, -.026)	-.009 (-.028, .010)	-.045 *** (-.061, -.029)
Typology of Affordable Care Act implementation			
ACA-supportive states	Reference	Reference	Reference
ACA-hybrid states	-1.409 (-3.328, .510)	-.123 (-.738, .493)	-1.067 (-2.542, .408)
ACA-resistant states	-.866 (-2.664, .933)	-.027 (-.591, .537)	-.504 (-1.924, .916)
Region			
Northeast	Reference	Reference	Reference
Midwest	-3.978 ** (-6.268, -1.688)	-1.556 *** (-2.216, -.895)	-2.799 ** (-4.763, -.0836)
South	-3.768 *** (-5.715, -1.820)	-1.068 *** (-1.629, -.506)	-2.873 ** (-4.543, -1.204)
West	-2.790 * (-5.131, -.449)	-1.252 *** (-1.927, -.577)	-1.815 (-3.823, .192)
% Uninsured residents	.115 (-.096, .326)	-.034 (-.095, .027)	.118 (-.063, .299)
% Medicaid-insured residents	.344 *** (.189, .500)	.064 ** (.019, .109)	.301 *** (.167, .434)
Number of opioid treatment programs per 100,000 residents	6.385 *** (3.266, 9.504)	.919 * (.020, 1.818)	5.406 *** (2.731, 8.080)
Number of substance use disorder treatment facilities per 100,000 residents	.382 ** (.122, .642)	.083 * (.009, .158)	.320 ** (.097, .543)
Number of individuals, aged 12 or older, with past-year opioid abuse or dependence, per 1,000 residents	-.105 (-.376, .165)	.024 (-.054, .102)	-.096 (-.328, .136)
High-dose and extended-release opioid prescriptions per 100 residents	-.044 (-.201, .112)	-.006 (-.051, .039)	-.033 (-.167, .102)
Opioid-related overdose deaths per 100,000 residents	.135 (-.012, .281)	.057 ** (.015, .099)	.116 (-.010, .241)
Overall non-waivered physician supply per 100,000 residents	.005 (-.008, .017)	-.001 (-.004, .003)	.006 (-.005, .017)
Constant	-.540 (-6.893, 5.812)	1.550 (-.289, 3.390)	-2.870 (-8.297, 2.558)
Random-Effects Parameters			
State: Unstructured			
Variance(Month)	.002 (.001, .003)	.0009 (.0006, .0013)	.0006 (.0004, .0009)
Variance(_cons)	4.766 (2.910, 7.808)	.519 (.300, .896)	2.600 (1.742, 3.882)
Covariance(month, _cons)	.053 (.013, .093)	.015 (.005, .023)	.011 (-.003, .024)
Variance(Residual)	.021 (.020, .023)	.006 (.006, .007)	.021 (.019, .022)

	Model 1: Total Supply Coefficient (95% CI)	Model 2: 100-Patient Supply Coefficient (95% CI)	Model 3: 30-Patient Supply Coefficient (95% CI)
Log likelihood	289.557	1050.678	345.889

Notes.

Coefficients for month represent the average monthly growth in waived physicians in ACA-supportive states, the month-by-ACA typology interactions represent tests of whether the rate of monthly growth in ACA-hybrid and ACA-resistant states differed from ACA-supportive states, and all other coefficients represent associations between the control variables and the intercepts (i.e., baseline waived physician supply).

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$ (two-tailed tests).