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Buprenorphine physician supply: Relationship with state-level prescription opioid mortality

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ABSTRACT

Background: Buprenorphine is an effective treatment for opioid use disorder but the supply of buprenorphine physicians is currently inadequate to address the nation's prescription opioid crisis. Perception of need due to rising opioid overdose rates is one possible reason for physicians to adopt buprenorphine. This study examined associations between rates of growth in buprenorphine physicians and prescription opioid overdose mortality rates in US states.

Methods: The total buprenorphine physician supply and number of physicians approved to treat 100 patients (per 100,000 population) were measured from June 2013 to January 2016. States were divided into two groups: those with rates of prescription opioid overdose mortality in 2013 at or above the median (>5.5 deaths per 100,000 population) and those with rates below the median. State-level growth curves were estimated using mixed-effects regression to compare rates of growth between high and low overdose states.

Results: The total supply and the supply of 100-patient buprenorphine physicians grew significantly (total supply from 7.7 to 9.9 per 100,000 population, $p < 0.001$; 100-patient supply from 2.2 to 3.4 per 100,000 population, $p < 0.001$). Rates of growth were significantly greater in high overdose states when compared to low overdose states (total supply $b = 0.033$, $p < 0.01$; 100-patient $b = 0.022$, $p < 0.01$).

Conclusions: The magnitude of the US prescription opioid crisis, as measured by the rate of prescription opioid overdose mortality, is associated with growth in the number of buprenorphine physicians. Because this observational design cannot establish causality, further research is needed to elucidate the factors influencing physicians' decisions to begin prescribing buprenorphine.

1. Introduction

The United States is now in the second decade of a prescription opioid epidemic (Compton et al., 2015; Compton and Volkow, 2006) that has seen a rapid escalation of non-medical use (Han et al., 2015) and prescription opioid use disorder rates that are second only to marijuana in the most recent National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2015). Opioid use disorder has well-documented negative consequences including premature mortality and family disruption, as well as acquisition and transmission of HIV and hepatitis C (Mechanic, 2014; Paulozzi and Xi, 2008; Volkow et al., 2014). Moreover, in recent years, many of those abusing prescription opioids have transitioned to using heroin (Cerda et al., 2015; Jones, 2013), underscoring the potential negative outcomes associated with abusing prescription opioids. Perhaps the most alarming trend is that of prescription opioid-associated fatal overdoses. The cur-

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rent opioid abuse epidemic has given rise to significantly greater numbers of prescription-opioid associated fatal overdoses nationwide (Jones et al., 2013; Paulozzi et al., 2014; Rudd et al., 2016).

Concurrent with the dramatic rise in prescription opioid use disorder and subsequent fatal overdose rates has been the emergence and expansion of buprenorphine as a treatment option. Buprenorphine is an effective treatment (Fiellin et al., 2008; Fudula et al., 2003), although methadone may be more effective than buprenorphine in retaining individuals in treatment (Mattick et al., 2014). There has been a steady increase in buprenorphine's diffusion, particularly in office-based practice (Altice et al., 2011; Dick et al., 2015; Stein et al., 2015b). Buprenorphine is primarily delivered in physicians' offices, which is notable because of the historical segregation of substance use disorder (SUD) treatment to organizations outside of mainstream medicine (McLellan and Woodsworth, 2014; Roman et al., 2011).

The regulatory system enacted under the US Drug Addiction Treatment Act (DATA) of 2000 requires physicians who intend to prescribe Schedule III controlled substances to treat opioid dependence to submit a notification of intent to the Substance Abuse and Mental Health Services Administration (SAMSHA); currently, buprenorphine is the only medication that is included under this designation (Center for Substance Abuse Treatment, 2004). As of spring 2016, physicians initially can only treat up to 30 patients concurrently in their first year. In subsequent years, physicians can expand their treatment capacity up to 100 patients at any given time, but to do so, they must submit a second notification of intent. Information about whether physicians can treat up to 30 patients at any given time or up to 100 patients is maintained in the Controlled Substances Act (CSA) Active Registrants database.

This aspect of buprenorphine's regulation allows for measurement of buprenorphine physician supply, which is a population-adjusted measure of the number of physicians in a given geographic area (Cooper, 2009). The current study defines total buprenorphine physician supply as the number of physicians who hold the buprenorphine waiver per 100,000 residents within a state, and we also measure the number of physicians who can treat up to 100 patients. Conceptually, growth in the total physician supply is largely driven by physicians initially seeking the buprenorphine waiver, and therefore, may reflect physicians who are responding to the scope of the opioid epidemic. Submitting a notification to treat up to 100 patients, because it can only occur after at least one year of treating patients, suggests that physicians are directly experiencing sufficient demand for treatment to warrant this larger capacity.

Five recent studies have examined buprenorphine physician supply, but none have measured the extent to which growth in supply is associated with the prescription opioid crisis within states. Prior studies have examined the relationships between state policies and the supply of buprenorphine physicians within counties (Stein et al., 2015a) as well as the rates of growth in buprenorphine physician supply from 2002 to 2011 (Dick et al., 2015). Another study of US counties found greater supplies in counties on the East and West coasts and differences between rural and urban counties (Rosenblatt et al., 2015). A cross-sectional analysis of states also reported significant regional variation as well as correlations between buprenorphine physician supply and the availability of other SUD treatment, the percentage of residents insured by Medicaid, and the rate of overdose mortality from heroin and other opioids (Knudsen, 2015).

The present study builds upon our prior work, which examined buprenorphine physician supply over a 24-month period and its associations with states' implementation of the Affordable Care Act (Knudsen et al., 2015). We integrated information about states' decisions regarding the expansion of Medicaid and the building of state-based health insurance exchanges (Blumenthal and Collins, 2014; Buttorff et al., 2015; Gluck, 2014). Compared to states that both expanded Medicaid and established a state-based health insurance exchange, growth in the total buprenorphine physician supply was significantly lower in states that had only adopted one of these elements of ACA and lower in states that adopted neither of these elements. These differences in growth were confined to 30-patient and total physician supply; there were not significant differences in the supply of the more experienced 100-patient physicians by ACA implementation.

This paper extends our work by considering two additional state characteristics while controlling for this ACA typology. The magnitude of the prescription opioid crisis within states has not been tested for its potential impact on the rates of growth in buprenorphine physicians. Prior work has identified that the rate of overdose mortality from heroin and prescription opioids combined is positively correlated with the average number of 100-patient physicians (Knudsen et al., 2015), but the association with prescription opioid mortality alone has not been examined.

Conceptually, the extent of a state's prescription opioid crisis may represent an important element of the outer context, or environment, in which physicians' decisions about pursuing the buprenorphine waiver are made. Major theories of innovation implementation suggest the outer context can affect decisions to adopt and implement a novel intervention (Aarons et al., 2011; Damschroder et al., 2009; Damschroder and Hagedorn, 2011; Fixsen et al., 2005). As noted by Rogers (2003) in his classic work, *Diffusion of Innovations*, innovations are more likely to spread when there is a perceived need for change. Media attention and public awareness regarding the prescription opioid crisis has increased over time (Barry et al., 2016; McGinty et al., 2016), which may increase the perceived need for solutions among physicians in states with greater rates of overdose mortality. These implementation frameworks offer one rationale for why the rates of growth in buprenorphine physicians may be greater in states with high rates of prescription opioid overdose mortality.

Region of the country has been examined in cross-sectional analyses of buprenorphine physician supply and controlled in growth models for its relationship with the intercept (i.e., states' baseline levels), but region has not been tested for its impact on growth rates (Knudsen, 2015; Knudsen et al., 2015). Large mean differences have been documented between the Northeast and the South, Midwest, and West. From a public health perspective, it is important to consider whether the Northeast is also advantaged in its rate of growth in buprenorphine physicians because that would widen the gap between the Northeast and other regions over time.

It is hypothesized that states with a more pronounced prescription opioid problem, as measured by the rate of prescription opioid-related overdose mortality, have experienced greater growth in buprenorphine physician supply than states with a less pronounced prescription opioid problem. We also hypothesize that states outside the Northeast will have significantly lower rates of growth than Northeastern states. This study tests these hypotheses by examining data on buprenorphine physician supply from June 2013 to January 2016.

2. Methods

2.1. Study design

Growth in the supply of buprenorphine physicians at the state-level was measured using an observational design that integrated data from several sources. The study team purchased a database to extract information about buprenorphine physicians and collated other state characteristics from publicly available data sources.