Temporal Trends and Predictors of Opioid Use Among Older Patients With Cancer

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Objectives: While opioids represent a cornerstone of cancer pain management, the timing and patterns of opioid use in the cancer population have not been well studied. This study sought to explore longitudinal trends in opioid use among Medicare beneficiaries with nonmetastatic cancer.

Materials and Methods: Within a cohort of 16,072 Medicare beneficiaries ≥66 years old diagnosed with nonmetastatic cancer between 2007 and 2013, we determined the likelihood of receiving a short-term (0 to 6 mo postdiagnosis), intermediate-term (6 to 12 mo postdiagnosis), long-term (1 to 2 y postdiagnosis), and high-risk (morphine equivalent dose ≥90 mg/day) opioid prescription after cancer diagnosis. Multivariable logistic regression models were used to identify patient and cancer risk factors associated with these opioid use endpoints.

Results: During the study period, 74.6% of patients received an opioid prescription, while only 2.66% of patients received a high-risk prescription. Factors associated with use varied somewhat between short-term, intermediate-term, and long-term use, though in general, patients at higher risk of receiving an opioid prescription after their cancer diagnosis were younger, had higher stage disease, lived in regions of higher poverty, and had a history of prior opioid use. Prescriptions for high-risk opioids were associated with individuals living in regions with lower poverty.

Conclusions: Temporal trends in opioid use in cancer patients depend on patient, demographic, and tumor characteristics. Overall, understanding these correlations may help physicians better identify patient-specific risks of opioid use and could help better inform future evidence-based, cancer-specific opioid prescription guidelines.

Key Words: opioids, pain, Medicare, cancer

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Opioids comprise a vital means of managing pain in cancer patients, who have exceptionally high rates of reported pain.[1,2] Nevertheless, specific guidelines for the safe use of opioids in the cancer population have not been well established, and clinicians must often turn to data from noncancer cohorts to guide cancer pain management.[3–6] In the midst of the ongoing opioid epidemic, the lack of cancer-specific opioid guidelines can generate confusion surrounding opioid prescription practices for oncology patients. For instance, the Centers for Disease Control and Prevention (CDC) released guidelines on opioid prescriptions in 2016.[7] These guidelines were frequently misapplied to patients with cancer, leading the CDC to revise its position to exclude these patients in 2019.[8,9] The lack of clear recommendations for appropriate opioid use in cancer patients can create barriers to medically appropriate cancer pain relief.[10] Thus, there is a need for the development of cancer-specific opioid prescription guidelines.

The development of evidence-based oncology-specific opioid prescription guidelines first requires a clear understanding of the patterns of acute and long-term opioid use among cancer patients. Patterns of opioid use in the general population have been well-described; however, few studies have explored patterns of opioid use among cancer patients.[11] Opioid use in this population should ideally focus on providing opioids to appropriate individuals with pain while minimizing adverse outcomes associated with their long-term use. Research demonstrates that opioids can place cancer patients at risk for opioid abuse,[12] toxicity,[13] and even death.[14] One must also consider the impact of opioid dose given that the risk of opioid overdose and opioid-related mortality rise sharply with morphine equivalent doses (MEDs) greater than 90 mg/day.[15–17] Indeed, the CDC recommends against increasing opioid MEDs to 90 mg/day or above without careful justification[7]; yet, research has not addressed patterns of high-dose opioid use among cancer patients. This project seeks to fill these knowledge gaps with a retrospective cohort study that assessed patterns of use and factors associated with short-term, intermediate term, and long term as well as high-risk opioid use among Medicare beneficiaries with cancer. This work can help support the development of opioid prescription guidelines for cancer-related pain.

MATERIALS AND METHODS

Data Source

Cancer patients were selected from the Surveillance, Epidemiology, and End Results (SEER) database linked to Medicare claims. SEER encompasses a geographically diverse collection of cancer registries that collectively account for 28% of cancer diagnoses in the United States. The SEER database collects information on incident cancer diagnoses including information on staging and treatment, as well as patient-level demographic information. Medicare provides federally funded health insurance to individuals age 65 years and older within the United States. Medicare data includes information about diagnoses, inpatient hospitalizations, emergency department visits, outpatient encounters, and prescription drug data, which together allow for longitudinal assessment of patterns of care for elderly cancer patients.

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Study Population

This cohort included patients age 66 years or above diagnosed with breast, colorectal, head and neck, liver, lung, or prostate cancer between 2007 and 2013. In seeking to understand long-term opioid use patterns, we required that patients survive at least 2 years after diagnosis. We required patients to have continuous Medicare coverage from 1 year before cancer diagnosis (to assess preexisting conditions) through 2 years after diagnosis (to assess outcomes). Continuous Medicare coverage included enrollment in Medicare prescription drug coverage (Part D) as well as continuous hospital (Part A) and doctor/outpatient services (Part B) coverage without managed care (Part C) coverage. We sought to focus on patients with potentially curable cancer, therefore we excluded patients with missing staging information or metastatic disease on presentation. We identified 22,968 patients aged 66 or above diagnosed with the above cancers between 2007 and 2013 with continuous Medicare enrollment at least 1 year before diagnosis through 2 years' survival after cancer diagnosis. Of these, 5481 patients had metastatic disease and 1415 patients had missing staging data. The final study cohort included 16,072 patients.

Study Covariates

We used SEER tumor registry data to obtain baseline patient demographic and tumor data.[18] For information on treatment and comorbidities, we used physician claims data from Medicare, including International Classification of Disease codes 9th edition (ICD-9). To assess patient comorbidities, we used the National Cancer Institute (NCI)-adapted Charlson Comorbidity Index,[19] a standardized methodology for translating medical claims in the year before cancer diagnosis into a numerical estimate of noncancer comorbidity burden. Similarly, ICD-9 codes were used to capture precancer diagnoses of depression and "high-risk" psychiatric diagnoses, including bipolar disorder, schizophrenia, obsessive compulsive disorder, and attention deficit disorder.[3,12,20]

Prior Opioid Use

Opioid prescription data, including prior opioid use and the opioid use endpoints defined below, were ascertained from Medicare Part D data. Using prior methodology,[21–23] we defined patients as "opioid naïve" if no prescriptions were filled in the year before diagnosis. We defined patients as "chronic opioid users" if they received $\geq$120 days' supply of opioids in the year before diagnosis.[22–24] "Intermittent opioid users" were defined as patients with opioid use in the year before cancer diagnosis who did not meet criteria for chronic opioid use.[24]

Endpoints

The endpoints of this study included receipt of an opioid prescription in the short-term (0 to 6 mo after cancer diagnosis), intermediate term (6 to 12 mo after diagnosis), or long term (1 to 2 y after diagnosis). In addition, we assessed the receipt of a high-dose opioid prescription (MED $\geq$90 mg/day) at any point within the first 2 years after diagnosis. MEDs for each prescription were calculated to convert prescribed opioid doses and strengths into standard values with the following formula:[25]

$$\text{MED} = \frac{(\text{strength per unit}) \times (\text{quantity dispensed}) \times (\text{MME conversion factor})}{(\text{days supply})}$$

Statistical Analysis

We used standard multivariable logistic regression models to identify associations between our study endpoints and predictive variables. Variables included in the multivariable models were chosen a priori and included year of diagnosis (2007 to 2009 vs. 2010 to 2013), tumor site, stage as assessed by the American Joint Committee on Cancer Staging, age at diagnosis, sex, ethnicity, race, marital status, original reason for Medicare entitlement, population density, local poverty rate, Charlson comorbidity index, prior diagnosis of depression, prior "high-risk" psychiatric diagnosis, and prior opioid use (defined above). Statistical analyses were performed using R version 3.6.1 (https://cran.r-project.org/). All tests were 2-sided and a P-value <0.05 was considered statistically significant.

RESULTS

Patient and clinical characteristics are summarized in Table 1. Among the 16,072 patients in this study 11,994 (74.6%) received an opioid prescription and 427 (2.66%) received a high-risk opioid prescription in the first 2 years after cancer diagnosis. Figure 1 demonstrates the patterns of opioid use across the study period. The figure demonstrates that the rates of total (7.7% of total prescriptions) and high-risk (6.4% of total high-risk prescriptions) prescriptions were highest in the second month after diagnosis. While the rates of total and high-risk prescriptions declined overall throughout the 2-year study period, the rate of each prescription type increased slightly at about 1 year after diagnosis.

Patient and clinical factors associated with short-term, intermediate-term, and long-term opioid use on multivariable logistic regression analysis are shown in Table 2. Compared with patients diagnosed between 2007 and 2009, patients diagnosed between 2010 and 2013 had higher odds of receiving a short-term prescription (odds ratio [OR] = 1.20, 95% confidence interval [CI] = 1.12-1.29, $P < 0.001$). Compared with breast cancer patients, colon, rectal, lung, and prostate cancer patients were less likely to receive a short-term opioid prescription, while head and neck cancer patients were more likely to receive an opioid. Higher cancer stage at diagnosis, Asian/Pacific Islander race, higher local poverty level, history of depression, and prior opioid use were associated with a greater likelihood of receiving a short-term opioid prescription. Older and single patients as well as patients with higher Charlson comorbidity scores were also less likely to receive an opioid prescription in the short-term.

There was no difference in the probability of receiving an intermediate-term opioid prescription between patients diagnosed in more recent versus later years (OR = 1.02, 95% CI = 0.95-1.11, $P = 0.29$). Compared with breast cancer patients, rectum, head and neck, liver, and lung cancer patients were more likely to receive an opioid, while prostate cancer patients were less likely to receive an intermediate-term opioid prescription. Higher cancer stage at diagnosis, female sex, greater local poverty level, higher Charlson comorbidity score, divorced status, original Medicare entitlement because of disability or end-stage renal disease (ESRD), history of depression, prior/current tobacco use, and prior opioid use were associated with a greater likelihood of an intermediate-term prescription. Older patients were less likely to receive an opioid during this time.

The odds of receiving a long-term opioid prescription declined among patients diagnosed at later time points (OR = 0.79, 95% CI = 0.74-0.85, $P < 0.001$). Compared with breast cancer patients, head and neck, liver, and lung cancer patients were more likely to receive an opioid 1 to 2 years after diagnosis, while prostate cancer patients were less likely to receive an opioid during this time. Higher cancer stage at diagnosis,

TABLE 1. Patient, Cancer, and Treatment Characteristics

Covariate	No. (%), n = 16,072
Tumor site	
Breast	3256 (20.3)
Colon	2723 (16.9)
Rectum	478 (3.0)
Head and neck	1883 (11.7)
Liver	749 (4.7)
Lung	2728 (17.0)
Prostate	4255 (26.5)
AJCC stage	
0	111 (0.7)
I	5562 (34.6)
II	6657 (41.4)
III	2758 (17.2)
IV	984 (6.1)
Year of diagnosis	
2007-2009	6965 (43.3)
2010-2012	9107 (56.7)
Sex	
Male	8107 (50.4)
Female	7965 (49.6)
Median age at diagnosis (range)	75 (66-106)
Ethnicity	
Hispanic	573 (3.6)
Non-Hispanic	15,499 (96.4)
Race	
White	13,803 (85.9)
Black	963 (6.0)
Asian/Pacific Islander	1130 (7.0)
American Indian/Alaskan	49 (0.3)
Other	127 (0.8)
Marital status	
Married	8413 (52.3)
Single	1315 (8.2)
Divorced	1316 (8.2)
Other	5014 (31.2)
Original reason for Medicare entitlement	
Age	14,575 (90.7)
Disability or ESRD	1497 (9.3)
Percent living below poverty line	
0%-5%	4285 (26.7)
5%-10%	4773 (29.7)
10%-20%	4770 (27.8)
20%-100%	2396 (14.9)
Unknown	148 (0.9)
Charlson comorbidity index	
0	7509 (46.7)
1	4568 (28.4)
2	2017 (12.5)
3+	1978 (12.3)
Current/prior tobacco use	2584 (16.1)
Prior diagnoses	
Depression	2684 (16.7)
High-risk psychiatric condition	138 (0.9)
Prior opioid use	
None	11,417 (71.0)
Intermittent	3644 (22.7)
Chronic	1011 (6.3)

AJCC indicates American Joint Committee on Cancer Staging; ESRD, end-stage renal disease; MED, morphine equivalent dose.

original Medicare entitlement because of disability or ESRD, Native American/Alaskan race, Hispanic ethnicity, greater local poverty level, higher Charlson comorbidity score, history of depression, prior/current tobacco use, and prior opioid use were associated with a greater likelihood of opioid prescription 1 to 2 years after diagnosis. Older and single patients were less likely to receive an opioid during this time.

Associations between high-risk opioid use and patient and clinical characteristics are illustrated in Table 3. There was no significant difference in the likelihood of receiving an MED ≥ 90 mg/day between patients diagnosed between 2007 and 2009 and 2010 and 2013 (OR = 0.94, 95% CI = 0.77-1.15, $P = 0.55$). Head and neck and lung cancer patients were more likely to receive a high-risk prescription than breast cancer patients. Native American/Alaskan patients were more likely to receive high-risk opioid prescriptions, while higher local poverty rate and a history of intermittent opioid use were associated with a lower likelihood of receiving a high-risk prescription.

DISCUSSION

A major goal of opioid use in the cancer population is to adequately address pain while minimizing the risk of opioid-related toxicity. Opioid prescription guidelines for the non-cancer population may not generalize to cancer patients, who comprise a distinct population with unique requirements for pain relief. In an effort to better understand opioid use patterns in the cancer population, we explored trends in short-term, intermediate term, and long term as well as high-risk opioid use among Medicare beneficiaries with nonmetastatic cancer.

The majority of patients in this cohort received an opioid at some point during the study period. As one might expect, the highest rates of total and high-risk opioid prescriptions occurred immediately after diagnosis, when most patients undergo treatment for their cancer. Of note, after initially declining, the rate of both prescription types rose again toward the middle of the study period. This may reflect increasing opioid requirements secondary to disease progression over time or opioid tolerance and dependence with long-term use. Indeed, prior opioid use is associated with a substantial risk for subsequent opioid dependence and abuse.[12,26] Further studies are needed to understand the drivers of the longer-term rise in opioid prescription volume seen in this study.

While patients diagnosed with cancer between 2010 and 2013 were more likely to receive an opioid in the short-term, they were less likely to receive a long-term opioid prescription. There was no difference in the likelihood of receiving a high-risk prescription between patients diagnosed in earlier versus later years. The underlying cause of these temporal trends remains unclear, though one must consider the impact of opioid prescription policy on long-term trends. Since 2009, multiple organizations have published guidelines for opioid use in the general population.[5,7,27] While not specifically geared toward the cancer population, these guidelines have had unintended consequences on opioid prescription rates among cancer patients. A recent study[28] found that opioid prescription rates declined significantly among oncologists and nononcologists between 2013 and 2017, suggesting that restrictive opioid prescription policies are increasingly being applied inappropriately to cancer patients. Another study reported that the proportion of oncologists' patients that filled opioid prescriptions declined by 4.8% between 2013 and 2017 in states with mandated prescription drug monitoring programs compared with only 2.8% in states without them.[29] Similarly, a report from the American Cancer Society Action Network and Patient Quality of Life Coalition found that cancer patients and survivors faced markedly increased difficulty in access to their opioid medications between 2016 and 2018.[10] It is important to note that this study assessed longitudinal trends in opioid use before 2017, when the opioid crisis was declared a national

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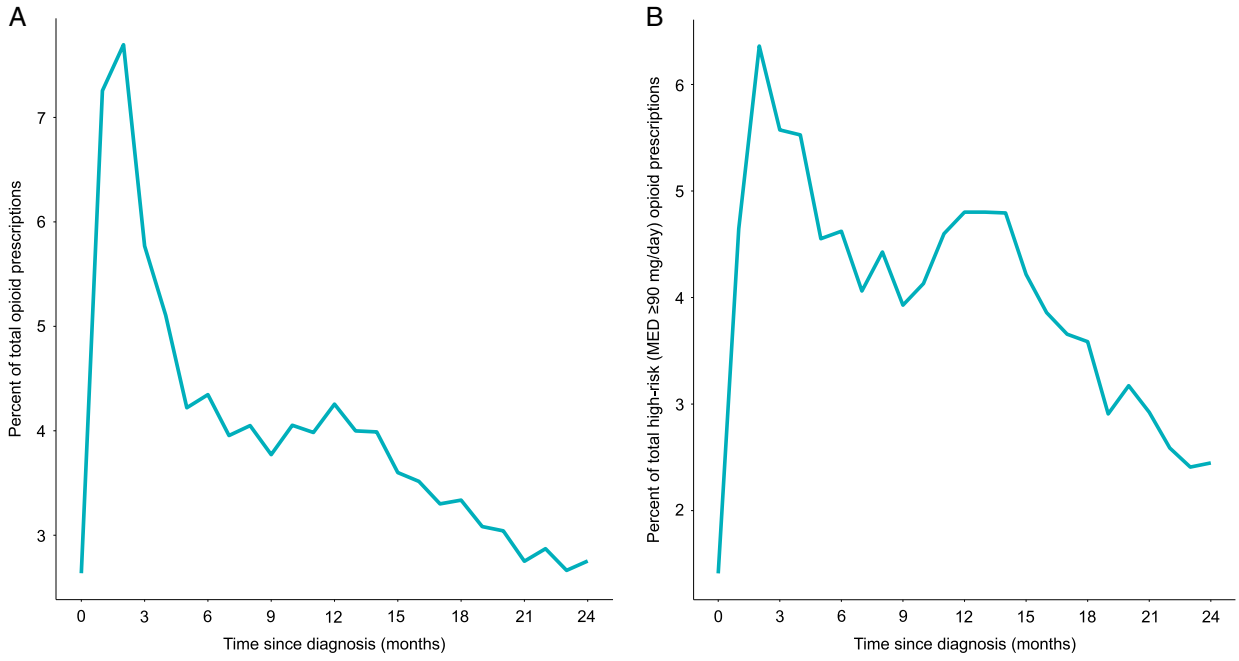

FIGURE 1. Patterns of opioid use across the study period. Fraction of (A) total opioid prescriptions and (B) total high-risk (morphine equivalent dose ≥90 mg/day) opioid prescriptions prescribed each month after cancer diagnosis during the study period. full color online

emergency; this may in part explain why we did not observe a decrease in high-risk opioid use over time. Future studies examining patterns of opioid use among cancer patients at the height of the opioid epidemic will reveal the impact of stricter opioid restrictions enacted during this time.

We found varying patterns of opioid use among different cancer sites across the study period. Some of this variation may arise from differences in treatment between cancer types and the central role of opioids in the management of postoperative pain. For example, surgery is the primary component of curative therapy for all nonmetastatic breast cancer patients,[30] who served as the reference group in our analysis. Breast cancer surgery is typically performed within 6 weeks of diagnosis,[31] which may have influenced the apparent short-term opioid use odds of other cancer types. Though we were unable to assess patients' pain levels with this dataset, our findings additionally suggest that pain severity plays a role in patients' risk of longer-term and high-risk opioid use. We found that patients more likely to experience greater pain severity, including those with a higher cancer stage at diagnosis and with cancers requiring more intensive, multimodal therapy, such as liver, head and neck, and lung cancers, had a higher risk of receiving opioids in the intermediate term and long term.[32] Similarly, cancers with a higher symptom burden, such as lung cancer,[33] portended a greater likelihood of high-risk opioid use. These findings have been echoed in previous studies of cancer patients.[34,35]

In accordance with several prior studies,[12,36–38] we found that patients with worse functional status had a higher risk of longer-term opioid use. Indeed, patients with higher Charlson comorbidity scores were more likely to receive an opioid 6 months to 2 years after their cancer diagnosis. Similarly, patients who originally qualified for Medicare secondary to disability or ESRD, as opposed to age, were more likely to receive intermediate-term and long-term prescriptions. Patients with more medical comorbidities at baseline face higher morbidity following cancer treatment,[39] and may thus have a greater requirement for pain relief in the long term from their cancer or underlying comorbidity. Our findings suggest that cancer patients with poor functional status may be exceptionally shielded from stricter opioid prescription laws.[40] Nevertheless, these patients are not immune to the dangers of opioid misuse; patients who qualify for Medicare because of disability comprise a disproportionate number of opioid deaths among all Medicare enrollees in the general population.[41] Further work is needed to delineate opioid prescription policy in this unique patient population.

Younger age, tobacco use, history of depression, and prior opioid use were all associated with a greater likelihood of receiving short-term, intermediate-term, and long-term prescriptions. These factors have been identified as predictors of problematic opioid use in cancer and noncancer patients.[12,42–44] Interestingly, patients with a history of prior intermittent opioid use were less likely to receive a high-dose prescription compared with opioid naive patients. We cannot ascertain the underlying cause for this association, though this may be attributed to prescribers' heightened awareness of the risks of opioid medications, particularly among patients with a history of prior opioid use.

Finally, we identified racial and socioeconomic differences in opioid use. Black patients were more likely to receive opioids in the intermediate period, while Native American/Alaskan patients were more likely to receive long-term prescriptions. In addition, higher local poverty rates were consistently associated with a greater likelihood of opioid prescription. This finding has been replicated in prior studies of noncancer patients,[45,46] yet it is unclear if this is because patients with a lower socioeconomic status experience more pain,[47,48] more often see doctors inclined to prescribe opioids,[49] or have reduced access to evidence-based addiction treatment.[50,51] Alternatively, lower socioeconomic status was associated with reduced odds of receiving a high-risk prescription. Studies of opioid use in the noncancer population

TABLE 2. Multivariable Logistic Regression Analysis of the Likelihood of Opioid Prescription Between 0 to 6 Months, 6 to 12 Months, and 1 to 2 Years

	0-6 mo Postdiagnosis		6-12 mo Postdiagnosis		1-2 y Postdiagnosis	
Covariate	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Year of diagnosis						
2007-2009	Ref		Ref		Ref	
2010-2013	1.20	**1.12-1.29**	1.02	0.95-1.11	0.79	**0.74-0.85**
Tumor site						
Breast	Ref		Ref		Ref	
Colon	0.50	**0.44-0.56**	0.88	0.77-1.01	0.97	0.86-1.09
Rectum	0.58	**0.47-0.72**	1.98	**1.58-2.48**	1.22	0.98-1.52
Head/neck	2.12	**1.77-2.54**	1.57	**1.34-1.84**	1.20	**1.03-1.40**
Liver	0.86	0.70-1.05	2.68	**2.21-3.26**	1.97	**1.64-2.39**
Lung	0.73	**0.64-0.83**	1.53	**1.34-1.75**	1.52	**1.34-1.72**
Prostate	0.19	**0.17-0.23**	0.82	**0.70-0.96**	0.84	**0.72-0.97**
AJCC stage						
0	Ref		Ref		Ref	
I	1.50	1.00-2.27	0.96	0.60-1.54	1.23	0.79-1.91
II	1.58	**1.06-2.38**	1.22	0.76-1.95	1.40	0.90-2.18
III	2.24	**1.48-3.39**	1.56	0.97-2.50	1.84	**1.18-2.87**
IV	3.60	**2.28-5.69**	2.30	**1.41-3.78**	2.44	**1.53-3.90**
Age, per 10 y	0.51	**0.48-0.54**	0.82	**0.77-0.87**	0.93	**0.88-0.98**
Female sex	0.95	0.85-1.06	1.17	**1.05-1.30**	1.08	0.98-1.19
Race						
White	Ref		Ref		Ref	
Native American/Alaskan	1.95	0.91-4.17	1.46	0.78-2.76	2.12	**1.12-4.02**
Black	1.14	0.96-1.36	1.16	0.98-1.37	1.16	0.99-1.36
Asian/Pacific Islander	1.23	**1.06-1.41**	0.90	0.78-1.04	0.95	0.83-1.09
Not specified	1.33	0.65-2.73	1.28	0.59-2.76	0.97	0.46-2.04
Hispanic	1.13	0.92-1.39	1.04	0.85-1.27	1.22	**1.01-1.47**
Marital status						
Married	Ref		Ref		Ref	
Single	0.84	**0.73-0.97**	1.11	0.96-1.28	0.95	0.83-1.09
Divorced	0.92	0.80-1.06	1.17	**1.02-1.35**	1.09	0.97-1.16
Other	1.00	0.91-1.09	1.02	0.93-1.12	1.06	0.97-1.16
Original reason for Medicare entitlement						
Age	Ref		Ref		Ref	
Disability	0.88	0.77-1.01	1.21	**1.06-1.38**	1.34	**1.19-1.53**
Urban location	0.92	0.75-1.12	0.91	0.73-1.13	0.95	0.77-1.16
Local poverty level						
0%-5%	Ref		Ref		Ref	
5%-10%	1.02	0.93-1.12	1.13	**1.02-1.25**	1.06	0.97-1.16
10%-20%	0.99	0.90-1.09	1.15	**1.03-1.27**	1.03	0.94-1.13
20%-100%	1.15	**1.00-1.30**	1.28	**1.12-1.45**	1.30	**1.15-1.46**
Charlson comorbidity score						
0	Ref		Ref		Ref	
1	0.97	0.89-1.06	1.12	**1.02-1.23**	1.10	**1.02-1.20**
2	0.97	0.80-1.09	1.34	**1.19-1.51**	1.13	**1.01-1.27**
3+	0.91	0.80-1.03	1.36	**1.21-1.54**	1.20	**1.07-1.35**
Prior diagnoses						
Depression	1.14	**1.03-1.26**	1.25	**1.13-1.39**	1.17	**1.06-1.29**
High-risk psychiatric dx	0.96	0.65-1.44	0.93	0.63-1.40	0.88	0.60-1.28
Prior/current tobacco use	0.98	0.88-1.09	1.27	**1.14-1.41**	1.29	**1.17-1.43**
Prior opioid use						
None	Ref		Ref		Ref	
Intermittent	2.08	**1.91-2.27**	2.64	**2.43-2.87**	2.42	**2.24-2.62**
Chronic	55.7	**33.3-93.4**	49.2	**36.8-65.9**	30.1	**22.9-39.5**

Bold value indicates statistical significance ($P < 0.05$).

Multivariable logistic regression analysis of the likelihood of receiving an opioid prescription between 0 to 6 months, 6 to 12 months, and 1 to 2 years after cancer diagnosis.

AJCC indicates American Joint Cancer Committee on Cancer Staging; CI, confidence interval; OR, odds ratio.

have found an opposite trend, with poorer patients more likely to receive high-dose opioids,[52] suggesting that opioid use patterns may differ between cancer and noncancer patients. We are unable to assess the appropriateness of opioid prescriptions in this cohort; therefore, we cannot comment on the significance of these disparate findings. Ultimately, any racial or socioeconomic difference in prescription rates highlights the potential for disparities in opioid use among cancer patients. Additional research with data assessing prescription appropriateness is needed to fully characterize the disparities in opioid use seen here.

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TABLE 3. Likelihood of Receiving a High-risk (MED ≥90 mg/day) Opioid Prescription in the First Two Years After Cancer Diagnosis

Covariate	OR	95% CI
Year of diagnosis		
2007-2009	Ref	
2010-2013	0.94	0.77-1.15
Tumor site		
Breast	Ref	
Colon	1.17	0.79-1.73
Rectum	1.58	0.85-2.93
Head and neck	2.46	**1.65-3.68**
Liver	1.41	0.80-2.47
Lung	2.08	**1.45-2.98**
Prostate	0.84	0.54-1.31
AJCC stage		
0	Ref	
I	0.45	0.16-1.28
II	0.50	0.17-1.42
III	0.65	0.28-1.86
IV	0.84	0.28-2.51
Sex		
Male	Ref	
Female	0.93	0.72-1.20
Age, per 10 y	0.91	0.78-1.08
Hispanic ethnicity	0.58	0.30-1.11
Race		
White	Ref	
Native American/Alaskan	2.96	**1.02-8.58**
Black	1.01	0.64-1.60
Asian/Pacific Islander	1.04	0.71-1.53
Not specified	1.44	0.19-10.7
Marital status		
Married	Ref	
Single	1.18	0.83-1.69
Divorced	1.15	0.82-1.63
Other	1.03	0.81-1.32
Original reason for Medicare entitlement		
Age	Ref	
Disability or ESRD	1.25	0.90-1.73
Area		
Rural	Ref	
Urban	1.35	0.68-2.65
Percent living below poverty line		
0%-5%	Ref	
5%-10%	0.72	**0.60-0.99**
10%-20%	0.75	**0.57-0.97**
20%-100%	0.71	0.51-1.00
Charlson comorbidity index		
0	Ref	
1	0.90	0.71-1.14
2	0.95	0.69-1.29
3+	0.91	0.65-1.27
Current/prior tobacco use	0.84	0.63-1.10
Prior diagnoses		
Depression	1.07	0.82-1.39
High-risk psychiatric condition	0.49	0.12-2.00
Prior opioid use		
None	Ref	
Intermittent	0.45	**0.34-0.60**
Chronic	0.92	0.64-1.34

Bold value indicates statistical significance ($P < 0.05$).

Multivariable logistic regression analysis of the likelihood of a prescription with MED ≥90 mg/day among cancer patients who survived ≥2 years beyond diagnosis.

AJCC indicates American Joint Committee on Cancer Staging; CI, confidence interval; ESRD, end-stage renal disease; MED, morphine equivalent dose; OR, odds ratio.

This study has several limitations. Patients included in our cohort may have received additional opioid prescriptions not captured by Medicare claims data, leading to underestimation of opioid use rates. We required all included patients to have continuous hospital (Part A), doctor/outpatient services (Part B), and prescription drug (Part D) coverage without managed care (Part C) coverage. The rationale behind these inclusion criteria stemmed from the need to avoid missing data, yet one must consider that individuals without continuous insurance could represent a more vulnerable population with different opioid use patterns. One must also consider the possibility of misclassification of study variables when using claims data. While we hypothesize that this would occur at random, we cannot assess the possibility of whether biased misclassification could impact our results. Given that this study was conducted in Medicare-aged patients, the trends observed here may not reflect opioid use patterns in younger patients. Finally, we were unable to assess the appropriateness of opioid prescriptions, which limited our ability to fully define the racial and socioeconomic disparities observed in this analysis.

We present the first study to assess patterns of opioid use among Medicare beneficiaries with nonmetastatic cancer. We characterized opioid prescription rates within the first 2 years after cancer diagnosis, identified trends in short-term, intermediate-term, long-term, and high-risk opioid prescriptions over time, and uncovered patient and clinical factors associated with each type of opioid use. This work may ultimately support the development of cancer-specific opioid prescription guidelines.

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