Trends in Opioid Use in Pediatric Patients in US Emergency Departments From 2006 to 2015

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Abstract

IMPORTANCE The use of opioids to treat pain in pediatric patients has been viewed as necessary; however, this practice has raised concerns regarding opioid abuse and the effects of opioid use. To effectively adjust policy regarding opioids in the pediatric population, prescribing patterns must be better understood.

OBJECTIVE To evaluate opioid prescribing patterns in US pediatric patients and factors associated with opioid prescribing.

DESIGN, SETTING, AND PARTICIPANTS This cross-sectional study used publicly available data from the National Hospital Ambulatory Medical Care Survey from January 1, 2006, to December 31, 2015. Analysis included the use of bivariate and multivariate models to evaluate factors associated with opioid prescribing. Practitioners from emergency departments throughout the United States were surveyed, and data were collected using a representative sample of visits to hospital emergency departments. The study analyzed all emergency department visits included in the National Hospital Ambulatory Medical Care Survey for patients younger than 18 years. All statistical analysis was completed in June of 2018 and updated upon receiving reviewer feedback in October of 2018.

EXPOSURES Information regarding participants’ medications was collected at time of visit. Participants who reported taking 1 or more opioids were identified.

MAIN OUTCOMES AND MEASURES Evaluation of opioid prescribing patterns across demographic factors and pain diagnoses.

RESULTS A total of 69 152 visits with patients younger than 18 years (32 727 female) were included, which were extrapolated by the National Hospital Ambulatory Medical Care Survey to represent 293 528 632 visits nationwide, with opioid use representing 21 276 831 (7.25%) of the extrapolated visits. Factors including geographic region, race, age, and payment method were associated with statistically significant differences in opioid prescribing. The Northeast reported an opioid prescribing rate of 4.69% (95% CI, 3.69%-5.70%) vs 8.84% (95% CI, 6.82%-10.86%) in the West ($P = .004$). White individuals were prescribed an opioid at 8.11% (95% CI, 7.23%-8.99%) of visits vs 5.31% (95% CI, 4.31%-6.32%) for nonwhite individuals ($P < .001$). Those aged 13 to 17 years were significantly more likely to receive opioid prescriptions (16.20%; 95% CI, 14.29%-18.12%) than those aged 3 to 12 years (6.59%; 95% CI, 5.75%-7.43%) or 0 to 2 years (1.70%; 95% CI, 1.42%-1.98%). Patients using Medicaid for payment were less likely to receive an opioid than those using private insurance (5.47%; 95% CI, 4.79%-6.15%) vs 9.73% (95% CI, 8.56%-10.90%).

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Abstract (continued)

P < .001); however, opioid prescribing rates remained unchanged in specific pain diagnoses, including pelvic and back pain.

CONCLUSIONS AND RELEVANCE  This research demonstrated an overall reduction in opioid use among pediatric patients from 2011 to 2015 compared with the previous 5 years; however, there appear to be variations in factors associated with opioid prescribing. The association of location, race, payment method, and pain diagnoses with rates of prescribing of opioids suggests areas of potential quality improvement and further research.

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Introduction

Acute pain is common among pediatric patients presenting to hospital emergency departments (EDs). The cause of pediatric pain disorders includes, but is not limited to, headaches, abdominal pain, back pain, musculoskeletal injury, postoperative pain, and cancer-related pain. In the treatment of moderate and severe acute pediatric pain, it can be difficult to balance the risks of treatment while providing adequate pain control. Health care practitioners often must choose between the use of opioids, traditional nonnarcotic agents (including nonsteroidal anti-inflammatory drugs and acetaminophen), and nonpharmacological options.

The use of opioids to treat moderate to severe pain in pediatric patients for specific pain disorders has generally been considered appropriate and necessary; however, recent concerns regarding opioid abuse and increases in opioid-related hospitalizations and deaths among pediatric patients have raised questions about the practice of prescribing opioids for management of pain in children. Although not as extensive as in adults, the use of opioids in pediatric patients had seen a significant increase prior to 2010, with the rate of opioid prescribing doubling from 1994 to 2007 in pediatric patients. More specifically, ED prescribing of opioids in pediatric patients increased from occurring in 11.2% of visits in 2001 to 14.5% in 2010. Additionally, studies suggest that when opioids are prescribed to pediatric patients, approximately 60% of opioid prescriptions dispensed include more opioids than are needed to treat the acute pain disorder.

Recent studies have shown that as opioid prescribing has increased in pediatric patients, the rate of opioid abuse and opioid-related death have also increased among these patients. Additionally, in recent years, as opioid prescribing rates have actually declined among pediatric patients, opioid-related hospitalizations have continued to increase. This continued trend reinforces the potential risk associated with opioid use in pediatrics, with increased likelihood and accelerated progression from use to abuse in pediatric populations. Research has shown that young people who report receiving a legitimate prescription for a narcotic pain medication by 12th grade are significantly more likely to abuse prescription pain medications in the future. This risk for misuse has also been shown among pediatric patients who report nonmedical use of opioids prior to adulthood. The risks associated with use of opioids at an early age suggest the need for further review of opioid prescribing in pediatric patients.

This study aims to evaluate trends of pediatric opioid prescribing in EDs in US hospitals and patient-related factors associated with opioid prescribing.

Methods

This study analyzes data collected from the 2006 to 2015 National Hospital Ambulatory Medical Care Survey (NHAMCS) focusing on patients younger than 18 years. This survey is conducted using a representative sample of visits to EDs, collecting data from medical records on patients' symptoms, diagnoses, comorbidities, demographic characteristics, and medications ordered or provided. The
survey uses a complex 4-stage study design. A description of the sampling design is available elsewhere.12,13 Prior to completion of this study, the Chapman University institutional review board reviewed and granted this study exempt status, as the analysis of deidentified, publicly available data does not constitute human subjects research as defined in federal regulations and as such does not require review. Hence, informed consent was not necessary. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

The NHAMCS data were weighted by the Centers for Disease Control and Prevention (CDC) using the most recent census data to most accurately represent national hospital visit and patient population characteristics. All analyses were conducted on weighted data, as recommended by the CDC’s National Center for Health Statistics, to be representative of national hospital visit characteristics. The use of opioids was determined using the CDC’s New Ambulatory Care Drug Database system, with drugs being classified as opioid or other.14 Medications included all drugs reported as either ordered as a prescription or provided during the visit.

A visit was considered pain related if a pain diagnosis was reported in the reasons for the visit through the evaluation of reported International Classification of Diseases, Ninth Revision, Clinical Modification codes. Pain diagnosis codes were established based on the clinical classification software categories available from the Agency for Healthcare Research and Quality Healthcare Cost and Utilization project. Included pain categories were abdominal pain, arthritis or joint pain, back pain, cancer-related pain, chest pain, cholelithiasis, fractures, headache, injury excluding fracture, neck pain, nephrolithiasis, pelvic pain, sickle cell anemia, dental or jaw pain, fibromyalgia, and peripheral neuropathy. Pain categories that did not meet the minimum of 30 visits in the unweighted sample were recategorized into a category labeled other pain.

Metropolitan setting of the visit was determined using Metropolitan and Micropolitan Statistical Area methodology, the definition used by federal agencies for research purposes. Length of visit was recoded into dichotomous categories of prolonged (lasting >240 minutes) or not prolonged (lasting ≤240 minutes).

**Statistical Analysis**

All participants’ records were stored in a relational database using the open-source database software MySQL version 5.7.11 (Oracle). All statistical analyses were performed using the open-source statistical computing software R version 3.2.3 (R Foundation) and finalized October 12, 2018. The function svydesign from the R package survey was used to account for stratified, clustered, and weighted variables in the NHAMCS data. A Wald test of association was used to determine significance for all analyses.

Descriptive statistics were used to compare the characteristics of ED visits associated with opioids with those in which patients were not currently prescribed an opioid. Wald tests of association were used to determine significance for bivariate analysis, and logistic regression models were conducted using weighted patient data with opioid use as the dependent variable and age, race, sex, pain diagnosis, payment method, region, and length of ED visit as dependent variables. The model was simultaneously adjusted for all dependent variables.

All confidence intervals correspond to 95% CIs, as computed from the standard error. Comparison and associations were considered significant if 2-sided P < .05. All analysis conducted used cohorts of more than 30 visits and had a relative standard error of less than 30% per CDC guidelines. The CDC provided detailed documentation of the NHAMCS instrument, methodology, and data files that were used as the basis for this analysis and are available elsewhere.12

**Results**

A total of 69,152 hospital ED visits by patients younger than 18 years at the time of the visit (32,727 female) from January 1, 2006, through December 31, 2015, were included. These visits were extrapolated by the National Hospital Ambulatory Medical Care Survey to represent 293,528,632
hospital ED visits throughout the United States, with 7.25% (95% CI, 6.43%-8.06%) of those visits (21,276,831) associated with either being currently prescribed an opioid or attaining one from the visit. Among pediatric patients, those aged 13 to 17 years were significantly more likely to have visits associated with opioid administration and/or prescription, with 16.20% (95% CI, 14.29%-18.12%) of individuals aged 13 to 17 years having an opioid prescribed compared with 6.59% (95% CI, 5.75%-7.43%) for those aged 3 to 12 years and 1.70% (95% CI, 1.42%-1.98%) for those aged 0 to 2 years (P < .001).

Significant differences in opioid prescription rates were observed across varying demographic factors. White participants reported an average opioid prescription rate of 8.11% (95% CI, 7.23%-8.99%) vs 5.31% (95% CI, 4.31%-6.32%) for nonwhite participants (P < .001). The likelihood of a visit being related to an opioid prescription was also statistically significant when comparing regions of the country, with visits occurring in the Northeast being associated with the lowest prescribing rate, having an average prescription rate of 4.69% (95% CI, 3.69%-5.70%) compared with 8.84% (95% CI, 6.82%-10.86%) for the West, the highest-prescribing region (P = .004).

Patients using Medicaid for payment were less likely to receive an opioid than those using private insurance (5.47%; 95% CI, 4.79%-6.15% vs 9.73%; 95% CI, 8.56%-10.90%). The population density of the area where the individual received care did not appear to be associated with overall prescribing rates of opioids, with similar opioid prescribing rates between metropolitan and nonmetropolitan areas. Further details on cohort size and weighted and unweighted visit counts, as well as opioid prescription rates based on specific demographics throughout the cohorts, are available in Table 1.

The use of opioids in pediatric patients varies significantly based on the reported diagnosis related to the visit (Table 2). Visits associated with a bone fracture had the highest rate of opioid prescribing, with 41.30% (95% CI, 36.20%-46.40%) of all visits having an opioid prescribed. Pelvic pain, back pain, and other pain had the next-highest likelihood of having an opioid prescribed, with 21.21% (95% CI, 15.77%-26.65%), 20.99% (95% CI, 14.83%-27.15%), and 21.28% (95% CI, 16.11%-26.45%) of visits having an opioid prescribed, respectively. Injuries other than fractures were the least likely pain diagnosis to result in an opioid prescribed, with 9.75% (95% CI, 8.38%-11.13%) of visits having an opioid prescribed. Headaches, arthritis or joint pain, and abdominal pain had similar opioid prescribing rates per visit (16.57% [95% CI, 12.58%-20.57%], 15.27% [95% CI, 10.66%-19.88%], and 15.01% [95% CI, 12.29%-17.73%], respectively).

Logistic regression was used to analyze the association of demographic factors and pain diagnosis with the rate of visits during which an opioid was prescribed (Table 3). Age, race, sex, pain diagnosis, region of care, length of visit, and payment method were used as independent variables with opioid prescription as the dependent variable. Comparing the adjusted odds ratios (aORs) of the age groups showed that the aOR of a visit being associated with an opioid prescription more than doubled as age increased, using 13 to 17 years as the reference cohort. The age cohort of 0 to 2 years had an aOR of 0.14 (95% CI, 0.12-0.16) and the age group of 3 to 12 years had an aOR of 0.41 (95% CI, 0.38-0.45). All pediatric age groups had a lower rate of opioid prescribing than all adult age groups, with the 13 to 17 years group being roughly half as likely as the 18 to 24 years group to be prescribed an opioid; however, 16.20% (95% CI, 14.29%-18.12%) of those aged 13 to 17 years with an ED visit were still prescribed an opioid.

Comparing opioid prescribing based on pain diagnosis revealed variable opioid prescribing rates dependent on the specific diagnosis. All non–pain diagnosis–related visits were used as the referent group, which had an overall opioid prescribing rate of 3.62% (95% CI, 3.16%-4.08%). Patients diagnosed with pain associated with a fracture had the greatest likelihood of being prescribed an opioid, with an aOR of 14.27 (95% CI, 12.60-16.16) when compared with the referent group. Pelvic pain and arthritis or joint-related pain were the next 2 pain diagnoses most likely to result in opioid prescribing, with aORs of 5.12 (95% CI, 3.80-6.92) and 4.84 (95% CI, 3.61-6.50), respectively. Visits associated with headaches and abdominal pain diagnoses had similar likelihood of opioid use, with aORs of 2.89 (95% CI, 2.21-3.77) and 2.69 (95% CI, 2.25-3.21), respectively.
Logistic regression analysis of payment method and opioid use demonstrated similar opioid prescribing rates among those who reported using private insurance, Medicare, and self-pay. Those using Medicaid as their primary payment method had a significantly lower likelihood of being prescribed an opioid, with an aOR of 0.74 (95% CI, 0.67-0.81) compared with those using private insurance. Comparing opioid prescribing in patients based on race revealed that white patients were more likely to be prescribed an opioid, with an aOR of 1.34 (95% CI, 1.19-1.50) compared with nonwhite patients. There was no difference in opioid prescribing between sexes, with female patients having an aOR of 1.03 (95% CI, 0.93-1.13) compared with male patients.

To analyze changes over time in opioid prescribing rates based on specific pain diagnoses, the original data set was separated into two 5-year cohorts, 2006 to 2010 and 2011 to 2015. Overall opioid prescription rates were significantly lower in the 2011 to 2015 cohort, decreasing from 8.23% (95% CI, 6.75%-9.70%) to 6.30% (95% CI, 5.44%-7.17%) \( (P < .001) \). Specifically, opioid prescribing rates for headaches, which had an overall prescribing rate of 16.6%, decreased from 21.93% (95% CI, 14.96%-28.90%) to 12.51% (95% CI, 7.54%-17.47%) \( (P = .008) \). The opioid prescribing rates for

| Table 1. Emergency Department Visits for US Pediatric Patients, 2006-2015* |
|-----------------|------------------|------------------|------------------|------------------|
| Variable        | Total Visits     | Visits With Opioid Prescription | P Value* |
|                 | Unweighted, No. | Weighted, No. | Unweighted, No. | Weighted, No. | Weighted, % (95% CI) |
| All visits      | 69 152          | 293 528 632    | 4910            | 21 276 831    | 7.25 (6.43-8.06)    |
| Age, y          |                 |                 |                 |                 |                     |
| 0-2             | 22 515          | 95 677 472     | 403             | 1 626 298     | 1.70 (1.42-1.98)    |
| 3-12            | 30 213          | 129 048 017    | 1919            | 8 501 284     | 6.59 (5.75-7.43)    |
| 13-17           | 16 424          | 68 803 143     | 2588            | 11 149 249    | 16.20 (14.29-18.12) |
| Race            |                 |                 |                 |                 |                     |
| Nonwhite        | 22 436          | 90 203 294     | 1138            | 4 793 140     | 5.31 (4.31-6.32)    |
| White           | 46 716          | 203 325 338    | 3772            | 16 483 691    | 8.11 (7.23-8.99)    |
| Sex             |                 |                 |                 |                 |                     |
| Female          | 32 727          | 13 943 0654    | 2320            | 10 091 754    | 7.24 (6.32-8.16)    |
| Male            | 36 425          | 154 097 978    | 2590            | 11 185 077    | 7.26 (6.42-8.10)    |
| Payment method  |                 |                 |                 |                 |                     |
| Medicaid        | 35 602          | 149 785 565    | 1961            | 8 189 855     | 5.47 (4.79-6.15)    |
| Private insurance | 22 265      | 92 174 669    | 2104            | 8 972 087     | 9.73 (8.56-10.90)   |
| Self-pay        | 4769            | 20 897 238     | 392             | 1 810 064     | 8.66 (7.03-10.29)   |
| Other payment method | 6516    | 30 671 160    | 453             | 2 304 825     | 7.51 (5.77-9.26)    |
| Region          |                 |                 |                 |                 |                     |
| Midwest         | 16 092          | 64 297 373     | 1104            | 4 411 876     | 6.86 (5.42-8.30)    |
| Northeast       | 14 943          | 48 114 360     | 620             | 2 258 130     | 4.69 (3.69-5.70)    |
| South           | 25 357          | 122 818 883    | 2078            | 9 453 757     | 7.70 (6.23-9.16)    |
| West            | 12 760          | 58 298 016     | 1108            | 5 153 068     | 8.84 (6.82-10.86)   |
| Metropolitan setting |            |                 |                 |                 |                     |
| Metropolitan area | 54 750    | 223 751 850   | 3888            | 16 127 742    | 7.21 (6.13-8.28)    |
| Nonmetropolitan area | 8224    | 42 120 692   | 614             | 3 156 909     | 7.49 (4.22-10.77)   |
| Length of visit |                 |                 |                 |                 |                     |
| Not prolonged (≤240 min) | 55 783    | 239 294 579   | 3728            | 18 814 630    | 6.79 (5.99-7.58)    |
| Prolonged (>240 min) | 10 229    | 38 880 272   | 1043            | 1 644 250     | 10.86 (9.48-12.23)  |
| Unknown or missing data | 3140    | 15 353 781   | 139             | 817 951       | 5.33 (3.07-7.58)    |
| Episode of care |                 |                 |                 |                 |                     |
| Follow-up visit to this emergency department | 2540    | 9 869 291   | 211             | 807 085       | 8.18 (6.48-9.88)    |
| Initial visit to this emergency department | 52 155    | 233 274 833   | 3715            | 16 734 073    | 7.17 (6.36-7.99)    |
| Unknown or missing data | 14 457    | 50 384 758   | 984             | 3 735 673     | 7.41 (6.04-8.79)    |

* All analyses account for the complex sampling design of the National Hospital Ambulatory Medical Care Survey.

b P values calculated with Wald test.
non-fracture-related injuries, abdominal pain, and non-pain-related visits also decreased over this time (Table 4). Additionally, opioid use in non-pain-related visits decreased from occurring in 4.07% of visits to 3.18% of visits. Other diagnoses, including pelvic pain, fractures, back pain, and arthritis or joint pain, did not have a statistically significant reduction in opioid prescribing over the same period. Further details are available in Table 4.

Discussion

The potentially addictive nature of opioids, coupled with their widespread use, has led to major discussions throughout the US health care system regarding the safety and effectiveness of using opioids overall. Opioid use in pediatrics has been met with additional clinical and ethical questions, with the latest CDC recommendation for opioid use in chronic pain suggesting that opioid use in pediatrics, particularly adolescents, be avoided whenever possible.15 Although much of the focus of better management of opioid use has focused on the adult population, several researchers have expressed concerns regarding the overprescription of opioids and excessive prescriptions for opioids in pediatric patients. The prescribing of opioids to pediatric patients is of particular concern because of this group’s increased risk of addiction and the potential long-term effects related to opioid abuse in pediatric patients.8,16

The use of opioids in pediatric patients in certain clinical circumstances is appropriate and necessary. The intent of this review is to evaluate the trends of use in a number of clinical diagnoses and evaluate patterns of use and inconsistencies, if any, in the use of opioids. For instance, the use of opioids to treat pain associated with an injury resulting in a bone fracture is likely appropriate, but an evaluation of patient-specific factors associated with prescribing trends in patients with fractures helps to assess consistency in use.

However, despite the importance of understanding the prescribing trends related to pediatric opioid use, very little research has been done in this area. The analysis presented here reveals that a large portion of the pediatric population continues to be prescribed opioids when being treated in EDs, with significant variations related to race, age, diagnosis, payment method, and region of the country where the patient visit occurred.

As anticipated, age had a significant association with the use of opioids, both in pediatric patients and adults. Those aged 13 to 17 years were significantly more likely to have visits associated with opioid use (16.20% of visits) compared with those aged 3 to 12 years (6.59% of visits) and 0 to 2 years (1.70% of visits). Although the overall rate of opioid prescribing for pediatric patients was lower than for adults, the fact that more than 16% of all visits for those aged 13 to 17 years have an opioid associated with them suggests that overall opioid use is also relatively high in pediatric patients. The rate of opioid prescribing related to headaches in this study was 16.57%, which was significantly lower than the previously reported rate of 46%.17 This difference in reporting is likely

| Pain Category                        | Total Visits Unweighted, No. | Weighted, No. | Visits With Opioid Prescription Unweighted, No. | Weighted, No. | Weighted, % (95% CI) |
|--------------------------------------|------------------------------|---------------|-----------------------------------------------|---------------|----------------------|
| Not pain related                     | 48 269                      | 205 295 925  | 1718                                         | 7 425 946     | 3.62 (3.16-4.08)     |
| Abdominal pain                       | 2578                        | 11 306 345   | 357                                          | 1 697 014     | 15.01 (12.29-17.73)  |
| Arthritis or joint pain              | 635                         | 2 632 174    | 97                                           | 401 903       | 15.27 (10.66-19.88)  |
| Back pain                            | 385                         | 1 710 840    | 80                                           | 359 075       | 20.99 (14.83-27.15)  |
| Fractures                            | 2692                        | 10 674 632   | 1043                                         | 4 408 498     | 41.30 (36.20-46.40)  |
| Headache                             | 919                         | 4 186 025    | 158                                          | 693 811       | 16.57 (12.58-20.57)  |
| Injury excluding fracture            | 12 305                      | 51 975 509   | 1165                                         | 5 069 429     | 9.75 (8.38-11.13)    |
| Other pain category                  | 703                         | 2 820 299    | 147                                          | 600 279       | 21.28 (16.11-26.45)  |
| Pelvic pain                          | 666                         | 2 926 883    | 145                                          | 620 876       | 21.21 (15.77-26.65)  |

*a All analyses account for the complex sampling design of the National Hospital Ambulatory Medical Care Survey.
due to the nature of the data provided, with the data restricted to a single visit, vs previous reports reviewing all prescription drug use over a full year. Additionally, previous research focused on opioid use in the treatment of headaches, specifically in patients aged 13 to 17 years, and this study includes analysis of use across all patients aged 17 years and younger.

Time-lapse analysis does show a reduction in overall opioid use comparing 2006 to 2010 with 2011 to 2015. This reduction suggests that the scrutiny of the safety of opioid use overall and particularly in pediatric patients has resulted in prescribers reevaluating their use of opioids overall. This reduction in use is primarily driven by reductions in opioid use in specific pain diagnoses, including headache, abdominal pain, and non-fracture-related injuries. The overall reductions were also partially the result of reduced opioid use in non-pain-related visits, which decreased from occurring in 4.07% of visits to 3.18%. The lack of change over time in the use of opioids for other pain diagnoses, particularly back and pelvic pain, suggests that alternative treatment options need to be further evaluated or encouraged among health care professionals. The use of opioids in back pain is

| Characteristic                  | Adjusted Odds Ratio (95% CI) |
|---------------------------------|-----------------------------|
| Age, y                          |                             |
| 0-2                             | 0.14 (0.12-0.16)            |
| 3-12                            | 0.41 (0.38-0.45)            |
| 13-17                           | 1 [Reference]              |
| Race                            |                             |
| Nonwhite                        | 1 [Reference]              |
| White                           | 1.34 (1.19-1.50)           |
| Sex                             |                             |
| Male                            | 1 [Reference]              |
| Female                          | 1.03 (0.93-1.13)           |
| Pain diagnosis                  |                             |
| Not pain related                | 1 [Reference]              |
| Abdominal pain                  | 2.69 (2.25-3.21)           |
| Arthritis or joint pain         | 4.84 (3.61-6.50)           |
| Back pain                       | 4.27 (2.93-6.23)           |
| Fractures                       | 14.27 (12.60-16.16)        |
| Headache                        | 2.89 (2.21-3.77)           |
| Injury excluding fracture       | 2.06 (1.83-2.32)           |
| Other pain category             | 4.15 (3.12-5.52)           |
| Pelvic pain                     | 5.12 (3.80-6.92)           |
| Payment method                  |                             |
| Private                         | 1 [Reference]              |
| Medicaid                        | 0.74 (0.67-0.81)           |
| Other or unknown                | 0.90 (0.77-1.07)           |
| Self-pay                        | 0.96 (0.82-1.13)           |
| Region                          |                             |
| Midwest                         | 1 [Reference]              |
| Northeast                       | 0.59 (0.50-0.69)           |
| South                           | 1.30 (1.13-1.50)           |
| West                            | 1.36 (1.14-1.62)           |
| Prolonged emergency department visit |                 |
| Unknown or missing data         | 1 [Reference]              |
| Not prolonged (≤240 min)        | 1.23 (0.92-1.65)           |
| Prolonged (>240 min)            | 2.08 (1.54-2.82)           |

a All analyses account for the complex sampling design of the National Hospital Ambulatory Medical Care Survey.

b The model was simultaneously adjusted for the covariates listed.
Table 4. Pain-Related Opioid Prescription Trends Over Time

| Pain Category                      | 2006-2010                      | 2011-2015                      |
|------------------------------------|--------------------------------|--------------------------------|
|                                   | Total Visits                   | Visits With Opioid Prescription | Total Visits                   | Visits With Opioid Prescription |
|                                   | Unweighted, No.                | Weighted, No.                  | Weighted, No.                  | Weighted, No.                  |
|                                   | Unweighted, No.                | Weighted, No.                  | Weighted, % (95% CI)           | Unweighted, No.                | Weighted, No.                  | Weighted, % (95% CI)           | P Value<sup>b</sup> |
| All opioid prescriptions          | 40698                          | 14408389                      | 3094                          | 11855012                      | 8.23 (6.75-9.70)               | 28454                         | 149444733                   | 1816                        | 9421819                      | 6.30 (5.44-7.17)               | .005                        |
| Not pain related                  | 28436                          | 100369050                     | 1077                          | 4086315                       | 4.07 (3.25-4.89)               | 19833                         | 104926875                   | 641                          | 3339631                       | 3.18 (2.63-3.74)               | <.001                       |
| Abdominal pain                    | 1392                           | 5060459                       | 217                           | 894048                        | 17.67 (12.97-22.36)            | 1186                          | 6245886                     | 140                          | 802966                        | 12.86 (9.48-16.24)            | .01                         |
| Arthritis or joint pain           | 392                            | 1435996                       | 63                            | 257757                        | 17.95 (10.27-25.62)            | 243                           | 1196178                     | 34                            | 144146                        | 12.05 (7.01-17.09)            | .17                         |
| Back pain                         | 206                            | 750832                        | 43                            | 173636                        | 23.13 (13.10-33.15)            | 179                           | 960008                      | 37                            | 185439                        | 19.32 (11.08-27.55)           | .52                         |
| Fractures                         | 1709                           | 5904487                       | 667                           | 2494409                       | 42.25 (34.72-49.77)            | 983                           | 4770145                     | 376                           | 1914089                       | 40.13 (33.16-47.10)           | .41                         |
| Headache                          | 486                            | 1806646                       | 96                            | 396193                        | 21.93 (14.96-28.90)            | 433                           | 2379379                     | 62                            | 297618                        | 12.51 (7.54-17.47)            | .008                        |
| Injury excluding fracture         | 7284                           | 25950359                      | 750                           | 2922544                       | 11.26 (9.03-13.49)             | 5021                          | 26025150                    | 415                          | 2146885                       | 8.25 (6.75-9.75)              | <.001                       |
| Other pain category               | 403                            | 1353625                       | 88                            | 301074                        | 22.24 (14.13-30.35)            | 300                           | 1466674                     | 59                            | 299205                        | 20.40 (13.56-27.24)           | .66                         |
| Pelvic pain                       | 390                            | 1452445                       | 93                            | 329036                        | 22.65 (14.52-30.78)            | 276                           | 1474438                     | 52                            | 291840                        | 19.79 (12.30-27.29)           | .54                         |

<sup>a</sup> All analyses account for the complex sampling design of the National Hospital Ambulatory Medical Care Survey.

<sup>b</sup> P values calculated with Wald test.
of significant concern because growing research suggests that chronic use of opioids to treat back pain is not effective for both pain and function and is associated with significant safety concerns.

Our findings indicate that patient visits in the western region of the country (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) are significantly more likely to be prescribed an opioid, while patients visits in the Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) are associated with the lowest likelihood of an opioid being prescribed despite a lack of significant difference in pain-related diagnosis in these region. Factors affecting the regional variability in opioid prescribing in pediatric patients need to be further evaluated to better understand what may be driving the overall prescribing patterns in each region, particularly those with higher opioid prescribing rates.

Race additionally had a significant association with overall prescription trends, with white patients having a significantly increased likelihood of being prescribed an opioid compared with nonwhite patients. These findings are similar to previous research that has indicated significant racial differences in prescription patterns of opioids in adult patients. When holding constant for pain diagnosis, white patients were significantly more likely to receive an opioid. For instance, white patients reporting abdominal pain were almost twice as likely to receive an opioid than their nonwhite counterparts. While there are numerous potential explanations for this difference, further subset analysis is needed to better evaluate the use of opioids based on race to determine the association of pain scale reports, age at time of visit, other patient-specific factors, and prescriber-specific factors with opioid prescribing across racial and ethnic groups.

Similar to previous research, individuals whose primary payment method reported was state Medicaid had a lower likelihood of being prescribed an opioid. This raises questions regarding the biases that may exist in prescribers when treating patients covered by state Medicaid programs, which appears to be true in pediatric patients as well as adults. This study’s analysis found that, unlike previous studies in adults, prescribing rates were similar between sexes.

The relationship between opioid use rates in pediatric patients and pain diagnoses suggests that different pain-related diagnoses are viewed by prescribers as more appropriate than others for opioid use. As expected, pain related to fracture injuries had the highest rate of opioid prescribing, which remained consistent when comparing 2006 to 2010 with 2011 to 2015. The relatively high use of opioids in pelvic pain and back pain, which also lack a statistically significant reduction over time, suggests additional evaluation is necessary regarding prescribers' attitudes toward treatment options in these specific pain-related diagnoses. Although the percentage of visits for headache, abdominal pain, non-fracture-related injuries, and non-pain-related diagnoses associated with opioid use has decreased, the continued use of opioids suggests additional opportunity for further evaluation and prescriber outreach to ensure appropriate and consistent prescribing of opioids. Each of these pain diagnoses have limited need for the use of opioids, and the reduction of use over time is a positive trend; however, more significant reductions of opioid use in these clinical circumstances would be appropriate.

Limitations
Limitations of this study include its retrospective nature and the general limitations of using a cross-sectional data set. Owing to this limitation, we can only report the findings of the analysis and are not able to draw conclusions about the causative nature of factors associated with opioid prescribing patterns. Additionally, this study is not able to determine which factors may have been associated with a reduction in the use of opioids for specific pain diagnoses. Many factors may need to be further explored to understand their role in opioid prescribing patterns. In addition, a number of comorbidities and preexisting diseases may affect the choice of drug for pain management. For example, opioid therapy is generally the first-line approach for moderate to severe pain control, alone or in combination with other medications, in patients with active cancer, particularly when a patient...
is neutropenic. The presented study is not able to evaluate patients’ comorbidities or determine their potential effects on opioid prescribing.

Conclusions

The findings of this study suggest the overall use of opioids in pediatric patients in EDs has declined since 2010; however, further research is warranted given the remarkable variability in opioid prescribing rates based on patient-specific demographic characteristics and pain-related diagnoses. Although the use of opioids is indicated for specific pain-related visits, it is important to keep prescribing consistent across all health care professionals regardless of patient demographic characteristics. The lack of consistency in prescribing opioids observed in this study also indicates the need to develop a more standardized opioid use guideline in pediatrics, which can help guide prescribers to make informed decisions when considering opioids for the treatment of patients younger than 18 years.

ARTICLE INFORMATION

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