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Article

Temporal Trends in Opioid Prescribing Patterns Among Oncologists in the Medicare Population

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Abstract

Background: In the wake of the US opioid epidemic, there have been efforts to curb opioid prescribing. However, it is unknown whether these efforts have affected prescribing among oncologists, whose patients often require opioids for symptom management. We investigated temporal patterns in opioid prescribing for Medicare beneficiaries among oncologists and nononcologists. **Methods:** We queried the Centers for Medicare and Medicaid Services Part D prescriber dataset for all physicians between January 1, 2013, and December 31, 2017. We used population-averaged multivariable negative binomial regression to estimate the association between time and per-provider opioid and gabapentinoid prescribing rate, defined as the annual number of drug claims (original prescriptions and refills) per beneficiary, among oncologists and nononcologists on a national and state level. **Results:** From 2013 to 2017, the national opioid-prescribing rate declined by 20.7% ($P < .001$) among oncologists and 22.8% ($P < .001$) among non oncologists. During this time frame, prescribing of gabapentin increased by 5.9% ($P < .001$) and 23.1% ($P < .001$) among oncologists and nononcologists, respectively. Among palliative care providers, opioid prescribe increased by 15.3% ($P < .001$). During the 5-year period, 43 states experienced a decrease ($P < .05$) in opioid prescribing among oncologists, and in 5 states, opioid prescribing decreased more among oncologists than nononcologists ($P < .05$). **Conclusions:** Between 2013 and 2017, the opioid-prescribing rate statistically significantly decreased nationwide among oncologists and nononcologists, respectively. Given similar declines in opioid prescribing among oncologists and nononcologists, there is concern that opioid-prescribing guidelines intended for the noncancer population are being applied inappropriately to patients with cancer and cancer survivors.

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The United States is currently suffering from an opioid epidemic, with more than 47 000 overdose-related deaths in 2017. Given the demonstrated link between high opioid prescribing and long-term opioid use in patients (1,2), multiple regulatory efforts have been made to curb opioid prescribing. These include the creation of prescription drug monitoring programs, state-based opioid prescription limits (3), and national prescribing guidelines (4). In turn, opioid prescribing has decreased nationally, with 1 study estimating a 13% reduction in prescriptions between 2006 and 2017 (5).

However, little is known about how this heightened scrutiny has affected opioid prescribing among oncologists. Some providers have sought pharmacologic alternatives to opioids, such as acetaminophen, nonsteroidal anti-inflammatory drugs, or neuropathic agents, which may harbor a lower potential for misuse (6,7). Other providers have chosen to refer their patients to palliative care, which has been shown to improve symptom intensity, quality of life, and overall survival for patients (8,9). Oncologists have also sought guidance from professional organizations and public health agencies. One of the more prominent guidelines to inform opioid prescribing for patients with chronic pain was issued by the Centers for Disease Control and Prevention in March 2016 (4). Notably, these guidelines excluded patients undergoing active cancer treatment but did apply to cancer survivors who had completed treatment, were in remission, and were under active surveillance. Yet, there has been concern about such guidelines being used to restrict opioid access to patients with cancer-related pain (10–12), which can

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affect up to 60% of patients undergoing active treatment and 33% of cancer survivors (13–16).

To date, there have been limited data on national opioid-prescribing trends among oncologists in the context of the opioid epidemic. We hereby present a comprehensive analysis of national and statewide time trends in opioid-prescribing patterns among oncologists and nononcologists in the Medicare population using a national prescriber dataset.

Methods

Data Source

Data were obtained from the Centers for Medicare and Medicaid Services (CMS) Part D Prescriber Public Use File (PUF), which provides information on prescription drugs prescribed by individual health care providers under the Medicare Part D Prescription Drug Program (17). As of 2018, the Medicare Part D program enrolled 43 million patients on Medicare (18). The PUF includes a detailed drug dataset organized by individual drug claims (original prescriptions and refills) per provider and a provider summary table, which tabulates all Part D claims per provider into a single record. These datasets identify providers by their National Provider Identifier and include detailed provider-level and prescription-level data. Provider-level data from the PUF dataset include year, sex, state of practice, and medical specialty. We obtained further provider-level data, including year of medical school graduation and number of group practice members, from the CMS Physician Compare dataset. Opioid prescription data were obtained from the summary dataset and included opioid beneficiary counts, total beneficiary counts, opioid claim counts, opioid day's supply, and opioid drug costs, any of which were suppressed in the dataset if the value was between 1 and 10 annually per provider to protect patient identity. Claims from any prescribed opioids counted towards the opioid claim count. To include providers with suppressed data in analysis, suppressed values for opioid claim count were imputed a value that reflected time trends for the overall cohort. Because opioid prescribing decreased by approximately 20% in the cohort over 5 years, a value of 5 was imputed for opioid claim count in 2013. This value decreased by 5% each year until a value of 4 was imputed for 2017. An imputed value of 5 was assigned for all other variables with suppressed values. The detailed drug dataset suppressed prescription information on individual drugs (ie, oxycontin) with fewer than 11 total annual claims per provider.

Study Sample and Construction of Variables

We queried the Medicare Part D PUF summary table and detailed drug datasets covering January 1, 2013, to December 31, 2017, for all physician providers. The primary dependent outcome variable, opioid-prescribing rate, was constructed as a ratio of the total annual opioid claim count to the total number of beneficiaries seen by a provider in a calendar year. Prescribing rates for nonopioid medications gabapentin and pregabalin were evaluated in a similar fashion. We constructed additional covariates, including provider specialty, experience level, and group practice size. For each provider, specialties were obtained from the summary table and aggregated into 1 of 2 provider categories: oncologists and nononcologists. Oncologists included providers in surgical oncology (surgical oncology, gynecological oncology), medical oncology (hematology or oncology, medical oncology), and radiation oncology, and nononcologists included all other providers. Palliative care providers (pain management, hospice, and palliative care) were analyzed as a subset of nononcologists. We derived the number of years in independent practice by subtracting the year of medical school graduation from the calendar year of prescription data. We characterized experience level as early career (1-10 years), mid-career (11-20 years), or late career (more than 20 years in independent practice), consistent with definitions used previously (19). We categorized practice size as 1-100 (small), 101-1000 (medium), or more than 1000 (large) group members.

Statistical Analysis

We compared baseline provider characteristics and opioid-prescribing patterns between oncologists and nononcologists using the Pearson χ^2 test for categorical variables and the Wilcoxon rank-sum test for continuous variables. We then evaluated time trends in opioid prescribing per provider using a population-averaged approach. To evaluate national trends, we created multivariable models with robust standard error estimates using a negative binominal distribution. This method of analyzing count data is similar to a Poisson model but has the advantage of better handling overdispersed data, in which the conditional variance exceeds the conditional mean. In these models, opioid-prescribing rate was the primary dependent variable and year was the primary independent variable. All models were adjusted for provider sex, state of practice, medical specialty, experience level, practice size, and total annual beneficiary count per provider. The association between opioid-prescribing rate and independent covariates was confirmed to be linear using a locally weighted regression smoother scatterplot in which we observed no departure between the smoothed and ordinary regression lines.

We then investigated time trends in opioid prescribing within individual US states by replicating the national analysis separately for each state. All analyses of temporal prescribing were conducted separately for oncologists and nononcologists. To compare opioid prescribing over time between oncologists and nononcologists, we created a series of state-based multivariable models using a calendar year × provider category (oncologist vs nononcologist) interaction term. Multivariable models were also used to evaluate time trends in prescribing of gabapentin, pregabalin, and the most common short-acting and long-acting opioids. The incidence rate ratio was used to assess relative differences in prescribing rate across covariates. Prescribing rates in all multivariable models were estimated using mean marginal effects over time. Hypothesis testing was 2-sided, and P less than .05 was used to indicate statistical significance for all comparisons. All analyses were carried out using STATA v16.0 (StataCorp LP, College Station, TX). This study was granted an institutional review board exemption by the Yale Human Investigations Committee, given that the data were publicly available and de-identified.

Results

Baseline Characteristics of Cohort

A total of 21 041 oncologists and 723 861 nononcologists met the inclusion criteria during the study period. Among nononcologists, 4115 (0.6%) were palliative care providers, for whom provider characteristics are described in Supplementary Table 1

Table 1. Baseline characteristics and opioid-prescribing patterns of oncologists and nononcologists

Baseline provider characteristics	Oncologists (n = 21 041)[a]	Nononcologists (n = 723 861)[a]	P[b]
Year, No. (%)			.007
2013	4326 (20.6)	149 883 (20.7)	
2014	4132 (19.6)	138 731 (19.2)	
2015	4098 (19.5)	137 334 (19.0)	
2016	4117 (19.6)	140 776 (19.5)	
2017	4368 (20.8)	157 137 (21.7)	
Provider sex, No. (%)			<.001
Male	15 048 (71.5)	539 046 (74.5)	
Female	5993 (28.5)	184 815 (25.5)	
Specialty, No. (%)			N/A
Surgical oncology	2281 (10.8)	—	
Medical oncology	13 556 (64.4)	—	
Radiation oncology	5204 (24.7)	—	
Palliative care	—	4115 (0.6)	
Other	—	719 746 (99.4)	
Experience level, years in practice, No. (%)			<.001
Early career, 1-10	2535 (12.1)	92 728 (12.8)	
Mid-career, 11-20	5634 (26.8)	125 320 (17.3)	
Late career, >20	12 863 (61.2)	505 291 (69.9)	
Practice size, group members, No. (%)			<.001
Small, 1-100	5940 (35.0)	182 740 (46.2)	
Medium, 101-1000	6837 (40.3)	142 290 (35.9)	
Large, >1000	4178 (24.6)	70 929 (17.9)	
Opioid-prescribing patterns			
Annual opioid claims per provider, median (IQR)	31 (5-85)	12 (4-69)	<.001
Annual length of opioid supply per patient, median (IQR), days	40.4 (5.8-69)	8.2 (1-70.0)	<.001
Annual no. of patients receiving opioids per provider, median (IQR)	15 (5-30)	5 (5-35)	<.001
Annual cost of opioids per patient ($), median (IQR)	90.89 (9.09-197.12)	12.46 (1.00-70.02)	<.001

[a]Percentages may not add up to 100 because of rounding or incomplete data. IQR = interquartile range.
[b]All *P* values were 2-sided. *P* values were calculated using the Pearson's χ^2 test for categorical variables and the Wilcoxon rank-sum test for continuous variables.

(available online). Baseline characteristics of oncologists and nononcologists are shown in Table 1. On unadjusted univariate analysis ($P < .001$), oncologists prescribed more opioids per year (median = 31, interquartile range [IQR] = 5-85 claims vs median = 12, IQR = 4-69 claims), to more beneficiaries (median = 15, IQR = 5-30 beneficiaries vs median = 5, IQR = 5-35 beneficiaries), for a longer length of time (median = 40.4 days, IQR = 5.8-69 days vs median = 8.1 days, IQR = 1-70.0 days), and at a higher annual cost per beneficiary (median = $90.89, IQR = $9.09-$197.12 vs median = $12.46, IQR = $1.00-$70.02) compared with nononcologists. The most frequently prescribed opioids among oncologists were hydrocodone-acetaminophen (1.6 million claims), oxycodone HCL (0.9 million claims), and oxycodone HCL-acetaminophen (0.6 million claims) (Supplementary Table 2, available online), and among nononcologists were hydrocodone-acetaminophen (117 million), tramadol HCL (55 million), and oxycodone HCL-acetaminophen (35 million) (Supplementary Table 3, available online). Among a total of 308 million opioid claims, 1.2% were imputed. Nearly one-half (47.5%) of providers had at least 1 imputed claim, with 12.7% of providers—11.6% of oncologists and 12.7% of nononcologists—possessing imputed claims in the first and last years of their inclusion in the dataset.

National Temporal Trends in Opioid Prescribing

On unadjusted analysis, the mean number of opioids per 100 beneficiaries prescribed per oncologist decreased 22.2% from 69.0 in 2013 to 53.7 in 2017. Meanwhile, the mean number of opioids per 100 beneficiaries prescribed per nononcologist decreased 25.7% from 52.9 in 2013 to 39.3 in 2017. In the adjusted population-averaged multivariable model, the per-provider opioid-prescribing rate among oncologists and nononcologists decreased by 20.7% (68.5 to 54.3 opioids per 100 beneficiaries, $P < .001$) and 22.8% (49.5 to 38.2 opioids per 100 beneficiaries, $P < .001$), respectively, from 2013 to 2017 (Figure 1, A Supplementary Table 4, available online). Among palliative care providers, opioid prescribing increased by 15.3% (241.9 to 278.9 opioids per 100 beneficiaries, $P < .001$). During this time frame, prescribing of gabapentin increased by 5.9% (18.5 to 19.5 claims per 100 beneficiaries, $P < .001$) and 23.1% (28.5 to 35.1 claims per 100 beneficiaries, $P < .001$) among oncologists and nononcologists, respectively. Meanwhile, prescribing of pregabalin decreased by 18.9% (11.0 to 8.9 claims per 100 beneficiaries, $P < .001$) and 1.2% (11.0 to 10.9 claims per 100 beneficiaries, $P = .005$) among oncologists and nononcologists, respectively (Figure 1, B and C).

Adjusted time trends for the most frequently prescribed individual opioids among oncologists and nononcologists were examined by duration of action. From 2013 to 2017, the prescribing rate for hydrocodone-acetaminophen declined the most among oncologists (−30.3%, 39.7 to 27.6 claims per 100 beneficiaries, $P < .001$) and nononcologists (−29.3%, 45.2 to 32.0 claims per 100 beneficiaries, $P < .001$) (Figure 2, A and C). All long-acting opioids demonstrated a decrease in prescribing rate, although the most statistically significant decline was seen in oxycontin among oncologists (−33.0%, 17.3 to 11.6 claims per 100 beneficiaries, $P < .001$) and nononcologists (−29.9%, 12.2 to 8.5 claims per 100 beneficiaries, $P < .001$) (Figure 2, B and D).

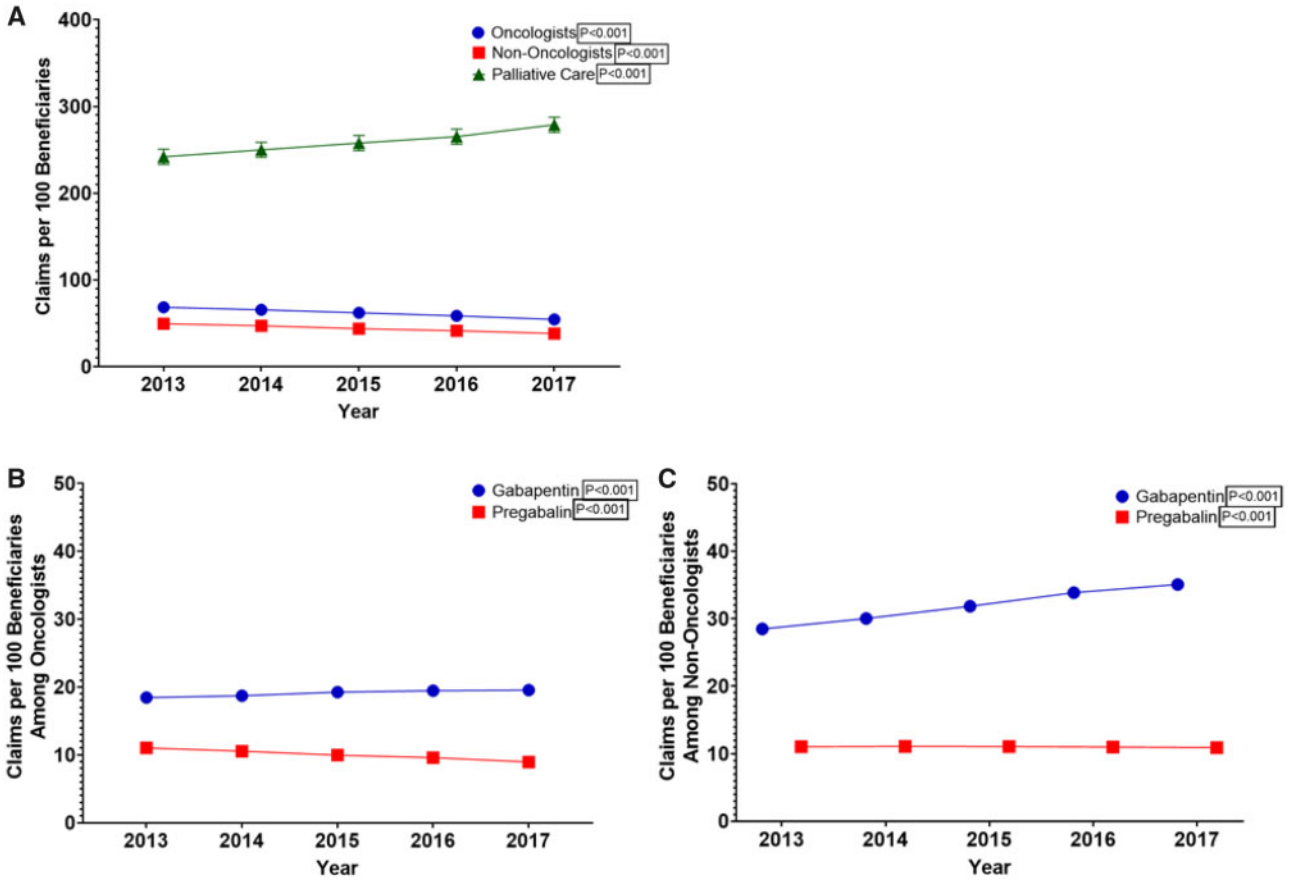

Figure 1. Time trends of adjusted prescribing rate, 2013-2017. Prescribing rates are shown for **A**) opioids among oncologists and nononcologists, **B**) gabapentinoids among oncologists, and **C**) gabapentinoids among nononcologists. Prescribing rates adjusted for provider sex, specialty, state, experience level, and practice size. *P* values for time trend are 2-sided and derived from multivariable negative binominal analyses.

State-Level Temporal Trends in Opioid Prescribing

Baseline state opioid-prescribing trends in 2013 are displayed in Supplementary Figure 1 (available online). Among oncologists, 43 of 50 states had a statistically significant decline ($P < .05$) in opioid prescribing from 2013 to 2017, with Vermont (−38.2%), New Hampshire (−35.8%), and Maine (−34.8%) experiencing the greatest decrease (Figure 3, A). Among nononcologists, all 50 states had a decline ($P < .05$) in opioid prescribing, most notably in New Hampshire (−38.0%), Rhode Island (−35.4%), and Connecticut (−31.9%) (Figure 3, B). When time trends in opioid prescribing were compared between oncologists and nononcologists, 5 states experienced a statistically significantly larger decline in opioid prescribing among oncologists compared with nononcologists ($P < .05$), most notably Oklahoma (−24.8% vs −8.9%), Idaho (−34.6% vs −18.4%), and Utah (−34.4% vs −22.0%) (Figure 3, C). A complete list of statewide time trends in opioid prescribing among oncologists and nononcologists is detailed in Supplementary Table 5 (available online).

Discussion

Our comprehensive analysis of Medicare prescribing data identified a 21% and 23% decrease nationally in opioid prescribing among oncologists and nononcologists, respectively, over a 5-year period. This change in opioid-prescribing patterns appears to be primarily mediated by a reduction in prescribing of hydrocodone-acetaminophen and long-acting opioids. This period coincided with an increase in gabapentin prescribing and opioid prescribing among palliative care providers. Among oncologists, opioid prescribing decreased in 43 US states, and in 5 states there was a greater decrease in prescribing among oncologists than nononcologists.

Our data showed that the national decline in opioid prescribing among oncologists and nononcologists coincided with an increase in prescribing of gabapentin. Indeed, this pattern likely reflects the desire of providers to seek nonopioid alternatives in the context of the opioid epidemic. National prescribing data show that from 2012 to 2016, gabapentin prescriptions increased 64% and pregabalin sales doubled (20). Gabapentinoids are often seen as safe and effective alternatives to opioids, although evidence regarding their efficacy in treating cancer-related pain has been mixed (21). Moreover, gabapentinoids may be more commonly prescribed as opioid alternatives in younger adults with cancer (22), which could explain the modest increase in gabapentin and decrease in pregabalin prescribing among oncologists to Medicare beneficiaries seen in our study. Our analysis also found a 15% increase in opioid prescribing among palliative care providers, suggesting that oncologists and nononcologists may be referring their patients with chronic pain to specialty care for symptom management. Given that palliative care providers are uniquely equipped to manage the

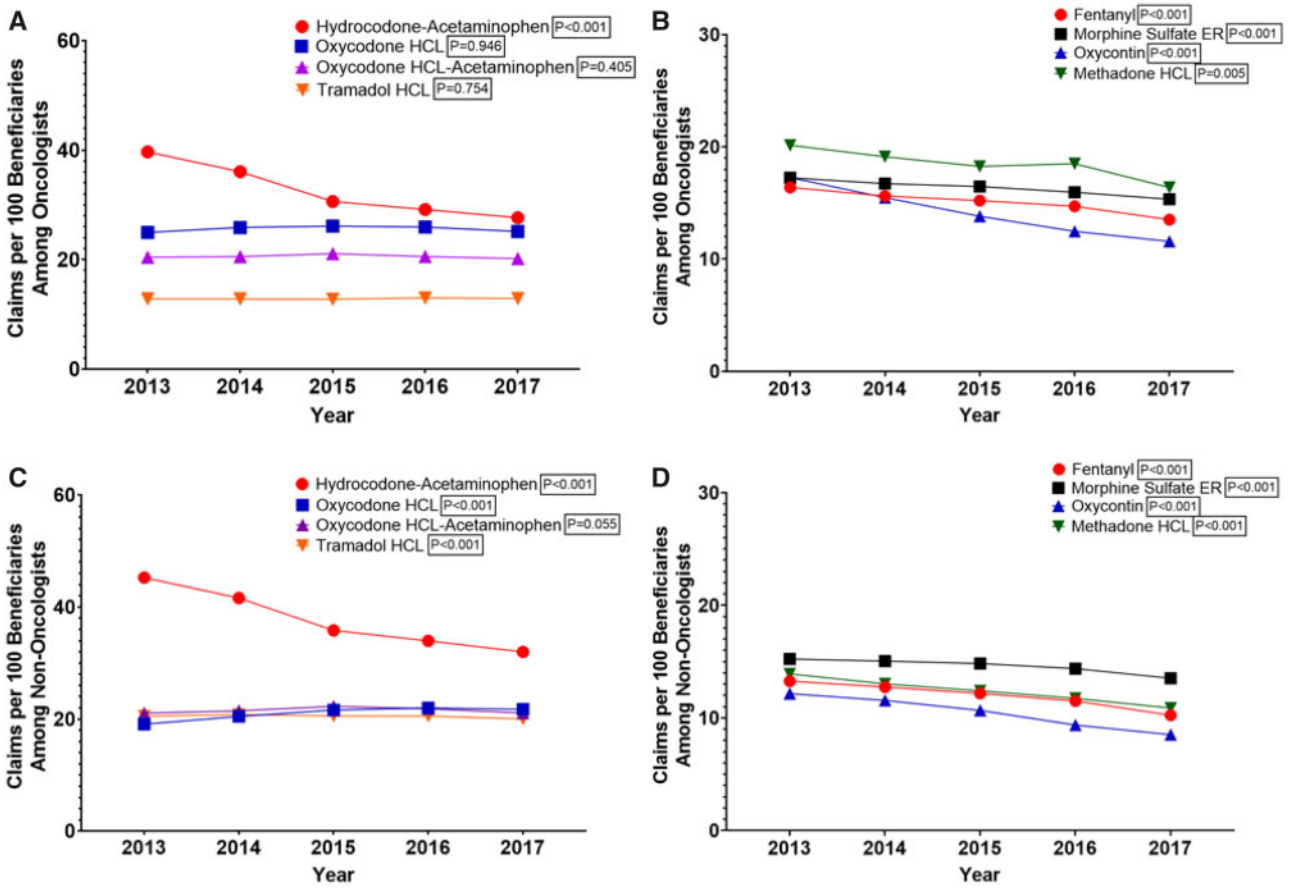

Figure 2. Time trends of adjusted prescribing rates for commonly prescribed short- and long-acting opioids, 2013-2017. Prescribing rates are shown for **A**) short-term opioids among oncologists, **B**) long-term opioids among oncologists, **C**) short-term opioids among nononcologists, and **D**) long-term opioids among nononcologists. *P* values for time trend are 2-sided and derived from multivariable negative binominal analyses.

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complex physical and emotional needs of patients with chronic pain, it is not surprising that they have taken on an increased role in opioid prescribing over time.

The time trends in prescribing of individual opioids are particularly interesting and merit further discussion. The decline in hydrocodone-acetaminophen prescribing may be partly due to its reclassification from a schedule III to the more stringent schedule II substance in 2014 (23). Indeed, our data show that after 2014, further reduction in hydrocodone-acetaminophen prescribing seems to have plateaued. A decrease in hydrocodone prescribing was also seen in a study of opioid prescriptions among patients with cancer referred to a palliative care clinic between 2010 and 2015 (24). Furthermore, our study showed that long-acting opioids all exhibited a statistically significant decline in prescribing, perhaps due to the association between long-acting opioids and unintended overdoses (25). Moreover, heightened regulation around prescribing of long-term opioids, such as requirements for signed opioid treatment agreements between physicians and patients as well as insurance-based barriers like prior authorizations (26), may have contributed to the decline in prescribing. Overall, these data suggest that both oncologists and nononcologists exhibited similar temporal patterns in prescribing of long-acting and short-acting opioids.

We found that most states experienced a statistically significant decrease in opioid prescribing among oncologists and nononcologists, although there was considerable heterogeneity in prescribing patterns. Southern states such as Arkansas, Louisiana, and Alabama had high baseline opioid-prescribing rates in 2013 and experienced little decrease in opioid prescribing over time. Meanwhile, northeast states such as Maine, New Hampshire, and Massachusetts had low baseline opioid-prescribing rates in 2013 and experienced a large decrease in prescribing over time. These patterns have been described previously among primary care providers and may be due to greater regulatory pressures and differences in patient and provider attitudes towards opioids in the northeast (27). Notably, states with the greatest decrease in opioid prescribing among oncologists, including Vermont, New Hampshire, and Maine, have few oncologists relative to other states (28). Therefore, large decreases in opioid prescribing among a small number of providers may greatly affect prescribing patterns within the state. Finally, we observed a greater decline in opioid prescribing among oncologists relative to nononcologists in 5 states. Although the reasons for this are unclear, possible etiologies may include prescriber preferences, palliative care referral patterns, and regulatory programs like prescription drug–monitoring programs, which may be associated with reduced opioid prescriptions among cancer survivors (29).

Strategies to reign in opioid overprescribing, including government legislation and prescribing guidelines, are critical to reducing opioid misuse, but may inadvertently restrict opioid access among cancer survivors. Our results demonstrated a steady decrease in opioid prescribing over a 5-year period,

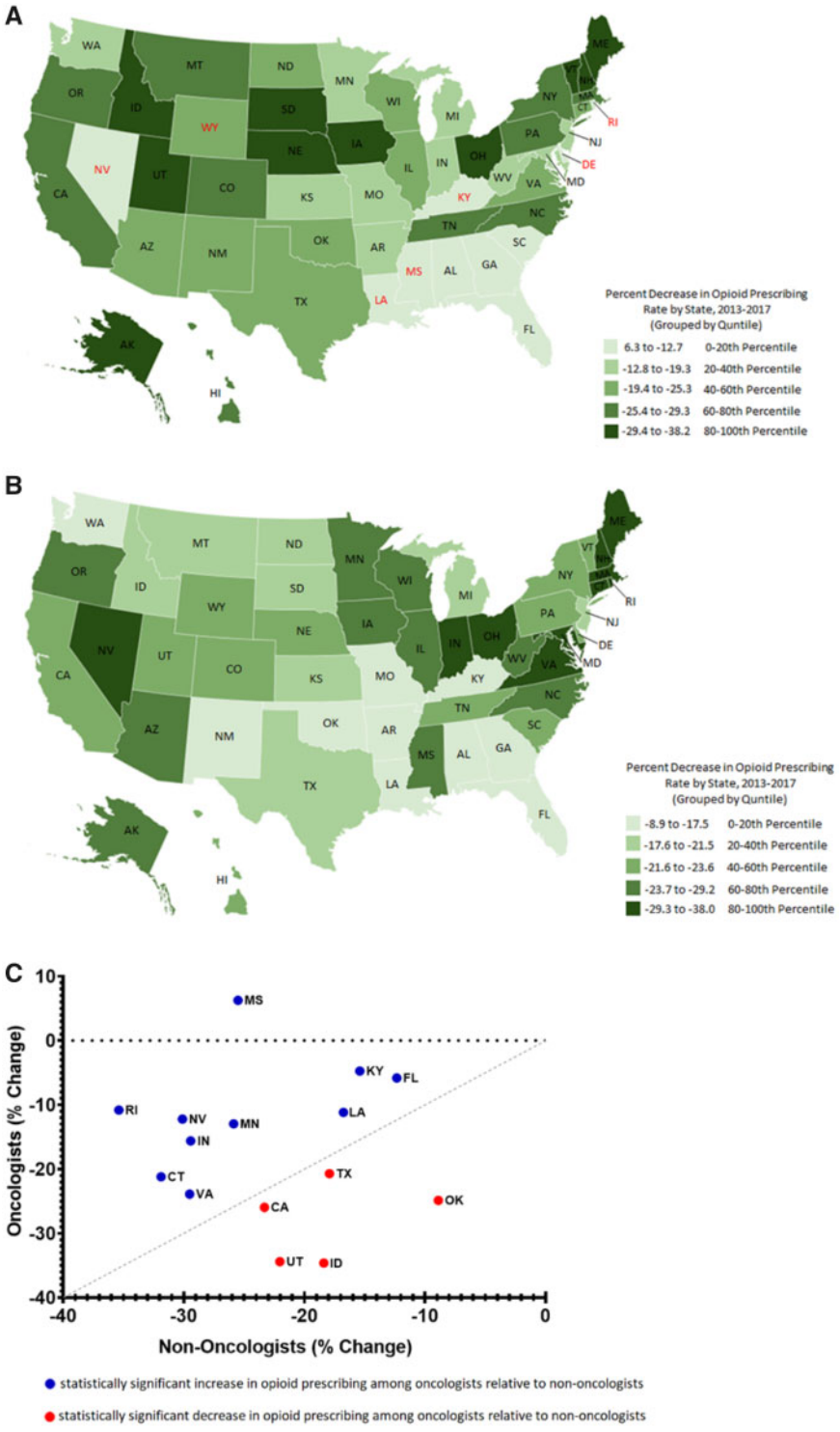

Figure 3. Time trends of adjusted opioid-prescribing rate across individual states, 2013-2017. Time trends in opioid prescribing are shown for **A**) oncologists, **B**) nononcologists, and **C**) both oncologists and nononcologists. States with a nonstatistically significant change in opioid prescribing in panel A are abbreviated in red.

which encompassed 1 year after publication of the Centers for Disease Control and Prevention opioid-prescribing guidelines in March 2016. Examination of more recent prescriber data will clarify whether these guidelines have affected opioid prescribing. Nevertheless, there are growing concerns about inadequate opioid prescribing and reduced access to effective pain management in cancer survivors living with chronic pain (11,12,30). A 2018 survey of patients with cancer and survivors revealed that 35% of respondents reported their physician refused to give them an opioid prescription, and almost one-half reported their physician told them their pain treatment options were limited by laws, guidelines, or insurance coverage (31).

Another study found a nearly 50% reduction in the morphine equivalent daily dose in patients with cancer referred to an outpatient palliative care clinic between 2010 and 2015 (24). Although caution against opioid misuse in cancer survivors is certainly warranted (32,33), appropriate pain management is equally critical to ensure the best quality of life for these patients.

The limitations of this study are related to this dataset and inherent to those of retrospective analyses. First, this cohort is restricted to the Medicare population with a Part D plan and may not be generalizable to other populations. For example, opioid prescribing may be higher in the overall cancer population, because studies show that pain symptoms are often undertreated in the elderly (34). Second, although we recognize the critical role that advanced practice providers play in pain management, we excluded nurse practitioners and physician assistants from this study due to concerns regarding specialty misclassification among these provider groups. Third, the true estimate of the opioid-prescribing rate in this cohort will likely differ from what our study reported because of suppressed data. However, claims from suppressed data represented less than 2% of the total opioid claim count. Fourth, the dataset lacks any patient-level information, rendering it impossible to determine the clinical appropriateness of opioid-prescribing behavior. Fifth, by excluding specialties that treat a mix of benign and oncologic conditions, we are likely underestimating the true magnitude of opioid prescribing for patients with cancer. Sixth, the Medicare Part D dataset lacks information on dose and pill count per claim, which would add more granular information on prescribing habits. Despite these limitations, given the overall paucity of data on opioid-prescribing patterns among oncologists, the CMS Medicare Part D PUF is one of the few datasets that can be used to study this topic effectively.

Our study showed that between 2013 and 2017, opioid prescribing declined by 21% and 23% among both oncologists and nononcologists, respectively. During this time frame, there was a modest increase in gabapentin prescribing among oncologists and opioid prescribing among palliative care providers. Given the similar decreases in opioid prescribing among oncologists and nononcologists, concerns remain about whether opioid-prescribing legislation and guidelines intended for the noncancer population are being applied inappropriately to patients with cancer and survivors. Further study is needed to determine how these prescribing changes have affected the care of this patient population.

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Data Availability

The data underlying this article are available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Provider-Charge-Data/Part-D-Prescriber

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