Impact of State Laws Restricting Opioid Duration on Characteristics of New Opioid Prescriptions

Chintan V. Dave, PharmD, PhD[1], Elisabetta Patorno, MD, DrPH[1], Jessica M. Franklin, PhD[1], Krista Huybrechts, PhD[1], Ameet Sarpatwari, JD, PhD[2], Aaron S. Kesselheim, MD, JD[2], and Brian T. Bateman, MD, MSc[1]

[1]Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA; [2]Program On Regulation, Therapeutics, And Law (PORTAL), Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine, Brigham and Women's Hospital, Boston, MA, USA.

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With opioid-related overdose deaths in the USA reaching 50,000 in 2017,[1] federal and state governments have struggled to respond to this growing crisis. Because nearly half of these deaths involve a prescription opioid, there is growing interest in limiting the amount of opioid dispensed to opioid-naïve patients.[2] In March 2016, Massachusetts (MA) became the first state to restrict opioid duration for opioid-naïve patients to seven days, citing Centers for Disease Control and Prevention guidelines.[3] Connecticut (CT) and New-York (NY) implemented similar legislation later that year. Currently, 33 states either have implemented or are in the process of implementation similar legislation. The objective of this study was to assess the impact of these laws—in the three states that implemented them in 2016—on the characteristics of new opioid prescriptions.

METHODS

The study utilized de-identified Optum© Clinformatics® Datamart (January 2014–September 2017), a commercial claims database. The cohort was comprised of non-cancer patients ≥ 18 years initiating an opioid (six-month washout) for common acute conditions (diagnosis recorded seven days prior to an opioid fill for either back pain, back pain with radiculopathy, mild-to-moderate musculoskeletal injury [e.g., sprained ligaments], severe musculoskeletal injury [e.g., tendon rupture], tendinitis/bursitis, or urinary calculus). The reported days' supply, number of tablets, and strength were utilized to estimate the prescribed duration and total opioid dose (in milligrams of morphine equivalents [MED]).

Patient-level segmented regressions modeled the probability of initiating a > seven-day opioid prescription, opioid duration, and MED, and included terms for baseline trend across annual quarters, change in level and trend following implementation of the law while adjusting for age (terciles), and acute conditions; results were pooled for the three states for the primary analysis but were also individually reported. We also examined the characteristics of opioid prescriptions in control states that had not implemented similar legislation. All analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

In the pooled analysis, implementation of the law was associated with a decreased probability of initiating a > seven-day opioid prescription, 0.85 (95% CI, 0.79, 0.93) and a lower opioid duration of − 0.46 days (95% CI − 0.74, − 0.21) without a significant corresponding immediate reduction in MED (− 5.25, 95% CI − 15.10, 4.59; Table 1). Rather, the MED decreased modestly in the subsequent quarters following implementation (− 3.55 MED per quarter, 95% CI − 6.06, − 1.07).

The study found between-state heterogeneity in response to these laws. While MA ($n = 7995$) and CT

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Table 1 Regression Analysis

State[a]	Time trend[b]	Change in level[c]	Change in trend[d]
Relative risk of a > seven-day prescription			
Pooled	–	0.85 (0.79, 0.93)	0.97 (0.95, 0.99)
Connecticut	0.98 (0.97, 1.00)	0.86 (0.72, 1.04)	0.99 (0.93, 1.05)
Massachusetts	1.00 (0.97, 1.02)	0.73 (0.60, 0.90)	0.96 (0.92, 1.02)
New York	1.00 (1.00, 1.01)	0.89 (0.82, 0.96)	0.96 (0.94, 0.99)
Control states[e]	1.00 (1.00, 1.01)	1.02 (1.00, 1.04)	0.98 (0.97, 0.98)
Change in opioid duration (in days)			
Pooled	–	− 0.46 (− 0.74, − 0.21)	− 0.05 (− 0.08, 0.05)
Connecticut	− 0.07 (− 0.13, − 0.03)	− 0.48 (− 0.95, − 0.02)	0.15 (0.00, 0.28)
Massachusetts	0.05 (− 0.01, 0.12)	− 0.73 (− 1.17, − 0.28)	− 0.11 (− 0.21, − 0.02)
New York	0.01 (− 0.02, 0.04)	− 0.07 (− 0.46, 0.36)	− 0.11 (− 0.23, − 0.00)
Control states[e]	0.03 (0.02, 0.04)	− 0.03 (− 0.09, 0.03)	− 0.06 (− 0.07, − 0.05)
Change in opioid dose (in morphine equivalents)			
Pooled	–	− 5.25 (− 15.10, 4.59)	− 3.55 (− 6.06, − 1.07)
Connecticut	− 0.77 (− 3.16, 1.48)	− 10.03 (− 27.06, 6.84)	− 4.48 (− 9.57, − 0.12)
Massachusetts	− 1.74 (− 3.83, 0.31)	5.09 (− 11.65, 23.62)	− 2.96 (− 6.56, 0.73)
New York	0.54 (− 0.72, 1.90)	− 6.20 (− 20.69, 6.62)	− 4.47 (− 8.70, − 0.39)
Control states[e]	1.07 (0.81, 1.31)	2.18 (0.01, 4.51)	− 4.18 (− 4.71, − 3.69)

[a]*MA (Mar 2016), CT (Jul 2016), and NY (Jul 2016) implemented seven-day restrictions to new opioid prescriptions. Poisson (for relative-risks), inverse Gaussian, and Gamma distributions were used to model the relative risk of initiating a > seven-day opioid prescription, opioid duration, and MED respectively. For the models, patient-level segmented regressions were fit by pooling the data from the three states, and individually within each state adjusting for age and acute conditions. 95% confidence intervals were estimated using 1000 bootstrap samples to account for autocorrelation. States were assigned equal weights so that data from larger states (e.g., NY) did not disproportionally contribute to the analysis*

[b]*Defined as the baseline trend in probability of > seven-day prescriptions, prescription duration, or dose. In the pooled analysis, variable relating to secular time trend was interacted with state variable to account for between-state heterogeneity*

[c]*Defined as the instantaneous change in probability of > seven-day prescriptions, prescription duration, or dose in the quarter when the opioid restriction was implemented*

[d]*Defined as the per-quarter change in the trend of probability of > seven-day prescriptions, prescription duration, or dose after the implementation of opioid restrictions*

[e]*Includes all US states except MA, CT, and NY which implemented a law restricting opioid duration in 2016, and DE, VT, AL, IN, NJ, RI, and ME which passed similar legislation afterwards. To evaluate whether similar changes were occurring in control states that did not have legislation introduced, we utilized Q2 2016 as an inflection time point for these states*

($n = 8301$) saw an immediate decline in opioid duration (Table 1; Fig. 1), NY ($n = 28{,}507$) did not experience an immediate reduction until subsequent quarters after implementation. The immediate impact on MED was not apparent in any of the three states, with the study finding a modest per-quarter MED reduction in the quarters following implementation; however, these rates of per-quarter MED reductions were similar to those in the control states.

DISCUSSION

Despite the similarities of the laws restricting opioid duration, their effectiveness varied between states, with the study finding an immediate reduction in the proportion of > seven-day opioid prescriptions, and a modest decline in opioid duration in CT and MA but not in NY. However, the impact of these laws on MED was unclear since these reductions were in line with the trends seen in states where the intervention was not implemented.

The between-state response might be reflective of the geographical heterogeneity in opioid-prescribing practices,[4] and the severity of the opioid crisis itself. For example, in 2016, when these laws were implemented, MA and CT were ranked fifth and ninth in per-capita opioid overdose deaths compared with NY which was ranked twenty-third.[5]

The study is subject to certain limitations. It was conducted in a commercial claims population and did not assess the impact of these laws on patient's pain control. Nevertheless, the laws appear to have a modest impact in reducing the duration and MED of first-opioid prescriptions; the clinical implications of this impact on future rates of opioid abuse warrant further research.

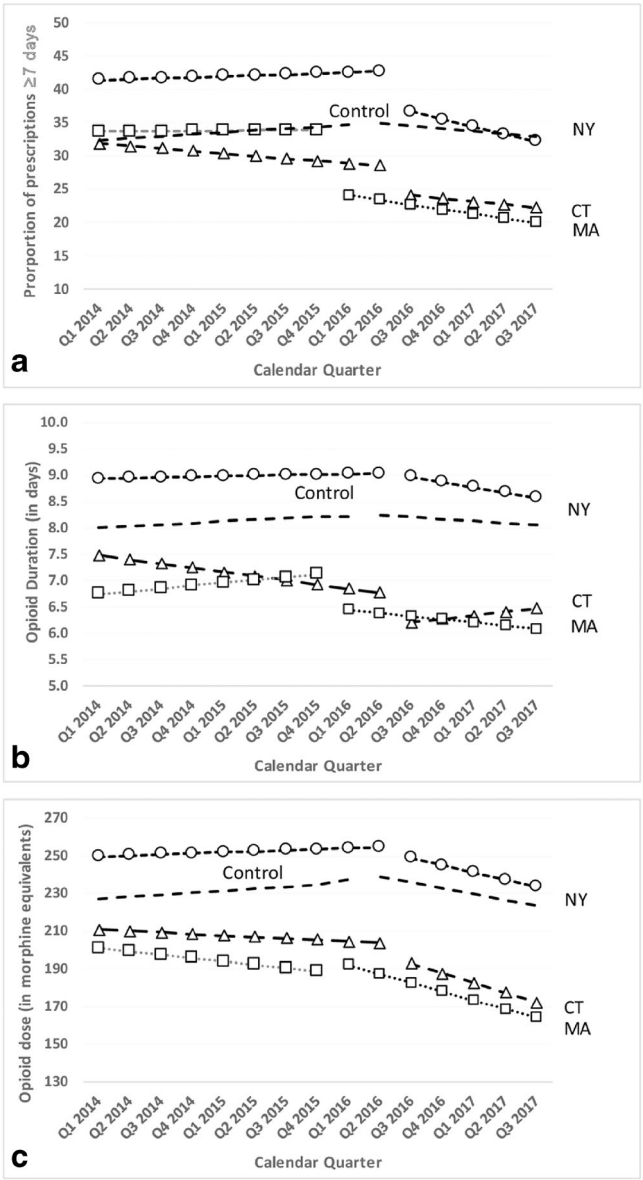

Figure 1 Predicted proportion of > seven-day opioid prescriptions (a), opioid duration (b), and MED (c) in patients initiating an opioid prescription in Connecticut, Massachusetts, and New York from January 2014 to September 2017. To allow for within- and between-state comparisons over all calendar quarters, the predictions were standardized by the baseline distribution of age (terciles) and acute conditions in 2015, the calendar year prior to when these laws were introduced. Because a Poisson regression utilizes a log link, predictions were derived using individual-level data (standardized to 2015 population) and the mean prediction over each calendar quarter was used to approximate the proportion of > seven-day prescriptions. Control states were all states except MA, CT, and NY which implemented a law restricting opioid duration in 2016, and DE, VT, AL, IN, NJ, RI, and ME which passed similar legislation in 2017. To evaluate whether similar changes were occurring in control states that did not have legislation introduced, we utilized Q2 2016 as an inflection time point for these states. MED, morphine equivalent dose (in milligrams).

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Corresponding Author: *Chintan V. Dave, PharmD, PhD; Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA (e-mail: chintandave19@gmail.com).*

Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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