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Multifactorial Determinants of Opioid Prescribing After Ambulatory Otolaryngology Surgery

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ABSTRACT

Objective: To examine the paradox of rising opioid mortality despite declining prescription rates, we evaluated the influence of surgical, surgeon, and patient factors on postoperative opioid prescribing in ambulatory otolaryngology.

Methods: We conducted a retrospective cohort study of 2,129 adults who underwent ambulatory otolaryngology procedures at a tertiary academic medical center from 2020 through 2023. Discharge prescriptions were converted to morphine milligram equivalents (MME). Associations between prescribing volume and covariates were examined using univariate analyses and multivariable negative binomial regression with surgeon-level random effects.

Results: Procedure type was the strongest determinant of prescribing. Compared with nasal procedures, oropharyngeal procedures were associated with nearly threefold higher MME (incidence rate ratio [IRR], 2.84; 95% confidence interval [CI], 2.24–3.59; $p < 0.001$). Trauma was associated with 44% higher MME (IRR, 1.44; 95% CI, 1.07–1.94; $p = 0.015$), while head and neck procedures were associated with 31% lower prescribing (IRR, 0.69; 95% CI, 0.54–0.89; $p = 0.003$). Patients who underwent multiple procedures had 71% higher MME (IRR, 1.71; 95% CI, 1.28–2.27; $p < 0.001$). Surgeon factors were also significant: those with ≤5 years of experience prescribed 43% less than those with >10 years (IRR, 0.57; 95% CI, 0.42–0.75; $p < 0.001$), and head and neck specialists prescribed 59% more than rhinologists (IRR, 1.59; 95% CI, 1.18–2.15; $p = 0.002$). Each 5-year increase in age corresponded to a 1% reduction in MME (IRR, 0.99; 95% CI, 0.97–1.00; $p = 0.041$). Patients who received a refill had been prescribed 21% more MME at discharge (IRR, 1.21; 95% CI, 1.03–1.43; $p = 0.021$). In unadjusted analyses, significant variation by race was observed ($p = 0.004$), with Black or African American patients receiving the highest median MME.

Conclusions: Postoperative opioid prescribing varied systematically by procedure type, surgeon characteristics, and patient factors, rather than representing a uniform response to pain. These results underscore the limitations of universal prescribing mandates and support the adoption of individualized, evidence-based opioid stewardship strategies that integrate procedure-specific, provider-level, and patient-level determinants.

INTRODUCTION

Opioid Epidemic Burden

The opioid crisis remains a major public health threat. Globally, more than 16 million people meet diagnostic criteria for opioid use disorder [1]. In the United States, the burden is substantial: nearly 450,000 deaths over the past two decades [2,3], a 292% increase in mortality between 2001 and 2016 [4], and an estimated 1.7 million years of life lost in recent years [5]. The economic impact is similarly large, with costs estimated at 78.5 billion dollars annually [4]. During the COVID-19 pandemic, mortality rose further, with opioid related deaths increasing by approximately 63% [6].

Surgery as an Opioid Gateway

Postoperative pain management has emerged as a critical contributor to the opioid crisis. Surgeons occupy a central position in this process, serving as the second most frequent prescribers of opioids after pain medicine specialists [7]. This pattern carries substantial iatrogenic risk. Between 3% and 10% of opioid-naïve patients become new persistent opioid users, continuing to take these medications for up to a year after routine, short-stay surgery [8–10]. These prescribing practices stem from a longstanding medical culture that prioritized aggressive pain control and normalized the routine use of opioids after surgery [5]. Surgeons now face a clinical dilemma: how to balance effective management of acute postoperative pain with the imperative to reduce the risk of long-term dependence.

Opioid Prescribing Paradox

The modern opioid crisis is characterized by a paradox: medical prescribing of opioids has declined, yet opioid-related mortality has continued to rise. A 2022 analysis reported a 38% reduction in prescriptions over the preceding decade, whereas deaths increased by nearly 300% during the same period [11]. The principal driver of this divergence is the spread of highly potent illicit synthetic opioids, such as fentanyl, which now dominate the drug supply [12]. However, this shift toward illicit use does not absolve the healthcare system of responsibility, as the path to illicit dependence often begins with a legitimate medical prescription [13,14]. Despite overall reductions in prescribing, opioid exposure remains widespread [12]; nearly 15% of the U.S. population continues to fill at least one opioid prescription each year [3]. This persistent exposure sustains a large population vulnerable to transition into an increasingly lethal illicit drug market. These dynamics underscore the continued importance of the surgeon's gatekeeper role, as each prescription represents a pivotal opportunity to prevent downstream harm.

Rationale and Study Objectives

The opioid prescribing paradox illustrates that strategies focused solely on reducing prescription volume are inadequate. Effective opioid steward-

Table 1. Association Between Patient Characteristics and Prescribed MME at Discharge Following Ambulatory Otolaryngology Procedures (n = 2,129)

Patient characteristic	Patients, *n* (%)	MME, median (IQR)	*p* value
Sex			0.337
Female	1,125 (52.8)	75 (50–100)	
Male	1,004 (47.2)	75 (50–100)	
Race			0.004
Asian	97 (4.6)	60 (40–90)	
Black/African American	205 (9.6)	80 (50–236.5)	
White	1,455 (68.3)	75 (50–100)	
Other/Unknown	372 (17.5)	75 (50–100)	
Ethnicity			0.282
Non-Hispanic	1,654 (77.7)	75 (50–100)	
Hispanic	376 (17.7)	75 (50 –110)	
Unknown	99 (4.7)	60 (50–100)	
Smoking status			0.768
Current	241 (11.3)	75 (50–100)	
Former	435 (20.4)	75 (50–100)	
Never	1,440 (67.6)	75 (50–100)	
Unknown	13 (0.6)	70 (35–100)	

Abbreviations: IQR, interquartile range; MME, morphine milligram equivalents.

ship requires a clearer understanding of the factors that drive prescribing behavior, yet significant knowledge gaps remain. The independent and combined contributions of procedure type, surgeon practice patterns, and patient characteristics to prescribing variation are not well quantified. This limitation has impeded the development of evidence-based, procedure-specific protocols necessary for safe and equitable pain management [15].

Accordingly, the primary objective of this study was to characterize postoperative opioid prescribing patterns in ambulatory otolaryngology. We aimed to quantify the total morphine milligram equivalents (MME) prescribed and to identify the surgical, surgeon, and patient-level factors independently associated with prescribing variation. These findings are intended to inform the development of standardized, data-driven institutional protocols that balance effective pain control with the imperative to reduce opioid-related harm.

METHODS

Study Design

We conducted a retrospective cohort study of adult patients (18 years of age or older) who underwent ambulatory otolaryngology procedures at a tertiary academic medical center between March 1, 2020, and March 31, 2023. Using data from the electronic medical record, we performed a cross-sectional analysis restricted to opioid prescriptions issued at hospital discharge. The primary outcome was the total prescribed opioid quantity, standardized to MME. We assessed the association of this outcome with a set of patient, procedural, and surgeon-level variables. The entire study period occurred during the COVID-19 pandemic, a context that may have influenced clinical and prescribing behaviors.

Patient Selection

The study cohort was composed of adult patients (18 years of age or older) who underwent an ambulatory otolaryngology procedure. Eligible procedures were classified into six primary categories: nasal, oropharyngeal, trauma, head and neck, otologic, and multiple procedures. We excluded patients from the analysis if the indication for surgery was an active malignancy or if they had a pre-existing diagnosis of chronic opioid use disorder. To ensure a comprehensive analysis of prescribing practices, patients who did not receive an opioid prescription (a total MME of zero) were retained in the final cohort.

Outcome Measures

The primary outcome was the total quantity of opioids prescribed at discharge, measured in MME and analyzed as a continuous variable. The total MME for each patient was calculated by summing the MME values for all discharge opioid prescriptions documented in the electronic medical record. This calculation was performed in accordance with the 2022 U.S. Centers for Disease Control and Prevention guidelines and conversion factors [16,17]. For medications containing multiple active ingredients, only the opioid component was included in the MME calculation.

Covariates

We assessed a set of prespecified covariates at the patient, surgical, and surgeon levels.

Patient-level covariates included age, sex, and race. The following comorbid conditions, identified from the electronic medical record, were also included in the analysis: hypertension, diabetes, chronic obstructive pulmonary disease, asthma, and psychiatric illness. Other patient characteristics, such as smoking status, were collected for descriptive purposes. The receipt of a subsequent prescription refill was also documented as a patient-level variable for use in an exploratory analysis.

Surgical covariates were defined by the primary procedure, which was classified into one of six categories: nasal, oropharyngeal, head and neck, trauma, otologic, or multiple procedures.

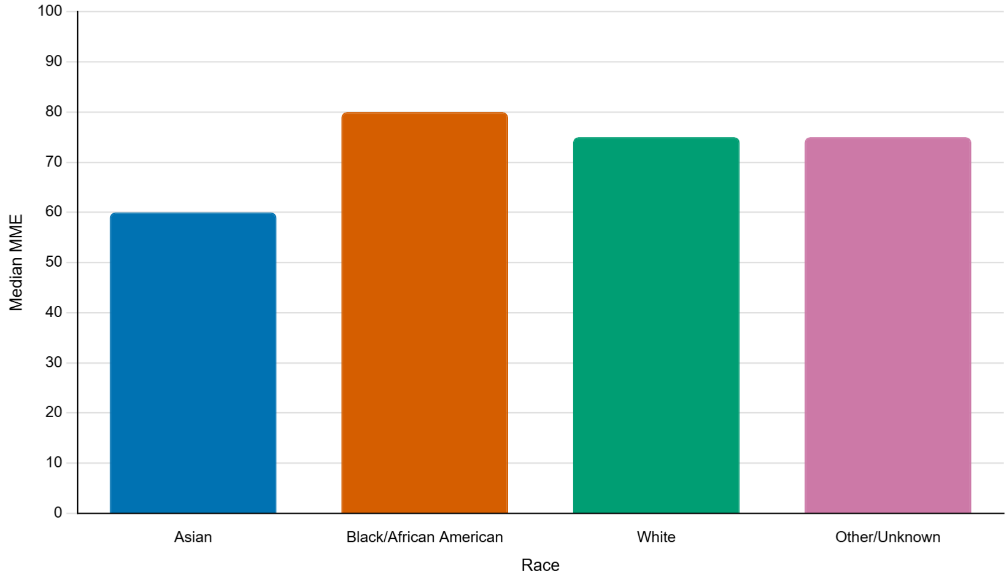

Figure 1. Racial variation in median discharge opioid prescribing after ambulatory otolaryngology surgery. The bar chart shows the median morphine milligram equivalents (MME) prescribed at discharge across four racial groups within the study cohort (n = 2,129). Prescribing volume differs significantly among groups (p = 0.004). Black/African American patients receive the highest median MME, whereas Asian patients receive the lowest, with White and Other/Unknown groups demonstrating intermediate values.

Surgeon-level covariates included subspecialty, sex, and years of post-residency clinical experience. Experience was categorized as 5 or fewer years, 6 to 10 years, or more than 10 years, with the last serving as the reference category in regression models.

Statistical Analysis

Baseline patient, surgical, and surgeon characteristics were summarized using frequencies and percentages for categorical variables. Continuous variables were reported as means with standard deviations (SD) and medians with interquartile ranges (IQR), depending on their distribution.

We first performed univariable analyses, including the use of the Kruskal-Wallis test, to evaluate initial associations between individual covariates and prescribed MME. To subsequently identify factors that were independently associated with the outcome, we developed a multivariable negative binomial regression model. This approach was chosen to address the overdispersed nature of the prescription data and to account for the clustering of prescribing patterns by individual surgeons through the use of surgeon-level random effects. Covariates for the final model were prespecified on the basis of clinical relevance and prior literature to represent distinct domains of influence, including patient, surgical, and surgeon characteristics. Key covariates were retained for adjustment regardless of their statistical significance in univariable analyses to mitigate confounding. Results from the model are reported as incidence rate ratios (IRR) with corresponding 95% confidence intervals (CI).

In a separate exploratory analysis, we evaluated the association between the initial MME prescribed at discharge and the subsequent receipt of a prescription refill. Since refills occur after discharge, this analysis was strictly associative and intended to generate hypotheses. These findings should therefore be interpreted as preliminary and not as evidence of causality. All statistical tests were two-sided, and a p value of less than 0.05 was considered statistically significant. Analyses were conducted using Stata, version 18 (StataCorp, 2023).

RESULTS

Patient Characteristics

The analytic sample included 2,129 patients (Table 1). The mean age was 46.7 years (SD, 18.3), and the median was 47 years (IQR, 32–61). A total of 52.8% were female. Patients were predominantly White (68.3%), followed by Black or African American (9.6%) and Asian (4.6%), with 17.5% classified as Other or Unknown. Most patients identified as non-Hispanic (77.7%).

Race was the only baseline demographic factor significantly associated with prescribed MME (p = 0.004). In contrast, age, sex, ethnicity, and smoking status were not significantly associated (p = 0.280–0.770). Among racial groups, Black or African American patients received the highest prescriptions (80; IQR, 50–236.5), Asian patients the lowest (60; IQR, 40–90), and White or Other/Unknown groups were intermediate (75; IQR, 50–100) (Table 1 and Figure 1).

Comorbid Conditions

The most prevalent comorbidity was osteoarthritis (38%), followed by hypothyroidism (10.7%), myocardial infarction (9.3%), obesity (8.8%), and neuropathy (7.8%). Several conditions were significantly associated with prescribed MME. Depression (p < 0.001) and anxiety (p = 0.042) were linked to higher prescriptions, with depression showing the greatest difference (100 vs. 75; IQR, 60–150 vs. 50–100). In contrast, hypothyroidism (p = 0.019; 60 vs. 75), liver disease (p = 0.008; 60 vs. 75), neuropathy (p < 0.001; 60 vs. 75), metastatic solid tumor (p = 0.002; 60 vs. 50), and renal disease (p = 0.009; 50 vs. 75) were each associated with lower prescriptions (Table 2).

Surgical and Surgeon Characteristics

Among 2,129 patients, the most common procedure was nasal surgery (38.6%), followed by otologic (22.7%), head and neck (22.6%), oropharyngeal (10.9%), and trauma (2.5%) (Table 3 and Figure 2). Approximately 2.7% underwent multiple procedures during admission, a proportion

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Table 2. Association Between Comorbid Conditions and Prescribed MME at Discharge Following Ambulatory Otolaryngology Procedures

Comorbidity	Patients, *n* (%)	MME, median (IQR)	*p* value
Depression			<0.001
No	2,059 (96.7)	75 (50–100)	
Yes	70 (3.3)	100 (60–150)	
Anxiety			0.042
No	2,037 (95.7)	75 (50–100)	
Yes	92 (4.3)	90 (50–120)	
Neuropathy			<0.001
No	1,963 (92.2)	75 (50–100)	
Yes	166 (7.8)	60 (30–100)	
Metastatic solid tumor			0.002
No	2,004 (94.1)	75 (50–100)	
Yes	125 (5.9)	60 (25–100)	
Liver disease			0.008
No	1,964 (92.2)	75 (50–100)	
Yes	165 (7.8)	60 (40–100)	
Renal disease			0.009
No	2,093 (98.3)	75 (50–100)	
Yes	36 (1.7)	50 (0–100)	
Hypothyroidism			0.019
No	1,902 (89.3)	75 (50–100)	
Yes	227 (10.7)	60 (40–100)	
Malignancy			0.076
No	2,072 (97.3)	75 (50–100)	
Yes	57 (2.7)	60 (40–100)	
Cardiac arrhythmias			0.078
No	2,077 (97.6)	75 (50–100)	
Yes	52 (2.4)	60 (0–100)	
Cardiovascular disease			0.366
No	2,094 (98.4)	75 (50–100)	
Yes	35 (1.6)	75 (25–100)	
Chronic obstructive pulmonary disease			0.792
No	2,093 (98.3)	75 (50–100)	
Yes	36 (1.7)	75 (45–110)	
Congestive heart failure			0.369
No	2,107 (99.0)	75 (50–100)	
Yes	22 (1.0)	67.5 (25–100)	
Metastatic cancer			0.978
No	2,081 (97.7)	75 (50–100)	
Yes	48 (2.3)	70 (33.8–135)	
Myocardial infarction			0.136
No	1,931 (90.7)	75 (50–100)	
Yes	198 (9.3)	75 (50–150)	
Obesity			0.346
No	1,941 (91.2)	75 (50–100)	
Yes	188 (8.8)	75 (50–106.3)	
Other neurologic disorders/migraine			0.138
No	2,051 (96.3)	75 (50–100)	
Yes	78 (3.7)	77.5 (50–100)	

Table 2. Association Between Comorbid Conditions and Prescribed MME at Discharge Following Ambulatory Otolaryngology Procedures (Continued)

Comorbidity	Patients, *n* (%)	MME, median (IQR)	*p* value
Other psychiatric conditions			0.500
No	2,067 (97.1)	75 (50–100)	
Yes	62 (2.9)	75 (40–120)	
Autoimmune disease			0.109
No	2,064 (96.9)	75 (50–100)	
Yes	65 (3.1)	70 (40–100)	
Rheumatoid arthritis/collagen vascular disease			0.174
No	2,003 (94.1)	75 (50–100)	
Yes	126 (5.9)	60 (40–100)	
Fibromyalgia			0.693
No	2,095 (98.4)	75 (50–100)	
Yes	34 (1.6)	75 (50–100)	
Osteoarthritis			0.652
No	1,321 (62.0)	70 (50–100)	
Yes	808 (38.0)	75 (50–100)	
Musculoskeletal disease			0.685
No	2,094 (98.4)	75 (50–100)	
Yes	35 (1.6)	75 (59–100)	

Abbreviations: IQR, interquartile range; MME, morphine milligram equivalents.

too small to materially affect overall results (median MME, 110; IQR, 60–236.5). Procedure type was significantly associated with prescribed MME ($p < 0.001$). Oropharyngeal procedures had the highest median prescription (236.5; IQR, 0), nearly five times that for head and neck or otologic procedures (50 for both), while nasal procedures showed intermediate values (75; IQR, 25–100) (Table 3 and Figure 3). Prescribing for oropharyngeal procedures showed no variability, with an IQR of zero.

Attending surgeons were predominantly male (72.3%), and female surgeons prescribed more MME than male surgeons (80 vs. 60; $p < 0.001$). Prescribing increased stepwise with experience, with median values of 50, 60, and 75 for surgeons with ≤5, 6–10, and >10 years of practice, respectively ($p < 0.001$). Rhinology was the most common subspecialty (35.7%), but the highest prescribing was observed among pediatric and comprehensive otolaryngologists (236.5 and 150, respectively), with the lowest among laryngology and neurotology specialists (50 for both).

Refills were uncommon: 92.9% of patients had none, whereas 7.1% had at least one. Among those with a refill, the initial prescription was

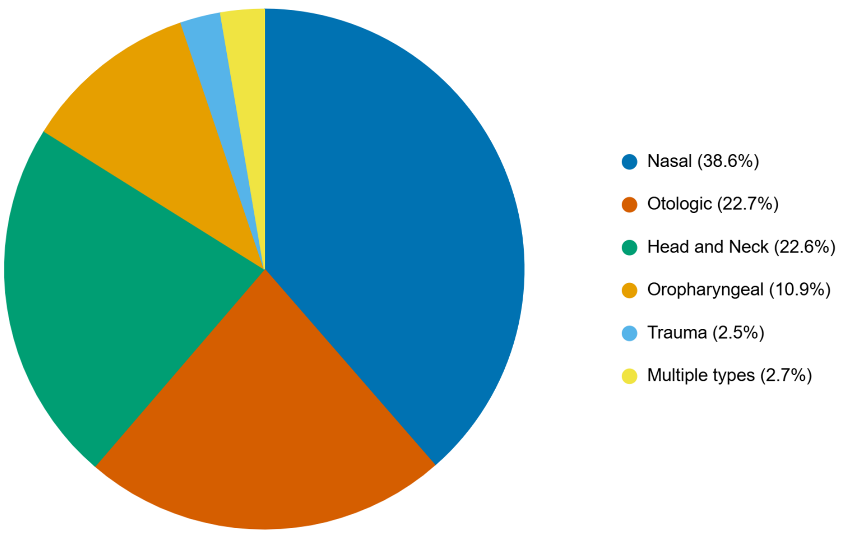

Figure 2. Distribution of surgical procedure types. The pie chart shows the proportional distribution of ambulatory otolaryngology procedures in the study cohort ($n = 2{,}129$). Percentages for each category are displayed to highlight relative case volumes across the major surgical groups.

Table 3. Association of Perioperative and Surgeon Characteristics with Prescribed MME at Discharge Following Ambulatory Otolaryngology Procedures (*n* = 2,129)

Characteristic	Patients, *n* (%)	MME, median (IQR)	*p* value
Prescription refill status			<0.001
Yes	152 (7.1)	100 (60–236.5)	
No	1,977 (92.9)	70 (50–100)	
Surgery type			<0.001
Oropharyngeal	232 (10.9)	236.5 (0)	
Trauma	53 (2.5)	100 (50–150)	
Nasal	821 (38.6)	75 (25–100)	
Head and neck	482 (22.6)	50 (25–100)	
Otologic	483 (22.7)	50 (40–80)	
Multiple procedures*	58 (2.7)	110 (60–236.5)	
Surgeon sex			<0.001
Female	589 (27.7)	80 (59–100)	
Male	1,540 (72.3)	60 (50–100)	
Surgeon experience, years			<0.001
>10	1,396 (65.6)	75 (50–100)	
6–10	649 (30.5)	60 (40–100)	
≤5	84 (4.0)	50 (25–225)	
Surgeon Specialty			<0.001
Pediatric	101 (4.7)	236.5 (100–236.5)	
Comprehensive	146 (6.9)	150 (60–236.5)	
Plastic and reconstructive	34 (1.6)	75 (50–100)	
Head and neck	361 (17.0)	75 (50–100)	
Rhinology	760 (35.7)	75 (50–100)	
Laryngology	217 (10.2)	50 (0–236.5)	
Neurotology	510 (24.0)	50 (40–80)	

*Patients who underwent more than one type of procedure during a single surgical encounter were classified into a distinct "multiple procedures" category for all analyses. Abbreviations: IQR, interquartile range; MME, morphine milligram equivalents.

significantly larger (100; IQR, 60–236.5) than among those without (70; IQR, 50–100; $p < 0.001$).

Adjusted Associations

In the fully adjusted multivariable negative binomial regression model with surgeon-level random effects (Table 4), several patient, surgical, and surgeon characteristics remained independently associated with prescribed MME. Using nasal procedures as the reference, oropharyngeal surgeries were associated with nearly three times higher prescribing (IRR, 2.84; 95% CI, 2.24–3.59; $p < 0.001$), trauma with 44% higher prescribing (IRR, 1.44; 95% CI, 1.07–1.94; $p = 0.015$), and multiple procedures with 71% higher prescribing (IRR, 1.71; 95% CI, 1.28–2.27; $p < 0.001$). Head and neck surgeries, in contrast, were associated with 31% lower prescribing (IRR, 0.69; 95% CI, 0.54–0.89; $p = 0.003$). These findings were consistent with the univariate distributions shown in Figure 3 and confirmed that procedure type remained the dominant determinant of prescribing after adjustment.

Among surgeon-level factors, those with ≤5 years of experience prescribed 43% less than those with >10 years (IRR, 0.57; 95% CI, 0.42–0.75; $p < 0.001$). Head and neck surgeons prescribed 59% more than rhinologists (IRR, 1.59; 95% CI, 1.18–2.15; $p = 0.002$). Other subspecialties showed no significant difference from the rhinology reference group.

At the patient level, each 5-year increase in age was associated with a 1% reduction (IRR, 0.99; 95% CI, 0.97–1.00; $p = 0.041$). Obesity demonstrated a borderline association (IRR, 1.09; 95% CI, 1.00–1.20; $p = 0.052$). Patients who received at least one refill had initial prescriptions that were 21% higher than those without a refill (IRR, 1.21; 95% CI, 1.03–1.43; $p = 0.021$).

DISCUSSION

This study demonstrated significant variation in opioid prescribing after ambulatory otolaryngology procedures, shaped by the combined influence of surgical, surgeon, and patient-level factors. Surgical procedure was the dominant determinant of prescribing volume, but surgeon-specific characteristics, including clinical experience and subspecialty, also exerted strong and independent effects. Patient-related factors revealed more complex patterns: the observed racial disparities ran counter to prior reports, and the associations with comorbid conditions suggested a nuanced approach to clinical risk stratification. In the sections that follow, we examine these findings in order of their relative impact, beginning with the central role of procedure type, then considering surgeon-level influences, and concluding with patient-level determinants.

Dominant Influence of Surgical Procedure

Multivariable analysis confirmed that the type of surgical procedure was

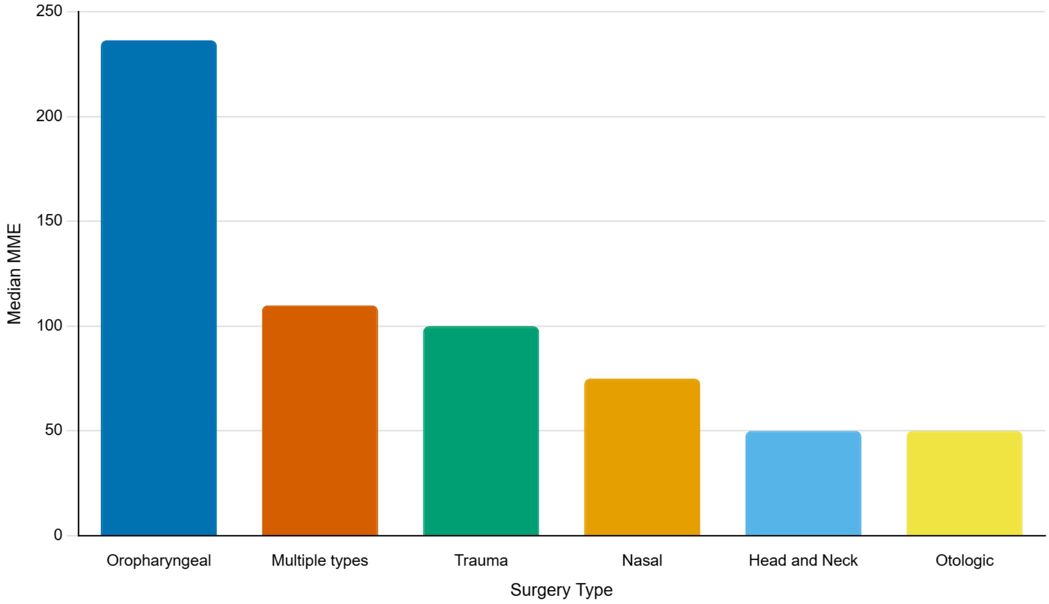

Figure 3. Median prescribed morphine milligram equivalents (MME) by surgical procedure type. The bar chart shows the median MME prescribed at discharge, stratified by surgical category (n = 2,129). Prescribing differs significantly among groups ($p < 0.001$). Oropharyngeal procedures are associated with the highest median MME, whereas head and neck and otologic procedures are associated with the lowest.

the strongest determinant of postoperative opioid prescribing (Table 4). This finding aligns with prior literature [18–21], which has shown that procedures associated with greater postoperative pain are typically linked to higher prescribing. In our study, oropharyngeal procedures exemplified this pattern, requiring substantially higher doses than nasal surgery.

However, the findings for head and neck procedures highlight a key limitation of using broad surgical categories in prescribing research. In our adjusted analysis, this category was associated with unexpectedly lower prescribing despite encompassing operations known to be highly painful, such as parotidectomy. The most plausible explanation is the substantial heterogeneity within this group, where high-pain but less common procedures were masked by high-volume, lower-pain operations such as thyroidectomy. Although sub-analysis by individual procedure was not feasible in our dataset, interpreting this result as an artifact of procedural heterogeneity is consistent with prior studies showing elevated opioid requirements for specific head and neck surgeries [18–21].

These findings illustrate that broad surgical categories can obscure clinically important differences in analgesic requirements. Such classifications risk misleading interpretation and producing inadequate prescribing guidance. The evidence instead supports the need for procedure-specific recommendations to reduce variability and enhance patient safety.

Surgeon Factors in Prescribing Variation

Surgeon-related characteristics also emerged as strong and independent determinants of prescribing behavior. Two consistent patterns were observed: a generational gradient, with less experienced surgeons prescribing more conservatively, and specialty-specific differences, with head and neck surgeons prescribing more than their rhinology counterparts.

These differences are likely multifactorial. More conservative prescribing among junior surgeons may reflect the influence of recent educational reforms and heightened awareness of the opioid crisis. The adoption of perioperative protocols such as Enhanced Recovery After Surgery (ERAS) [22] has also shaped these patterns. ERAS emphasizes multimodal analgesia and aims to minimize opioid reliance by incorporating non-opioid agents, including acetaminophen, nonsteroidal anti-inflammatory drugs, and gabapentinoids. These principles have been widely integrated into contemporary training and likely contribute to the more cautious prescribing observed among less experienced surgeons. This interpretation is supported by a 2022 Medicare analysis, which showed that older physicians prescribed substantially more opioids than younger physicians and projected further declines as senior cohorts retire [23]. Alternatively, higher prescribing among senior surgeons may reflect reliance on accumulated experience and clinical intuition, which does not necessarily indicate inappropriate practice or disregard for evolving guidelines.

Separately, the higher prescribing observed among head and neck specialists likely reflects a specialty-specific culture shaped by a case mix historically recognized as highly painful. A well-established prescribing hierarchy within the otolaryngology literature supports this interpretation, with prior studies consistently identifying operations such as tonsillectomy as requiring the highest postoperative opioid doses [18–21]. This consensus that certain procedures are inherently high-pain has fostered a shared practice pattern, contributing to the higher baseline prescribing among head and neck surgeons.

These findings show that both experience and specialty exert distinct and lasting influences on prescribing behavior. Reducing this variation requires standardized, evidence-based protocols. Targeted educational interventions are also essential to harmonize practice and improve postoperative pain management. Attention must now turn to patient-level determinants, which reveal equally complex and clinically significant patterns.

Patient-Level Determinants of Prescribing

Refills and potential iatrogenic risk

Our analysis showed a statistically significant association between refill status and the size of the initial prescription: patients who received a refill had larger prescriptions at discharge than those with no refill (Table 4). Although this pattern may reflect appropriate titration for greater pain

Table 4. Multivariable Analysis of Factors Associated With Prescribed MME at Discharge Following Ambulatory Otolaryngology Procedures

Variable	IRR (95% CI)	*p* value
Procedure Factors		
Surgery type		
Nasal (referent)	1.00	NA
Oropharyngeal	2.84 (2.24–3.59)	<0.001
Trauma	1.44 (1.07–1.94)	0.015
Head and neck	0.69 (0.54–0.89)	0.003
Otologic	0.82 (0.58–1.16)	0.252
Multiple procedures*	1.71 (1.28–2.27)	<0.001
Surgeon Factors		
Surgeon experience, years		
>10 (referent)	1.00	NA
6–10	0.90 (0.77–1.05)	0.181
≤5	0.57 (0.42–0.75)	<0.001
Surgeon specialty		
Rhinology (referent)	1.00	NA
Head and neck	1.59 (1.18–2.15)	0.002
Comprehensive	1.16 (0.88–1.51)	0.290
Neurotology	1.09 (0.75–1.60)	0.651
Plastic and reconstructive	0.98 (0.64–1.50)	0.921
Pediatric	0.98 (0.70–1.38)	0.916
Laryngology	0.73 (0.52–1.01)	0.059
Patient Factors		
Age, per 5-year increase	0.99 (0.97–1.00)	0.041
Prescription refill status		
No	1.00	NA
Yes	1.21 (1.03–1.43)	0.021
Obesity		
No	1.00	NA
Yes	1.09 (1.00–1.20)	0.052

*Patients who underwent more than one type of procedure during a single surgical encounter were classified into a distinct “multiple procedures” category for all analyses.
Abbreviations: CI, confidence interval; IRR, incidence rate ratio; MME, morphine milligram equivalents; NA, not applicable.

severity, it also raises concern about iatrogenic risk, since the initial prescription itself can shape subsequent opioid use.

Prior studies support this interpretation. Brummett et al. found that the size of the initial perioperative prescription was independently associated with new persistent opioid use among opioid-naïve patients [24]. Howard et al. showed that the amount prescribed was directly associated with the amount consumed, challenging the assumption that patient demand alone determines use [25]. Pharmacologic reviews have further outlined how high opioid exposure can promote receptor desensitization and internalization, biological processes that underlie the development of tolerance [26,27]. Taken together, these clinical and mechanistic observations suggest a potential feedback loop in which larger initial prescriptions, though often intended to prevent refills, may inadvertently normalize higher consumption and foster sustained opioid use. Careful calibration of the initial postoperative prescription is therefore essential to provide adequate analgesia while minimizing long-term risk.

Counterintuitive racial disparities in prescribing

A notable finding of our study was a pattern of racial variation in opioid prescribing that diverges from much of the existing literature. Prior investigations have consistently reported that Black or African American patients are less likely than White patients to receive adequate opioid prescriptions for pain [28–30]. In contrast, our analysis showed higher prescribing for Black or African American patients, whereas White and Asian patients received less.

This reversal permits at least two interpretations. The most parsimonious explanation is confounding by procedure type. Our data show that procedure type was the dominant determinant of prescribed MME, with nasal procedures requiring substantially lower doses than high-pain operations such as oropharyngeal surgery. External evidence demonstrates that Black or African American patients undergo key procedures within this low-pain category (specifically sinonasal procedures) at significantly lower rates than White patients [31]. This underrepresentation in low-MME surgeries likely, in turn, inflated the aggregate prescribing level for Black or African American patients in our cohort. Thus, the observed disparity is more plausibly explained by differences in the distribution of surgical categories across racial groups, with some groups underrepresented in low-pain procedures.

However, an alternative interpretation is that our findings reflect a distinct manifestation of prescriber bias. Although prior studies have consistently documented undertreatment of minority patients [28–30], our analysis showed higher prescribing for Black or African American patients. This does not negate the influence of bias but suggests that it may operate differently. Clinicians aware of historical disparities may prescribe more in an effort to compensate. In addition, implicit assumptions about social support, health literacy, or resilience may lead to larger precautionary prescriptions for certain groups [32].

Our study cannot definitively distinguish between these two explanations, namely confounding by procedure type and a distinct manifestation of prescriber bias, and it is plausible that both mechanisms operate simultaneously. This uncertainty is itself important, highlighting the need for further research to disentangle these influences and to guide equitable approaches to postoperative pain management.

Paradoxical effects of comorbidity

Our analyses revealed opposing associations. Psychiatric conditions, particularly anxiety and depression, were associated with higher prescribed MME. This finding aligns with emerging evidence that preoperative mental health disorders independently predict elevated postoperative opioid needs and the risk of persistent use [33].

In contrast, several chronic medical conditions, including hypothyroidism, liver disease, metastatic solid tumor, renal disease, and neuropathy, were associated with lower prescribing. This pattern likely reflects a risk-stratification approach in which surgeons reduce opioid doses for patients with systemic disease to minimize drug interactions and adverse events.

These observations highlight opportunities for more integrated perioperative care. Preoperative mental health screening, combined with multimodal analgesia, may help reduce opioid reliance, mitigate misuse risk, and contribute to broader efforts to address the opioid epidemic increasingly driven by synthetic agents [12].

Age and clinical risk stratification

Patient age showed a modest but statistically significant association with opioid prescribing. Each 5-year increase corresponded to a 1% reduction in prescribed MME (Table 4). This pattern mirrors previous research. Bethell et al. and Zaveri et al. similarly found that younger patients tend to receive higher postoperative opioid doses, whereas prescribing decreases with advancing age [34,35].

This age-related decline likely reflects deliberate clinical judgment rather than reduced pain burden. Surgeons may adopt a more cautious approach for older adults to minimize opioid-related complications such as sedation, respiratory depression, falls, and drug–drug interactions. Moreover, although epidemiologic data show that adults aged 65 years or older have lower rates of opioid misuse than those aged 50 to 64 [36], this does not imply that opioid use is inherently safer in this population. Older adults remain highly vulnerable to adverse effects, making safety a major concern in postoperative management.

Taken together, the age-related decline in prescribing reflects rational clinical risk stratification. It aligns immediate postoperative management with both epidemiologic patterns of misuse and the heightened vulnerability of older adults to adverse events. This indicates that surgeons incorporate population-level evidence with patient-specific risk factors when guiding prescribing decisions. Future research linking discharge prescribing with actual use and adverse outcomes is needed to determine whether such strategies effectively reduce clinical harm.

Study Limitations

The findings of this study should be interpreted in the context of several limitations. First, the study design may limit the generalizability of our results. This was a retrospective analysis of data from a single academic medical center, and prescribing patterns may not be representative of other practice settings. The cross-sectional nature of the data, restricted to the point of discharge, also precludes any evaluation of the association between initial prescribing and long-term opioid use. Furthermore, the study was conducted entirely during the COVID-19 pandemic, a context that may have introduced practice variations not generalizable to other periods.

Second, the use of retrospective electronic medical record data introduced measurement limitations. Specifically, the dataset lacked consistent documentation on whether prescriptions were intended for scheduled or as-needed (PRN) use, and it did not reliably capture the total days of supply. This information deficit prevented the conversion of total MME to daily MME, constraining interpretation within guideline-based risk thresholds. Data quality for patient demographics was also limited; the cohort was predominantly White, and a substantial proportion of patients (17.5%) had a racial classification of “Other” or “Unknown,” which may have introduced misclassification bias.

Finally, our analytical approach required certain simplifications. To ensure model stability, we excluded several comorbidities that were significant in univariate analyses, creating a potential for residual confounding. Similarly, the grouping of specific operations into broad surgical categories may have attenuated true differences in prescribing between procedures.

Despite these constraints, this analysis provides a granular, real-world assessment of postoperative opioid prescribing in ambulatory otolaryngology. Our findings highlight critical areas of variability and provide an evidence-based foundation for future prospective research and quality improvement initiatives.

Clinical and Research Implications

The multifactorial variations in opioid prescribing identified in this study underscore the need for a transition from broad recommendations to more individualized postoperative pain management. The finding that surgical procedure type is the strongest determinant of prescribing highlights the importance of developing granular, procedure-specific guidelines. The additional influence of surgeon experience and specialty suggests that uniform educational strategies are insufficient. Quality improvement initiatives should instead be tailored to the needs of both junior and senior surgeons. Moreover, the observed associations between psychiatric comorbidities, prescription refills, and higher MME emphasize the importance of integrated perioperative care that includes routine preoperative screening for psychosocial risk factors.

This study also defines key priorities for future research. To overcome the limitations inherent in a single-center, retrospective design, prospective multicenter studies are required to validate these findings and clarify causal relationships between prescribing patterns and long-term outcomes, such as new persistent opioid use. Future work should incorporate systematic collection of standardized data elements, including days of supply, to enable alignment with national guideline thresholds. In addition, qualitative studies involving structured interviews with surgeons are needed to elucidate the cognitive, cultural, and institutional factors that shape prescribing behavior. A mixed-methods framework that integrates quantitative and qualitative insights may provide a more effective foundation for developing interventions to optimize clinical practice.

CONCLUSION

In this large, single-center cohort study, postoperative opioid prescribing emerged as a multifactorial behavior shaped by surgical procedure, surgeon characteristics, and patient factors rather than a uniform response to pain. These findings challenge the feasibility of standardizing postoperative pain management through a single prescribing model and highlight the need for individualized, evidence-based frameworks that balance effective analgesia with the reduction of opioid-related harm.

ARTICLE INFORMATION

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