Changes in Prescribing by Provider Type Following a State Prescription Opioid Restriction Law

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BACKGROUND: Many states have implemented opioid days' supply restriction policies, leading to reductions in opioid prescribing. Although research within certain provider types exist, no study has evaluated a restriction policy by various provider types.

OBJECTIVE: To evaluate changes in opioid utilization following a days' supply restriction policy stratified by provider type: surgery, emergency medicine, primary care, specialty care, and dentistry.

DESIGN: Interrupted time series (ITS)

PARTICIPANTS: Opioid prescription claims of patients in a private health plan serving a large Florida employer from 1/1/2015 to 3/31/2019. Provider types were determined using the Healthcare Provider Taxonomy Code associated with the national provider identifier (NPI).

INTERVENTIONS: Florida's opioid restriction policy implemented on July 1, 2018.

MAIN MEASURES: Changes in mean morphine milligram equivalent (MMEs), mean days' supply, and mean number of units dispensed per opioid prescription before and after policy implementation.

KEY RESULTS: There were 10,583 opioid initial prescriptions dispensed. Treating providers were classified as surgery (16.4%; n = 1732), emergency care (14.3%; n = 1516), primary care (21.2%; n = 2241), specialty care (11.4%; n = 1207), and dentistry providers (23.7%; n = 2511). Significant reductions in mean days' supply were observed across most provider types ranging from 14% reduction for dentistry providers to 41% reduction for specialty care providers. Significant changes were observed for emergency care and specialty care providers with a 30% ($p = 0.001$)and 29% ($p < 0.001$) reduction in mean MME, respectively, and a 27% ($p = 0.040$) reduction in mean number of units dispensed in emergency care providers, after implementation. Pre-implementation trends in opioid prescribing varied by provider type impacting the effects of the opioid days' supply restriction policy.

CONCLUSIONS: Pre-policy opioid prescribing varied by provider type with a differential impact on mean MMEs, mean days' supply, and mean number of units dispensed per prescription following implementation.

Prior Presentations: *Addiction Health Services Research Conference 2020–October 14th, 2020*

Received March 4, 2021
Accepted June 4, 2021
Published online July 8, 2021

J Gen Intern Med 37(8):1838–44
DOI: 10.1007/s11606-021-06966-4

INTRODUCTION

Rates of opioid-related harm, particularly overdose, have increased at an alarming rate over the last two decades.[1, 2] As a response, over 22 states have enacted policies limiting the total mean morphine equivalent daily dose.[3] Similarly, there has been an increasing number of exposure–avoidance policies implemented to limit opioid prescription days' supply, many of which were enacted over the last 2 years.[4–6] One such policy, Florida's House Bill 21 (HB 21), was implemented on July 1, 2018, and limited the days' supply of Schedule II opioids to 3 days for patients with acute pain, with the ability to extend to up to a 7-day supply if the provider documents it medically necessary on both the patient's medical record and the prescription itself. This law focuses on a time-limited response to pain and excludes opioid prescribing for any pain associated with traumatic injuries or terminal conditions.[7, 8]

Following the implementation of HB21, there was an immediate decrease in the number of new opioid users, number of tablets/capsules dispensed, days supplied, and total mean morphine milligram equivalent (MME) per opioid prescription.[9] Additionally, opioid prescriptions were substantially reduced within 6 months after implementation of HB21 for patients discharged after common outpatient surgical procedures.[10] However, a population-based policy evaluation on opioid utilization among plan enrollees may not capture the nuance of policy implementation as patients are treated with opioids for different conditions and by a variety of providers with diverse prescribing practices.

For example, the impact of the hydrocodone rescheduling policy enacted in 2014 differed even among surgeon specialties.[10] Due to differing pain presentations associated with specific procedures, stratification by surgery type has shown heterogeneity with a marked increase in oral morphine

equivalents observed among patients undergoing cancer, cardiac, orthopedic, and general surgical procedures.[10] Comparatively, in Massachusetts where the first-in-the-nation opioid limiting policy was passed in 2016, the implementation of opioid restriction was associated with a decreased probability of initiating a > 7-day opioid prescription for non-surgery patients diagnosed with acute pain (e.g., back pain, tendinitis, or urinary calculus) but no significant corresponding reduction in milligrams of morphine equivalents was observed.[11, 12] Conversely, an evaluation of a state law limiting prescribing in New Jersey demonstrated a 23% decrease in MME in an ambulatory care setting, further highlighting the potential differences based on provider types and their various settings.[13]

Currently, to our knowledge, there are no evaluations on the impact of opioid prescribing following an exposure–avoidance policy stratified by various provider types. Understanding the differential impacts of such policies is critically necessary as expected benefits and unintended consequences may differ based on provider types. Therefore, our objective was to categorize providers by surgery, emergency care, primary care, specialty care, and dentistry and then assess the impact of the Florida HB21 law on opioid prescribing by provider types to analyze changes in MME per prescription, monthly mean days' supply dispensed per prescription, and monthly mean number of units dispensed per prescription.

METHODS

Data Source and Study Population

We utilized pharmacy prescription claims for opioid medications dispensed starting from January 1, 2015, to March 31, 2019. Data prior to January 1, 2015, was not incorporated in order to avoid the effect of the Drug Enforcement Administration rescheduling of hydrocodone-containing products which was implemented in October of 2014.[14]

The pharmacy claims were obtained from a single health plan that serves over 45,000 employees of a large university and health system employer in Florida.

Patients were required to be enrolled for at least 180 days prior to their initial opioid claim and were considered to be opioid naïve if no opioid prescriptions were filled during that period. Patients could be counted again as having episodes of new use if there were subsequent opioid claims that occurred at least 180 days since the prior opioid claim. The opioid medications included were single-ingredient and combination products of the following opioid medications used for pain management: hydrocodone, oxycodone, morphine, hydromorphone, oxymorphone, codeine, tramadol, meperidine, and tapentadol. We excluded patients whose first opioid claim was non-oral (e.g., injectable, patch) or who filled the prescription outside of Florida.

We classified provider type and specialty via Healthcare Provider Taxonomy Code using providers' national provider identifier (NPI) as published by the Centers for Medicare & Medicaid Services.[15] We assessed the prescriber's first listed taxonomy (and the second when the first was missing or vague). After evaluating frequencies, we stratified by the following provider types: surgery, emergency care, primary care, specialty care, and dentistry (Appendix Table 3). Providers who were not classified or classified as "Student Health Care" were not further assessed since their taxonomy had not been updated and could belong to any provider type.

Outcome Measures

To assess changes in opioid utilization relative to HB21 policy implementation, we evaluated the monthly mean morphine milligram equivalents (MME) per prescription, the monthly mean days' supply dispensed per prescription, and the monthly mean number of units dispensed per prescription.

Statistical Analysis

We calculated the proportion of each prescriber type who wrote a prescription for opioids that was dispensed during the study period. We specified interrupted time series (ITS) models for each provider type for each of the three measures of opioid utilization (mean MME, mean days' supply, mean number of units). We accounted for autocorrelation of error terms, to estimate pre-existing trends in opioid utilization prior to implementation (i.e., time effect) and both immediate changes in opioid utilization (i.e., level effect) and changes over time in opioid utilization after the interruption (i.e., trend effect). A visual inspection of the trends was also conducted to identify any potential anticipatory effects prior to implementation, and an indicator value was included to account for any provider type with evidence of such effects.

A 2-sided $p < 0.05$ was considered statistically significant in evaluating the model coefficients for the time effect, and the level and trend changes resulting from the policy implementation. All analyses were conducted with R (R Foundation for Statistical Computing, Vienna, Austria) and SAS 9.4 (SAS Institute, Inc., Cary, NC). This study received approval from the institutional review board at the University of Florida.

RESULTS

There were 10,583 initial opioid prescriptions dispensed among the health plan enrollees meeting all inclusion criteria. The highest proportion of opioids were dispensed for patients evaluated by dentistry providers (23.7%; n = 2511), followed by primary care providers (21.2%; n = 2241), surgery providers (16.4%; n = 1732), emergency care providers (14.3%; n = 1516), and specialty care providers (11.4%; n = 1207). Providers who were not classified prescribed 13% (n = 1376) of the dispensed opioid medications (which were not further assessed). The proportion by provider subtypes are also listed in Table 1.

Table 1 Unique Provider Types by Taxonomy Description Using the National Provider Identifier Who Initiated Opioids

Provider types	Number of dispensed prescriptions n (%)	Provider type subgroups*	n (%)
Surgery	1732 (16.4)	Surgery	1661 (15.7)
		Rehabilitation medicine	71 (0.7)
Emergency medicine	1516 (14.3)	Emergency medicine	1516 (14.3)
Primary care	2241 (21.2)	Family and preventive medicine	1655 (15.6)
		Internal medicine	365 (3.5)
		Advanced practice/non-physician	141 (1.3)
Specialty care	1207 (11.4)	Pediatrics	80 (0.8)
		Obstetrics/gynecology	751 (7.1)
		Pain medicine	51 (0.5)
		Psychiatry	14 (0.1)
		Radiology	16 (0.2)
		Otolaryngology	213 (2.0)
		Ophthalmology	29 (0.3)
		Dermatology	31 (0.3)
		Non-specified specialty	102 (1.0)
Dentistry	2511 (23.7)	Dentistry	2511 (23.7)
Not classified†	1321 (12.5)	Not classified†	1321 (12.5)
Other/missing	55 (0.5)	Other/missing	55 (0.5)

Description of Subgroupings available upon request
†Taxonomy listed as Student Health Care (390200000X)

Changes in Morphine Milligram Equivalent by Prescribing Provider Type

Prior to implementation, the mean total MMEs dispensed varied largely depending on the provider type (ranging from 212 MMEs for surgery providers to 88 MMEs for emergency care providers). Among emergency care providers, there was a significant decreasing trend in MME prior to implementation (Table 2; Fig. 1b) and a 30% reduction of mean MME after implementation ($p < 0.001$). However, by the end of the study there was a significant increase in MME (61.5 to 95.5; $p = 0.004$). Following the implementation of the policy, specialty care providers observed a reduction in MME (29% reduction, $p < 0.001$) and dentistry providers (Fig. 1d) maintained a significant decreasing trend ($p = 0.010$). Both primary care and surgery providers experienced no significant reductions in trend or mean MME immediately following policy implementation (Fig. 1a, c).

Changes in Mean Days' Supply Dispensed by Prescribing Provider Type

Changes in mean days' supply were observed across most provider types with a 19% reduction for emergency care providers (3.5 to 2.8 days; $p = 0.036$), 36% reduction for primary care providers (8.9.5 to 5.8 days; $p = 0.011$), 41% reduction for specialty care providers (5.6 to 3.4 days; $p < 0.001$), and a 14% reduction for dentistry providers (3.5 to 3.0 days; $p = 0.012$). Surgery providers observed no significant changes in the trend or mean days' supply immediately after implementation of the policy (Fig. 2a–d). At the end of follow-up, the mean days' supply was less than 3 days for emergency care providers, primary care providers, and dentistry providers.

Changes in Mean Number of Units Dispensed by Prescribing Provider Type

There were large differences observed in the calculated proportion of mean number of units dispensed by providers prior to the implementation of the law (ranging from 15.5 in emergency care to 39.0 in specialty care). Among emergency care providers, there was a significant decreasing trend in mean number of units prior to HB21 (Table 2; Fig. 3b) and a 27% reduction in mean number of units after implementation ($p = 0.040$). Dentistry providers (Fig. 3d) also observed a significant change from an increasing trend prior to implementation to a decreasing trend immediately after policy implementation ($p = 0.040$). There were no significant reductions in trend or mean number of units dispensed immediately following policy implementation across any other provider type (Table 2; Fig. 3a, c).

DISCUSSION

Our results identified heterogeneous baseline opioid-prescribing practices for acute pain by provider types, as expected given the differing conditions and degrees of pain being treated. Additionally, we identified a differential impact on opioid prescribing immediately following policy implementation, suggesting that the impact of opioid prescribing limit laws on prescribing behaviors likely depends on the specific provider type and their pre-established opioid-prescribing trends prior to policy implementation.

In our study, we found a decreasing pre-policy trend in opioid prescribing among surgeons, with no meaningful changes in mean days' supply, number of units, or MMEs immediately after HB21 was implemented. These findings

Table 2 Changes in Opioid Utilization by Provider Types Associated with Florida's HB21 Law Implementation

Measure	Provider type	Beginning of study period	Prior implementation	p value (trend prior to implementation)	Immediately following implementation	p value (change after implementation)	End of study period	p value (trend following implementation)
Mean total morphine milligram equivalent dispensed	Surgery	280.53	212.22	< 0.001	189.96	0.244	182.32	0.809
	Emergency care	101.56	88.44	0.019	61.46	0.001	95.47	0.004
	Primary care	185.34	185.37	0.999	154.79	0.219	97.29	0.127
	Specialty care	233.86	184.93	< 0.001	130.53	< 0.001	165.04	0.092
	Dentistry	130.90	115.80	< 0.001	112.80	0.557	91.08	0.010
Mean days' supply dispensed	Surgery	7.56	5.40	< 0.001	3.95	0.055	4.58	0.567
	Emergency care	3.62	3.45	0.436	2.78	0.036	2.80	0.958
	Primary care	8.53	8.87	0.632	5.73	0.011	2.94	0.108
	Specialty care	5.44	5.57	0.584	3.35	< 0.001	3.53	0.850
	Dentistry	3.58	3.51	0.428	3.03	0.012	2.58	0.126
Mean number of units dispensed	Surgery	49.26	32.83	< 0.001	24.98	0.080	27.08	0.748
	Emergency care	18.60	15.45	0.027	11.31	0.040	13.40	0.473
	Primary care	33.01	29.04	0.132	21.65	0.097	19.91	0.781
	Specialty care	40.49	38.96	0.352	30.34	0.096	18.51	0.179
	Dentistry	21.22	21.48	0.849	21.20	0.903	13.59	0.041

suggest surgeons' opioid-prescribing trends were likely impacted by other forces outside of the HB21 law. Although lower than the pre-policy average of 5.4 days at 4.0 days, the surgeons' mean days' supply remained higher than 3 days, indicating a more frequent use of the exemption for acute pain prescribing. Another study in Florida analyzing whether the HB21 legislation changed opioid prescription practices after surgery did result in fewer patients receiving opioid prescriptions on discharge (21% reduction, $p < 0.001$) and fewer patients receiving prescriptions exceeding a 3-day supply (68% reduction, $p < 0.001$).[16] However, 6 months after implementation of HB21, the authors also observed a mean daily dose increase of 3.5 morphine milligram equivalents from a baseline mean of 9.4 MME which could suggest an attempt to adjust dosage to reduce immediate follow-up visits.[16] The discordance of evidence on which to base postoperative prescribing practices further highlights the need to create evidence-based opioid-prescribing recommendations that take into account the diverse surgery practice environments.[17, 18] Thus, further analysis of stratification by surgery type or surgeon subspecialty may be warranted given the vast heterogeneity of pain presentations associated with differing procedures.[10]

In our study population, the emergency care provider type was among the lowest in opioid prescribing for all three outcomes, and this appears to be in accordance with recent efforts by emergency departments to minimize opioid-related harms by taking advantage of non-opioid analgesics to manage acute pain.[19–21] Anticipatory effects were observed for emergency care providers, who experienced marked increases across all three variables in the month immediately prior to policy implementation. Further research as to what caused this occurrence is warranted. Furthermore, there was still a 20 to 30% immediate reduction across all three opioid-prescribing metrics measured following HB21 for emergency care medicine providers, consistent with other studies evaluating state-level guidelines on recommended opioid-prescribing practices in the emergency department.[22] However, there was a significant increase in mean MME from 61.0 to 95.5 in the 9 months following HB21 implementation. The increase in mean MME after the initial reduction may indicate a potential overcorrection in opioid prescribing (i.e., patients may not have been adequately treated immediately following HB21 implementation). The initial overcorrection of physicians' prescribing trends as a result of opioid restriction guidelines has been previously reported as an unintended consequence of expecting clinicians to immediately mitigate the risks of high-dose opioids, with some providers universally stopping opioid prescriptions even when the benefits might outweigh the risks.[21] Hence, the importance of individualizing application of

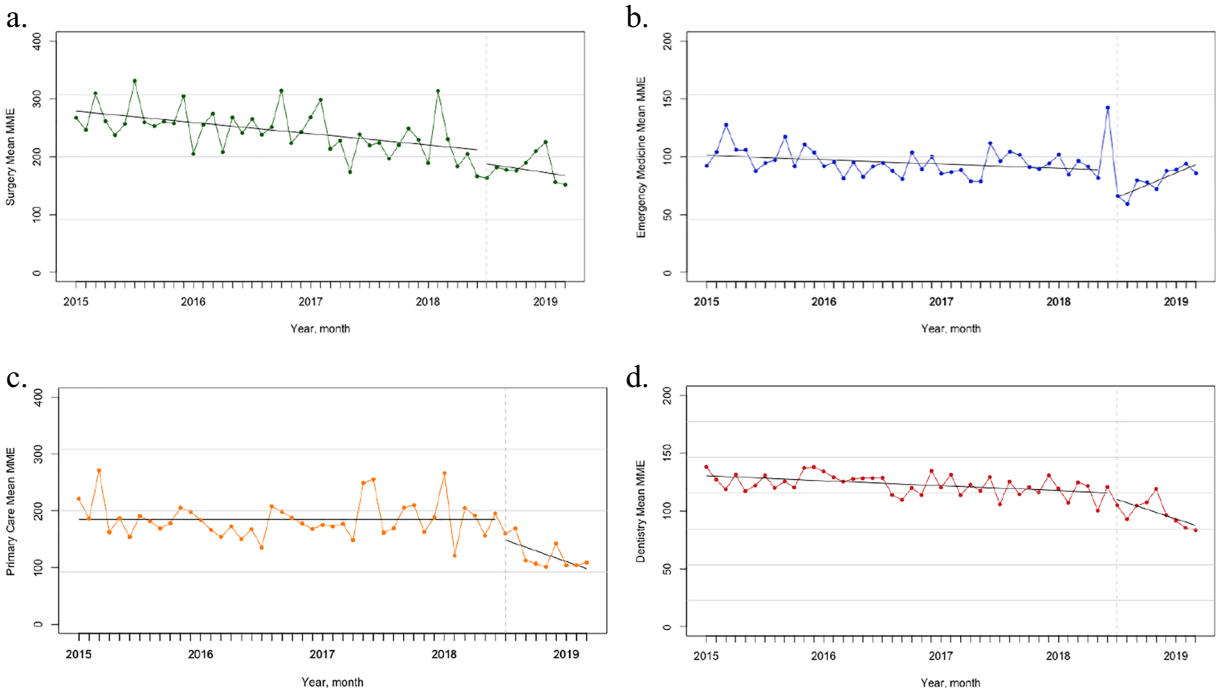

Figure 1 a–d Total mean morphine equivalent (MME) by month stratified by provider type. The implementation of the House Bill 21 policy, enacted on July 1st, 2018, is represented by the dash line.

policies and engaging in shared decision-making with patients when discussing pain therapy is warranted.[23–25]

Interpretations of specialty care providers' trends is challenging due to the heterogeneity of provider subgroups, leading to constantly fluctuating data points before and immediately after HB21 implementation. Among dentists, there was an immediate reduction in mean days' supply and a significant trend in the reductions of mean MME and mean number of units following HB21. This change, coupled with a recent statement by the American Dental Association on the use of opioids in the treatment of dental pain, which included a recommendation to consider NSAIDS as a first-line therapy option, represents a move towards potentially safer prescribing practices within the field of dentistry, especially as recent findings suggest the MME of opioid prescriptions by dentists was 29% higher than recommended for acute pain management, while 53% of dentists' opioid prescriptions exceeded the recommended days' supply.[26–29]

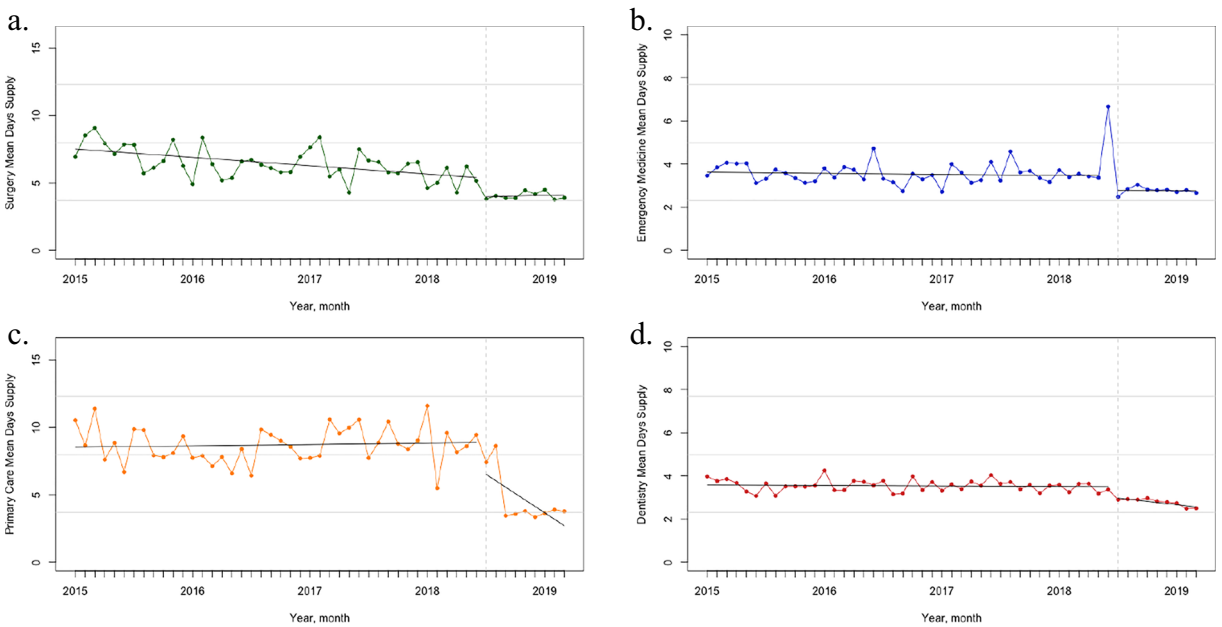

Figure 2 a–d Total mean days' supply by month stratified by provider type. The implementation of the House Bill 21 policy, enacted on July 1st, 2018, is represented by the dash line.

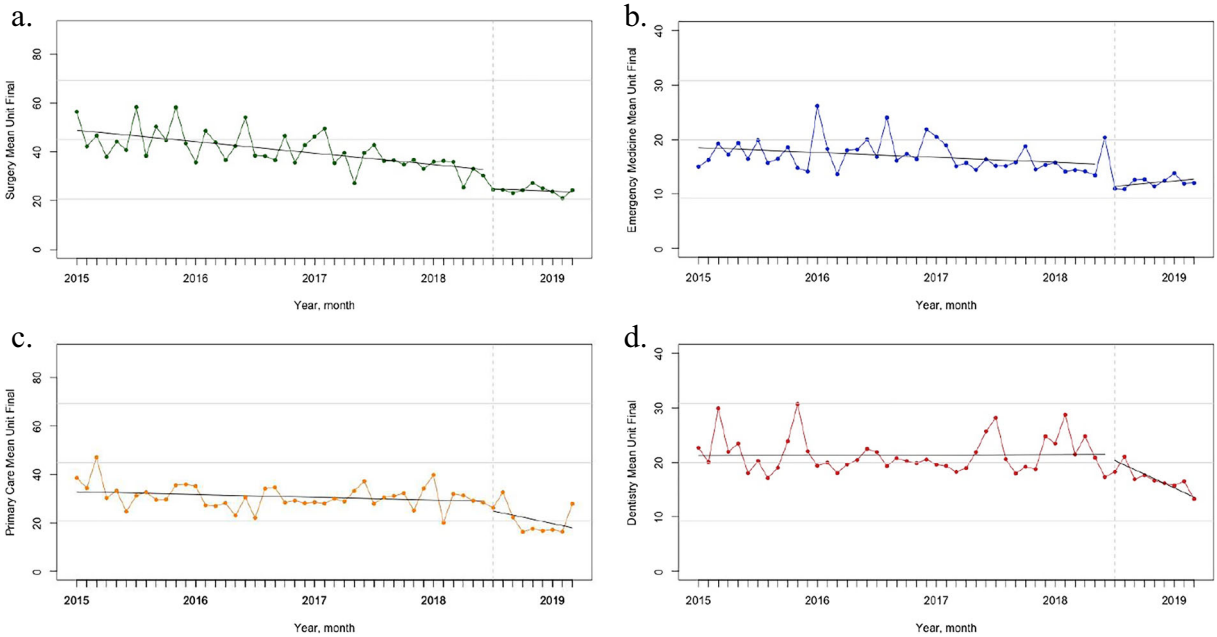

Figure 3 a–d Total mean number of units by month stratified by provider type. The implementation of the House Bill 21 policy, enacted on July 1st, 2018, is represented by the dash line.

Our study has several limitations. First, it only captures the opioid prescription claims of a single private health plan serving a large university-affiliated hospital, which limits the generalizability of our findings to other healthcare settings. Second, pharmacy claims data are unable to capture the type and severity of pain for which each opioid prescription was written and thus future studies evaluating these differences could prove informative. Third, in 13% of opioid prescriptions, the provider was classified as "Student Health Care" suggesting their taxonomy has not been updated. These providers were not further assessed as they could belong to any provider type. Lastly, unlike the findings from Potnuru, we were unable to determine changes in the number of patients prescribed opioids by provider type since we were unable to assess visits in which an opioid was not prescribed.[16]

Our findings expand on the previous research analyzing the effects of opioid-prescribing limitation laws that assessed either provider types in aggregate or by individual provider types.[6, 9, 10, 13, 16, 19, 30–33] To our knowledge, our study was the first to evaluate the impacts of an opioid-prescribing restriction policy across multiple provider types. Additionally, we utilized interrupted time series models, which allowed for the evaluation of pre- and post-policy trends which are not captured in simple pre-/post-analyses.

CONCLUSION

There has been a rapid proliferation of policies to limit the duration or number of doses in opioid prescriptions for acute pain. As such, evaluations of whether these changes lead to significant changes can further inform policy makers on future strategies. In our study, we found contrasting opioid-prescribing practices based on provider types prior to and after the implementation of HB21 policy in Florida. Additionally, opioid prescribing, as characterized by MMEs, mean days' supply, and mean number of units, by provider type was differentially impacted by this policy and potentially driven by differences in the various settings, as well as the populations being treated. Further research is warranted to understand the immediate and long-term clinical implications of opioid avoidance policies across a variety of provider types.

Supplementary Information *The online version contains supplementary material available at https://doi.org/10.1007/s11606-021-06966-4.*

Acknowledgements: *The authors would like to thank Silken Usmani for her review of the manuscript.*

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Declarations:

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

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