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Trends in Opioids Prescribed at Discharge From Emergency Departments Among Adults: United States, 2006–2017

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Abstract

Objective—This report describes trends in opioid prescribing at emergency department (ED) discharge among adults from 2006–2007 through 2016–2017, by selected patient and hospital characteristics and the type of opioids prescribed.

Methods—Data are from the 2006–2017 National Hospital Ambulatory Medical Care Survey. The study population included all ED visits by patients aged 18 and over. The main outcome studied was opioids prescribed at ED discharge, defined using Cerner Multum’s third-level therapeutic category codes for narcotic analgesics (Code 60) and narcotic-analgesic combinations (Code 191).

Results—The percentage of ED visits by adults with opioids prescribed at discharge increased from 2006–2007 (19.0%) through 2010–2011 (21.5%) and then decreased from 2010–2011 through 2016–2017 (14.6%). The rate of decrease was highest among visits by younger adults aged 18–44 (from 25.5% in 2010–2011 to 15.3% in 2016–2017) and those living in medium or small metropolitan counties (24.3% in 2010–2011 to 14.5% in 2016–2017). The percentage of visits with morphine-equivalent opioids prescribed increased from 2006–2007 (11.3%) through 2010–2011 (12.4%) and decreased from 2010–2011 through 2016–2017 (6.7%). The percentage of visits with stronger than morphine opioids prescribed similarly increased from 2006–2007 (3.8%) through 2010–2011 (5.5%) and decreased to 3.0% in 2016–2017. In contrast, the percentage of visits with weaker than morphine opioids prescribed decreased from 4.0% in 2006–2007 through 3.6% in 2010–2011 and increased to 5.0% in 2016–2017. Among all opioids prescribed at discharge, the percentage with acetaminophen-hydrocodone prescribed decreased from 53.1% in 2012–2013 to 41.5% in 2016–2017, with a corresponding increase for both tramadol and acetaminophen-codeine. Top diagnoses associated with an opioid prescribed at discharge included dental pain, urolithiasis (stones in the kidney, bladder, or urinary tract), fracture injuries, back pain, and extremity pain. For all top diagnoses, the percentage of visits with an opioid prescribed decreased from 2010–2011 through 2016–2017, though the decrease was not statistically significant for urolithiasis.

Keywords: narcotic • diagnoses • National Hospital Ambulatory Medical Care Survey

Introduction

Opioid analgesics are used primarily to treat chronic and acute pain (1). Pain is a common symptom among patients visiting the emergency department (ED) (2). Common causes of adult pain symptoms presenting to EDs include injury or trauma, abdominal pain, back pain, headache, and dental pain (3). In 2016, opioids were given during the ED visit and a prescription was provided at discharge at 35.4 ED visits per 1,000 adults (4). While prescribing opioids may improve the quality of life for patients suffering from acute and chronic pain, there is also the potential for opioid misuse, abuse, and overdose (5). Prescription opioids accounted for 36% of the 47,600 opioid-related overdose deaths in 2017 (6). Exposure to an opioid prescription in the ED has been identified as a potential risk factor for long-term use, with one study reporting that 17% of patients who filled their first opioid prescription for a minor painful condition were still receiving opioids 1 year later (7).

For 2001–2010, the proportion of adult ED visits in which any opioid medication was given or prescribed increased from 21% to 31%, with hydrocodone and oxycodone seeing the largest increases in discharge



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prescriptions (8). This report uses nationally representative data on ED visits and drug mentions to assess recent trends (up to 2017) in the prescribing of opioids upon discharge from the ED, by patient and hospital characteristics, type and strength of opioid, and pain-related diagnoses.

Methods

Data are from the 2006–2017 National Hospital Ambulatory Medical Care Survey (NHAMCS) ED component, which is conducted by the National Center for Health Statistics (NCHS). NHAMCS is an annual probability sample survey of U.S. hospital EDs and outpatient departments that uses a four-stage probability sampling procedure including sampling nonfederal, short-stay, and general hospitals within geographic areas and ED visits within hospitals. The NHAMCS documentation describes the plan and operation of NHAMCS (9). Between 2006 and 2017, the ED response rate ranged from 70.8% (2015) to 93.1% (2008). The unit of measurement for NHAMCS is the ED visit. ED visit data include patient demographic characteristics as well as visit information obtained from the medical record, including medical diagnosis, cause of injury, primary expected source of payment, diagnostic and therapeutic services ordered or provided, and drugs given in the ED or prescribed at discharge.

The main outcome studied was ED visits where opioids were prescribed at discharge from 2006 through 2017. Visits with one or more opioid mentions included visits where opioids were either “prescribed at discharge” or “both given in ED and prescribed at discharge.” Visits where opioids were only given at the time of the ED visit without a prescription upon discharge were excluded. Time points were grouped into 2-year intervals to increase the reliability of estimates by patient, visit, and hospital characteristics. During 2006–2011, data for up to 8 drugs and corresponding given or prescribed statuses could be collected per visit record. Therefore, for consistency, analysis of 2012–2017 data was limited to the first 8 drugs listed to assess trends over time in the percentage of opioids

prescribed at discharge. Covariates used for this study included age, sex, race and ethnicity, urban or rural status of patient residence, primary expected source of payment, region of hospital, type of hospital, primary diagnosis, type of opioid, and strength of opioid relative to morphine. More information about the definition of opioids and covariates can be found in the [Technical Notes](#).

Statistical analysis

To provide national estimates of ED use, sample weights were applied to each case. The weights include factors representing the selection of the primary sampling unit (PSU); the hospital within the PSU; EDs within hospitals, clinics, or both within outpatient departments; and the visit within the hospital ED. Adjustment factors for hospital nonresponse and the inclusion of hospital panels each year are also included in the construction of the weights. Estimates of sampling error were made using a Taylor Series approximation, which takes the complex sampling design into account. The study population for the main analyses includes all ED visits by adults aged 18 or over ([Tables 1, 2, and 4](#)). [Table 3](#) displays the percentage of opioid mentions but not visits. All analyses were conducted using SAS version 9.4 (SAS Institute, Cary, N.C.) and SAS-callable SUDAAN version 11.0 (RTI International, Research Triangle Park, N.C.). Linear and quadratic trends were modeled using orthogonal polynomials. If a quadratic trend was significant, Joinpoint software (10) was used to determine the change point in the trend line. Piecewise linear regression was used to test the significance of slopes. All proportion estimates presented meet NCHS guidelines for presentation of proportions (11) and follow NCHS trend analysis guidelines (12).

Results

The overall percentage of all ED visits by adults at which opioids were prescribed at discharge increased from 19.0% in 2006–2007 to 21.5% in 2010–2011, and decreased to 14.6% in 2016–2017, representing a 30.1%

decrease between 2006–2007 and 2016–2017 ([Table 1](#)).

Patient characteristics

Consistent with the trend in the overall percentage of ED visits at which opioids were prescribed at discharge for 2006–2017, a similar trend was observed for visits among the following subpopulations: women; men; patients aged 18–64; all race and ethnicity groups (non-Hispanic white, non-Hispanic black, Hispanic, and other); patients living in large central metropolitan and medium or small metropolitan counties; and visits with a primary expected source of payment of private insurance, Medicaid, and self-pay or no charge ([Table 1](#)). Unlike younger adults, the percentage of visits with an opioid prescribed at discharge for adults aged 65 and over remained stable from 2006–2007 (9.5%) through 2016–2017 (10.4%) ([Figure 1](#)). A similar trend was observed for visits with a primary expected source of payment of Medicare in which the percentage of visits with an opioid prescribed at discharge remained stable from 2006–2007 (11.4%) through 2016–2017 (11.7%). For visits by patients living in large fringe metropolitan and nonmetropolitan counties, the trend in the percentage at which opioids were prescribed at discharge followed the overall trend, however, the increase from 2006–2007 through 2010–2011 was not statistically significant.

Hospital characteristics

Similar to the overall trend, the percentage of ED visits that included an opioid prescribed at discharge increased from 2006–2007 through 2010–2011 and decreased from 2010–2011 through 2016–2017 at EDs located in the Northeast, Midwest, and West regions of the United States and for visits to voluntary or nonprofit hospitals ([Table 1](#)). Although the percentage of visits made to EDs located in the South that included an opioid prescribed at discharge followed a similar trend to the other three regions, the increase from 2006–2007 (22.0%) through 2010–2011 (24.0%) was not statistically significant. The percentage of ED visits to government hospitals

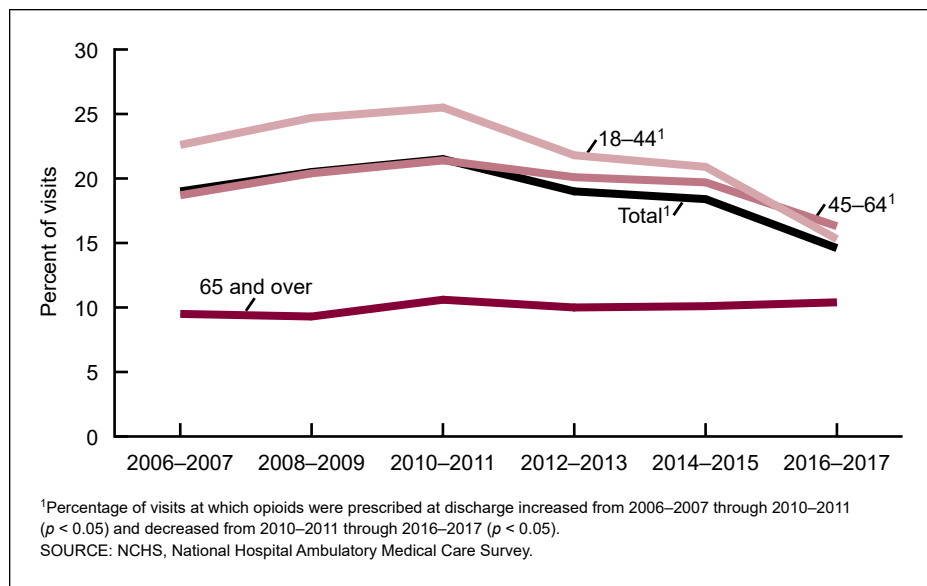


Figure 1. Trends in the percentage of all emergency department visits by adults at which opioids were prescribed at discharge, by age: United States, 2006–2017

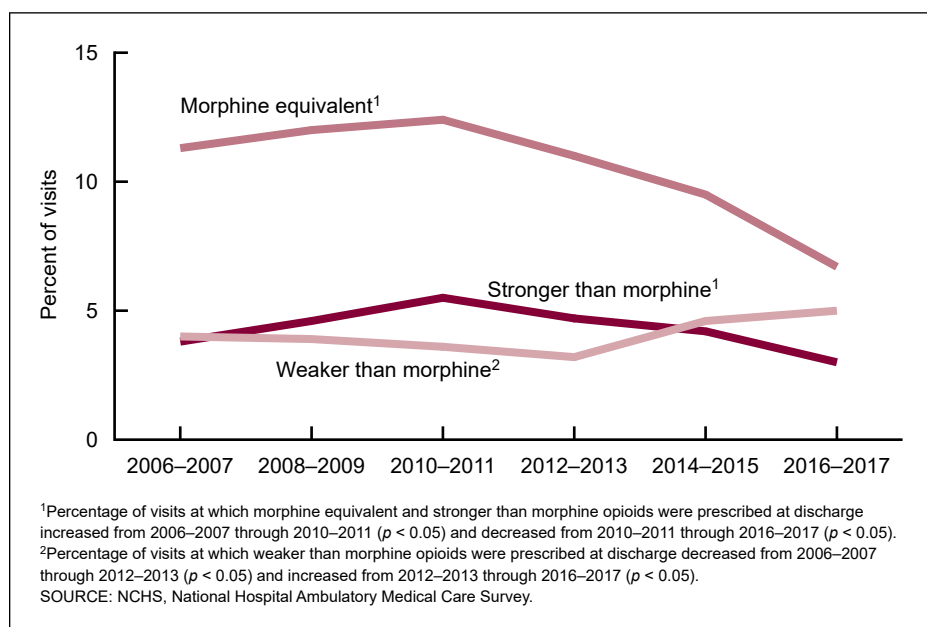


Figure 2. Trends in the percentage of emergency department visits by adults at which opioids were prescribed at discharge, by strength relative to morphine: United States, 2006–2017

that included an opioid prescribed at discharge followed a similar pattern to the trend for voluntary or nonprofit hospitals, however, the increase from 2006–2007 through 2010–2011 was not significant. Among visits to proprietary hospitals, the percentage with an opioid prescribed decreased from 23.0% in 2006–2007 to 19.0% in 2016–2017.

Strength relative to morphine

Consistent with the trend in the overall percentage of visits with an opioid prescribed at discharge from 2006–2007 through 2016–2017, the percentage of visits with a morphine-equivalent strength or stronger than morphine-strength opioid prescribed at discharge increased from 2006–2007 through 2010–2011 and decreased from 2010–2011 through 2016–2017 (Table 2 and Figure 2). The percentage

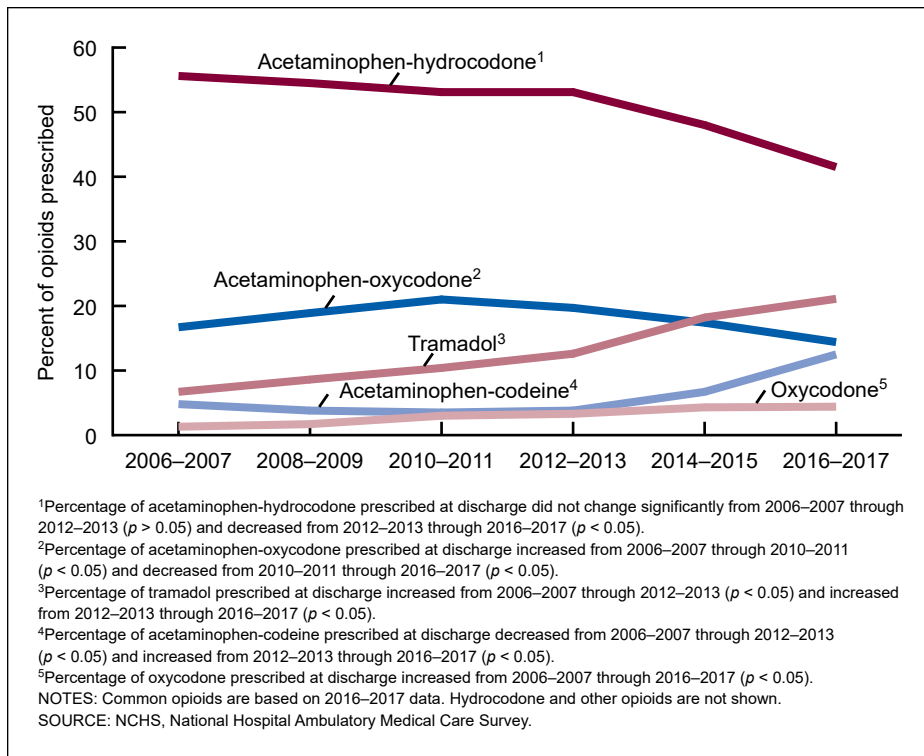
of visits with a morphine equivalent opioid prescribed at discharge increased from 11.3% in 2006–2007 to 12.4% in 2010–2011 and decreased to 6.7% in 2016–2017. The percentage of visits with a stronger than morphine opioid prescribed at discharge increased from 3.8% in 2006–2007 to 5.5% in 2010–2011 and decreased to 3.0% in 2016–2017. In contrast, the percentage of visits with a weaker than morphine opioid prescribed decreased from 4.0% in 2006–2007 to 3.2% in 2012–2013 and increased to 5.0% in 2016–2017.

Most common opioids prescribed

Based on 2016–2017 data, the most common opioids prescribed at ED discharge were acetaminophen-hydrocodone, tramadol, acetaminophen-oxycodone, acetaminophen-codeine, oxycodone, and hydrocodone (Table 3 and Figure 3). Acetaminophen-hydrocodone comprised 55.6% of all opioids prescribed in 2006–2007, and this percentage remained stable through 2012–2013 (53.1%) and decreased to 41.5% in 2016–2017. Tramadol comprised 6.7% of all opioids prescribed in 2006–2007 and increased to 21.1% of all prescribed opioids in 2016–2017. Acetaminophen-oxycodone comprised 16.7% of all prescribed opioids in 2006–2007, increased to 21.0% in 2010–2011, and then decreased to 14.4% in 2016–2017. Acetaminophen-codeine comprised 4.8% of all opioids prescribed in 2006–2007, decreased to 3.8% in 2012–2013, and then increased to 12.5% in 2016–2017. Oxycodone comprised 1.3% of prescribed opioids in 2006–2007 and increased to 4.4% in 2016–2017. No significant trend in the percentage of hydrocodone prescribed at discharge across the study period was observed.

Primary diagnoses

Based on 2016–2017 data, the primary diagnoses with the highest percentage of visits with an opioid prescribed at discharge were dental pain, urolithiasis (stones in the kidney, bladder, or urinary tract), fractures, back pain, and extremity pain (Table 4 and Figure 4). Other pain-related diagnoses for



opioid prescribed at discharge increased from 45.2% in 2006–2007 to 51.9% in 2010–2011 and decreased to 45.0% in 2016–2017. A similar trend was observed for abdominal pain. No significant trend in the percentage of visits for urolithiasis or chest pain with an opioid prescribed at discharge was observed across the study period.

Discussion

The percentage of all ED visits by adults in which an opioid was prescribed at discharge increased from 19.0% in 2006–2007 to 21.5% in 2010–2011, and decreased to 14.6% in 2016–2017, representing a 30.1% decrease from 2006–2007 to 2016–2017. This finding is consistent with the trend in national opioid prescribing rates based on pharmacy data in which rates increased from 2006 through 2010, were constant from 2010–2012, and decreased from 2012–2015 (13). A similar trend in the percentage of ED visits with opioids prescribed at discharge was observed for most of the patient characteristics examined in this report. The decreasing trend starting in 2010–2011 may be related to several factors: decreasing volume of prescription opioids (13); the hundreds of local, state, and federal programs that were implemented with the goal of changing prescribing practices (14,15); and prescription drug monitoring programs (16,17).

Variation in the rate of change was found for age, patient residence, and primary expected source of payment. The rate of decrease in the percentage of visits with an opioid prescribed at discharge by younger patients aged 18–44 from both the beginning of the study period (2006–2007) and from the inflection point (2010–2011) to the end of the study period (2016–2017) was the highest across all age groups. Similarly, the percentage of visits by patients living in medium or small metropolitan counties that included an opioid prescribed at discharge decreased by the highest percentage from both 2006–2007 and 2010–2011 through 2016–2017 among all urban or rural categories. Medicaid and self-pay or no charge or charity experienced the highest rate of decrease starting from 2010–2011 through

Figure 3. Trends in the percentage of all opioids prescribed at discharge, by common opioids: United States, 2006–2017

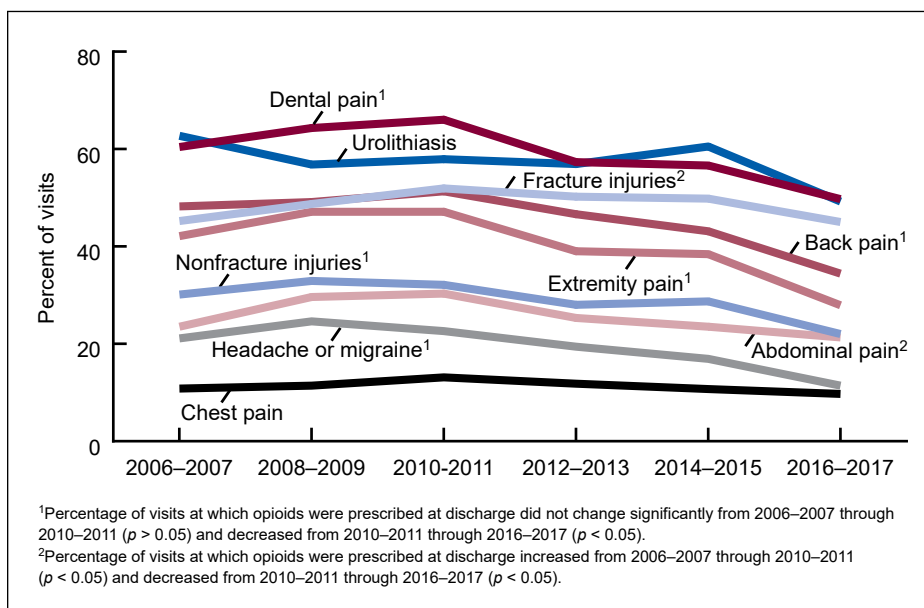


Figure 4. Trends in the percentage of emergency department visits by adults at which opioids were prescribed at discharge, by primary diagnoses: United States, 2006–2017

which an opioid was prescribed included nonfracture injuries, abdominal pain, headache or migraine, and chest pain. The percentage of visits for dental pain with an opioid prescribed at discharge remained stable from 2006–2007 (60.4%) through 2010–2011 (66.0%) and decreased to 49.7% in 2016–2017. A similar trend was observed for back

pain, extremity pain, nonfracture injuries, and headache or migraine, with the percentage of visits for headache or migraine with an opioid prescribed at discharge decreasing by the largest percentage (85.1%) between 2006–2007 and 2016–2017 across all primary diagnosis categories. The percentage of visits for fracture injuries with an

2016–2017. The percentage of visits by patients with Medicare that included an opioid prescribed at discharge remained stable over the study period, which is consistent with the stable trend in the percentage of visits by patients over age 65 with an opioid prescribed at discharge.

Across the study period, the largest decrease (among all four regions) in opioids prescribed at discharge from 2006–2007 through 2016–2017 was observed in the Northeast region (14.1% in 2006–2007 to 8.1% in 2016–2017). Generally, a higher percentage of visits at proprietary (or for-profit) hospital EDs, compared with nonprofit and government hospital EDs, included an opioid prescribed at discharge. Despite this relatively high percentage (19.0% in 2016–2017), the rate of decrease in the percentage with an opioid prescribed among visits made to proprietary hospital EDs was modest and the percentage in 2016–2017 (19.0%) was significantly higher than the national percentage (14.6%).

Consistent with the overall trend in the percentage of visits with opioids prescribed at discharge, the percentage of visits with morphine-equivalent and stronger than morphine opioids prescribed at discharge increased from 2006–2007 through 2010–2011 and decreased from 2010–2011 through 2016–2017. In contrast, the percentage of visits with weaker than morphine opioids prescribed at discharge decreased from 2006–2007 through 2012–2013 and increased from 2012–2013 through 2016–2017. The upward trend in the percentage of visits with weaker than morphine opioids and corresponding downward trend in the percentage of visits with stronger than morphine and morphine-equivalent opioids in recent years may potentially be attributed to changing prescribing practices as a result of guidelines and policies created to monitor and reduce opioid prescribing in the United States (14,15,18). Oxycodone and hydrocodone have been frequently associated with prescription drug abuse (8). The current analysis found an increase in the percentage of opioid mentions with oxycodone (including in combination with acetaminophen) prescribed at discharge from 2006–2007 through 2010–2011. From 2010–2011 through 2016–2017, the percentage of

opioid mentions with acetaminophen-oxycodone prescribed decreased whereas the percentage continued to increase for oxycodone (from 3.0% in 2010–2011 to 4.4% in 2016–2017). The percentage of opioid mentions with acetaminophen-hydrocodone (e.g., Vicodin, Lortab) prescribed remained stable from 2006–2007 through 2012–2013 and decreased starting from 2014–2015. In 2014, acetaminophen-hydrocodone was rescheduled from a schedule III to a schedule II controlled substance in response to increasing levels of abuse of this drug (15), which might explain the decreasing trend starting from 2014–2015 in the percentage of opioid mentions with acetaminophen-hydrocodone prescribed at discharge. Despite this decrease, acetaminophen-hydrocodone was still the most commonly prescribed opioid in 2016–2017, accounting for 41.5% of opioids prescribed at discharge. Corresponding to the decrease in the percentage of opioid mentions with acetaminophen-hydrocodone, the percentage with tramadol and acetaminophen-codeine, both classified as weaker than morphine, increased starting in 2014–2015. Tramadol, the second-most prescribed opioid in 2016–2017 (21.1%), is historically known as having a lesser risk of dependence, however, a recent study reported surgical patients receiving tramadol had a higher risk of prolonged use than those receiving other common opioids (19).

Dental pain, urolithiasis, fracture injuries, back pain, and extremity pain were the top diagnoses associated with the highest percentage of visits with opioids prescribed at discharge. Between 2010–2011 (inflection point) and 2016–2017, the percentage of visits for headache or migraine, extremity pain, and back pain with an opioid prescribed at discharge decreased by the largest percentages (98.2% for headache or migraine; 68.8% for extremity pain; and 49.1% for back pain). Evidence has grown that opioids should not be the first-line treatment for headache and migraine in the ED (20,21). Approximately half of the visits for extremity and back pain included an opioid prescribed at discharge in 2010–2011, which decreased substantially in 2016–2017

(27.9% for extremity pain and 34.4% for back pain). This decrease may be explained by changing prescribing behaviors of ED providers in response to the opioid epidemic combined with evidence that nonopioid analgesics are just as effective as commonly prescribed opioids in the treatment of acute extremity and back pain (22,23). In 2012, the American College of Emergency Physicians published a clinical policy recommending avoidance of the routine prescribing of opioids for acute low back pain, reserving opioids only for severe, disabling pain that is unlikely to be controlled with acetaminophen or nonsteroidal anti-inflammatory drugs (NSAIDs) (15). Dental pain was still the top diagnosis associated with an opioid prescribed at discharge in 2016–2017 (49.7%), a reduction from 2010–2011 (66.0%). Patients presenting to the ED complaining of dental pain often report very high levels of pain on numeric rating scales (24). Furthermore, EDs generally do not have dental professionals on staff who can treat the underlying cause of the pain, and instead use opioids as the main form of treatment (24). Recent studies report an increase in ED visits for dental disease, a condition that has been associated with drug-seeking behavior (25). Kidney stones cause acute and severe pain and opioids are commonly prescribed in the ED to manage pain associated with this condition (26). From 2006–2007 through 2016–2017, a decreasing trend in the percentage of visits for urolithiasis (a majority for kidney stones) with an opioid prescribed at discharge was observed, although this was not statistically significant.

There are limitations to this analysis. First, time points were grouped into 2-year intervals to increase the reliability of estimates by patient, visit, and hospital characteristics, thus constraining the granularity of trend analyses. Second, data on drug dosage and duration are not collected in NHAMCS, which precluded estimation of morphine milligram equivalents of opioids prescribed. Third, NHAMCS does not collect information on whether medications prescribed were actually taken by the patient; as a result, medication adherence was not examined in this report.

The findings from this report include the most recent trend estimates from a nationally representative survey showing that the percentage of ED visits by adults which resulted in an opioid prescribed at discharge increased from 2006–2007 through 2010–2011 and decreased from 2010–2011 through 2016–2017. Continuing to assess trends in opioid prescribing in the ED setting is important to monitor the effects of public health policy at the national level.

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Table 1. Trends in the percentage of all emergency department visits by adults at which opioids were prescribed at discharge, by patient and hospital characteristics: United States, 2006–2017

Characteristic	2006–2007	2008–2009	2010–2011	2012–2013	2014–2015	2016–2017	<i>p</i> for linear trend ¹
Percent (standard error)							
Total	19.0 (0.6)	20.5 (0.6)	21.5 (0.5)	19.0 (0.6)	18.4 (0.7)	14.6 (0.5)	†Less than 0.001
Patients							
Sex:							
Women	19.0 (0.6)	20.4 (0.6)	21.5 (0.5)	18.9 (0.7)	18.3 (0.6)	14.7 (0.6)	†Less than 0.001
Men	19.1 (0.6)	20.7 (0.6)	21.5 (0.6)	19.1 (0.7)	18.4 (1.0)	14.5 (0.7)	†Less than 0.001
Age:							
18–44	22.6 (0.8)	24.7 (0.7)	25.5 (0.7)	21.8 (0.8)	20.9 (0.7)	15.3 (0.6)	†Less than 0.001
45–64	18.7 (0.6)	20.4 (0.7)	21.4 (0.6)	20.1 (0.7)	19.7 (0.9)	16.3 (0.7)	‡0.010
65 and over	9.5 (0.5)	9.3 (0.5)	10.6 (0.5)	10.0 (0.6)	10.1 (0.6)	10.4 (0.6)	0.188
Race and ethnicity:							
Non-Hispanic white	20.1 (0.6)	21.3 (0.6)	22.0 (0.6)	19.4 (0.7)	18.7 (0.7)	15.1 (0.6)	†Less than 0.001
Non-Hispanic black	17.4 (0.9)	19.5 (0.8)	20.6 (0.8)	19.0 (1.0)	17.5 (1.2)	13.6 (0.8)	†Less than 0.001
Hispanic	17.9 (0.8)	19.2 (1.1)	20.6 (1.0)	17.5 (0.9)	18.5 (1.2)	14.5 (1.1)	‡0.011
Other	13.7 (1.1)	15.5 (1.3)	19.6 (1.5)	15.8 (1.3)	16.8 (2.0)	11.2 (1.2)	‡0.241
Urban or rural:							
Large central metropolitan	16.9 (0.9)	17.7 (0.9)	20.4 (0.9)	17.0 (0.9)	17.4 (1.2)	13.8 (1.0)	‡0.031
Large fringe metropolitan	18.3 (0.8)	21.8 (1.1)	20.6 (1.1)	19.1 (1.2)	19.0 (1.1)	16.4 (1.5)	‡0.040
Medium or small metropolitan	21.7 (0.8)	22.9 (0.8)	24.3 (0.8)	21.2 (1.1)	20.4 (0.9)	14.5 (0.7)	†Less than 0.001
Nonmetropolitan	18.0 (1.6)	19.3 (1.4)	19.7 (1.2)	18.0 (1.1)	16.5 (1.2)	15.2 (1.1)	‡0.036
Primary expected source of payment:							
Private	20.7 (0.7)	22.5 (0.7)	23.5 (0.6)	19.8 (0.8)	20.6 (1.0)	16.9 (0.9)	†Less than 0.001
Medicare	11.4 (0.5)	11.5 (0.5)	12.8 (0.5)	12.2 (0.6)	11.8 (0.7)	11.7 (0.7)	0.687
Medicaid	20.3 (0.8)	21.0 (0.8)	22.1 (0.8)	19.7 (0.9)	19.6 (1.0)	14.1 (0.7)	†Less than 0.001
Self-pay or no charge	23.4 (1.1)	27.3 (1.0)	27.5 (0.9)	25.7 (1.1)	24.2 (1.2)	18.7 (1.2)	†Less than 0.001
Other	24.4 (1.6)	24.1 (1.7)	23.9 (1.7)	22.2 (1.5)	18.4 (2.4)	18.1 (2.3)	0.003
Hospitals							
Region:							
Northeast	14.1 (0.7)	14.9 (0.9)	15.9 (0.7)	13.7 (1.2)	11.8 (1.3)	8.1 (0.7)	†Less than 0.001
Midwest	18.1 (1.1)	18.7 (0.9)	20.4 (0.9)	18.9 (1.6)	18.2 (1.6)	12.8 (0.8)	‡0.008
South	22.0 (1.0)	23.6 (0.9)	24.0 (0.8)	21.1 (0.9)	20.6 (0.9)	18.0 (1.0)	‡Less than 0.001
West	18.6 (1.1)	21.9 (1.5)	23.0 (1.6)	19.4 (1.2)	20.5 (1.2)	15.0 (0.9)	‡0.006
Type:							
Voluntary or nonprofit	19.0 (0.6)	19.9 (0.6)	21.4 (0.5)	19.0 (0.7)	18.0 (0.8)	14.0 (0.7)	†Less than 0.001
Government	16.4 (1.6)	20.1 (1.5)	20.3 (1.4)	17.6 (1.6)	17.6 (1.4)	14.0 (1.0)	‡0.063
Proprietary	23.0 (1.4)	25.5 (2.1)	23.9 (2.2)	20.2 (1.7)	23.5 (2.0)	19.0 (1.5)	0.026

†Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge increased from 2006–2007 through 2010–2011 ($p < 0.05$) and decreased from 2010–2011 through 2016–2017 ($p < 0.05$).

‡Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge did not change significantly from 2006–2007 through 2010–2011 ($p > 0.05$) and decreased from 2010–2011 through 2016–2017 ($p < 0.05$).

¹*P* values for trends were calculated using methodology from the National Center for Health Statistics Guidelines for Analysis of Trends (available from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_179.pdf).

SOURCE: NCHS, National Hospital Ambulatory Medical Care Survey.

Table 2. Trends in the percentage of emergency department visits by adults at which opioids were prescribed at discharge, by strength relative to morphine: United States, 2006–2017

Strength	2006–2007	2008–2009	2010–2011	2012–2013	2014–2015	2016–2017	<i>p</i> for linear trend ¹
Percent (standard error)							
Total	19.0 (0.6)	20.5 (0.6)	21.5 (0.5)	19.0 (0.6)	18.4 (0.7)	14.6 (0.5)	†Less than 0.001
Weaker than morphine	4.0 (0.2)	3.9 (0.2)	3.6 (0.2)	3.2 (0.2)	4.6 (0.3)	5.0 (0.6)	‡0.051
Morphine equivalent	11.3 (0.4)	12.0 (0.5)	12.4 (0.4)	11.0 (0.4)	9.5 (0.5)	6.7 (0.4)	†Less than 0.001
Stronger than morphine	3.8 (0.2)	4.6 (0.3)	5.5 (0.3)	4.7 (0.4)	4.2 (0.4)	3.0 (0.3)	‡0.006

†Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge increased from 2006–2007 through 2010–2011 ($p < 0.05$) and decreased from 2010–2011 through 2016–2017 ($p < 0.05$).

‡Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge decreased from 2006–2007 through 2012–2013 ($p < 0.05$) and increased from 2012–2013 through 2016–2017 ($p < 0.05$).

¹*P* values for trends were calculated using methodology from the National Center for Health Statistics Guidelines for Analysis of Trends (available from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_179.pdf).

NOTE: Numbers may not add to totals due to rounding.

SOURCE: NCHS, National Hospital Ambulatory Medical Care Survey.

Table 3. Trends in the percentage of all opioids prescribed at discharge, by type of opioid: United States, 2006–2017

Common opioids ^{1,2}	Strength classification	2006–2007	2008–2009	2010–2011	2012–2013	2014–2015	2016–2017	<i>p</i> for linear trend ³
		Percent of opioid mentions (standard error)						
All opioids prescribed at discharge. . . . .	...	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...	...
Acetaminophen-hydrocodone.	Morphine equivalent	55.6 (1.2)	54.5 (1.3)	53.1 (1.4)	53.1 (1.6)	48.0 (1.9)	41.5 (2.6)	†Less than 0.001
Tramadol.	Weaker than morphine	6.7 (0.6)	8.6 (0.6)	10.4 (0.7)	12.6 (0.9)	18.2 (1.2)	21.1 (1.5)	‡Less than 0.001
Acetaminophen-oxycodone.	Stronger than morphine	16.7 (1.0)	18.9 (1.1)	21.0 (1.1)	19.7 (1.5)	17.4 (1.5)	14.4 (1.5)	§0.091
Acetaminophen-codeine.	Weaker than morphine	4.8 (0.4)	3.8 (0.3)	3.5 (0.3)	3.8 (0.4)	6.7 (0.8)	12.5 (2.2)	¶Less than 0.001
Oxycodone.	Stronger than morphine	1.3 (0.3)	1.7 (0.3)	3.0 (0.4)	3.3 (0.5)	4.3 (0.9)	4.4 (0.5)	Less than 0.001
Hydrocodone.	Morphine equivalent	1.6 (0.3)	2.2 (0.3)	2.7 (0.4)	3.2 (0.7)	1.6 (0.3)	2.7 (0.7)	0.325
Other. . . . .	...	13.4 (0.7)	10.3 (0.5)	6.2 (0.4)	4.2 (0.4)	3.8 (0.4)	3.4 (0.5)	††Less than 0.001

...Category not applicable.

†Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge did not change significantly from 2006–2007 through 2012–2013 ($p > 0.05$) and decreased from 2012–2013 through 2016–2017 ($p < 0.05$).

‡Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge increased from 2006–2007 through 2012–2013 ($p < 0.05$) and increased from 2012–2013 through 2016–2017 ($p < 0.05$).

§Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge increased from 2006–2007 through 2010–2011 ($p < 0.05$) and decreased from 2010–2011 through 2016–2017 ($p < 0.05$).

¶Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge decreased from 2006–2007 through 2012–2013 ($p < 0.05$) and increased from 2012–2013 through 2016–2017 ($p < 0.05$).

††Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge decreased from 2006–2007 through 2012–2013 ($p < 0.05$) and did not change significantly from 2012–2013 through 2016–2017 ($p < 0.05$).

¹An emergency department visit record could have more than one opioid mention (i.e., opioid prescribed at discharge).

²Based on the Cerner Multum's Lexicon database (available from: <https://www.cerner.com/solutions/drug-database>). Common opioids are based on 2016–2017 data.

³*P* values for trends were calculated using methodology from the National Center for Health Statistics Guidelines for Analysis of Trends (available from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_179.pdf).

NOTE: Numbers may not add to totals due to rounding.

SOURCE: NCHS, National Hospital Ambulatory Medical Care Survey.

Table 4. Trends in the percentage of emergency department visits at which opioids were prescribed at discharge, by primary diagnosis: United States, 2006–2017

Primary diagnosis	2006–2007	2008–2009	2010–2011	2012–2013	2014–2015	2016–2017	<i>p</i> for linear trend ¹
	Percent (standard error)						
Total.	19.0 (0.6)	20.5 (0.6)	21.5 (0.5)	19.0 (0.6)	18.4 (0.7)	14.6 (0.5)	†Less than 0.001
Dental pain.	60.4 (2.5)	64.3 (2.4)	66.0 (2.1)	57.3 (2.5)	56.6 (3.4)	49.7 (3.1)	‡Less than 0.001
Urolithiasis.	62.7 (2.8)	56.8 (3.2)	57.9 (2.9)	56.9 (3.5)	60.5 (3.7)	49.2 (4.5)	0.058
Fracture injuries.	45.2 (1.9)	48.7 (1.8)	51.9 (2.1)	50.2 (2.4)	49.8 (2.4)	45.0 (2.4)	†0.973
Back pain.	48.2 (1.6)	49.1 (2.0)	51.3 (1.8)	46.6 (2.0)	43.1 (2.2)	34.4 (2.1)	‡Less than 0.001
Extremity pain.	42.1 (3.2)	47.1 (2.8)	47.1 (3.2)	39.0 (2.8)	38.4 (2.7)	27.9 (2.6)	‡Less than 0.001
Nonfracture injuries.	30.1 (1.0)	32.9 (1.1)	32.1 (1.0)	28.0 (1.2)	28.7 (1.5)	22.0 (1.2)	‡Less than 0.001
Abdominal pain.	23.5 (1.3)	29.6 (1.5)	30.3 (1.4)	25.3 (1.3)	23.5 (1.5)	21.3 (1.5)	†0.004
Headache or migraine.	21.1 (1.7)	24.6 (1.6)	22.6 (1.6)	19.4 (1.9)	16.9 (1.8)	11.4 (1.5)	‡Less than 0.001
Chest pain.	10.8 (1.0)	11.4 (0.8)	13.1 (1.0)	11.8 (1.4)	10.7 (1.1)	9.7 (1.5)	0.355
Other.	10.9 (0.4)	11.8 (0.4)	12.6 (0.4)	10.9 (0.4)	10.9 (0.5)	8.2 (0.4)	†Less than 0.001

†Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge increased from 2006–2007 through 2010–2011 ($p < 0.05$) and decreased from 2010–2011 through 2016–2017 ($p < 0.05$).

‡Includes a significant quadratic term for 2006–2017. Percentage of opioids prescribed at discharge did not change significantly from 2006–2007 through 2010–2011 ($p > 0.05$) and decreased from 2010–2011 through 2016–2017 ($p < 0.05$).

¹*P* values for trends were calculated using methodology from the National Center for Health Statistics Guidelines for Analysis of Trends (available from: https://www.cdc.gov/nchs/data/series/sr_02/sr02_179.pdf).

NOTE: Numbers may not add to totals due to rounding.

SOURCE: NCHS, National Hospital Ambulatory Medical Care Survey.

Technical Notes

Definition of terms

Opioid mention—Opioids prescribed at discharge. Opioids were defined using the Cerner Multum’s third-level therapeutic category codes for narcotic analgesics (Code 60) and narcotic analgesic combinations (Code 191). Buprenorphine, buprenorphine-naloxone, and antitussive formulations containing opioids were not included. If any opioid mention in the visit record had the designation of “prescribed at discharge” or “both given in emergency department (ED) and prescribed at discharge,” then that opioid was classified as an opioid mention. The unit of measurement is any opioid mention in the visit record. In 2006–2017, 30.7% of adult ED visits with at least one opioid mention included more than one opioid mention in the medical record.

Visits with an opioid prescribed at discharge—If an opioid in the visit record had the designation of “prescribed at discharge” or “both given in ED and prescribed at discharge,” then that visit was classified as a visit with an opioid prescribed at discharge. The unit of measurement is the ED visit.

Opioid strength relative to morphine—Opioids were classified into three groups: weaker than morphine, morphine equivalent, and stronger than morphine. Opioids were defined as follows:

- Weaker than morphine: Meperidine, meperidine-promethazine, codeine, aspirin-codeine, aspirin-caffeine-codeine-phenacetin, acetaminophen-codeine, acetaminophen-butalbital-caffeine-codeine, aspirin-butalbital-caffeine-codeine, pentazocine, naloxone-pentazocine, propoxyphene, acetaminophen-propoxyphene, aspirin-caffeine-propoxyphene, dihydrocodeine, acetaminophen-caffeine-dihydrocodeine, belladonna-opium, tramadol, and tapentadol.
- Morphine equivalent: hydrocodone, aspirin-hydrocodone, acetaminophen-hydrocodone, hydrocodone-ibuprofen, homatropine methyl bromide-hydrocodone, acetaminophen-ethanol-glycerin-

hydrocodone-parabens, morphine, atropine-morphine, nalbuphine, and opium.

- Stronger than morphine: fentanyl, droperidol-fentanyl, sufentanil, oxycodone, aspirin-oxycodone, ibuprofen-oxycodone, acetaminophen-oxycodone, oxymorphone, hydromorphone, bupivacaine-hydromorphone, methadone, butorphanol, levorphanol, and alfentanil.

Primary expected sources of payment—During data collection, all sources of payment were collected. These sources of payment were collapsed into one mutually exclusive variable (primary expected source of payment) that ranks payment sources based on the hierarchy below:

- Medicare: Partial or full payment by Medicare plan includes payments made directly to the hospital as well as payments reimbursed to the patient. Charges covered under a Medicare-sponsored prepaid plan are included.
- Medicaid: Partial or full payment by Medicaid plan includes payments made directly to the hospital or reimbursed to the patient. Charges covered under a Medicaid-sponsored prepaid plan (HMO) or “managed Medicaid” are included.
- Private: Partial or full payment by a private insurer (e.g., Blue Cross Blue Shield), either directly to the hospital or reimbursed to the patient. Charges covered under a private insurance-sponsored prepaid plan are included.
- Self-pay or no charge: Includes self-pay, no charge, or charity. Self-pay is charges that are paid by the patient or the patient’s family, which will not be reimbursed by a third party. Self-pay includes visits for which the patient is expected to be ultimately responsible for most of the bill, even if the patient never pays it. This does not include copayments or deductibles. No charge or charity are visits for which no fee is charged (e.g., charity, special research, or teaching).

Urban or rural—Based on the county of patient residence. Counties were classified according to their metropolitan status using the National Center for Health Statistics Urban-Rural Classification Scheme for Counties (27).

- Large central metropolitan: Counties in metropolitan statistical areas (MSAs) of 1 million or more population that contain the largest principal city of the MSA, are contained within the MSA’s largest principal city, or contain at least 250,000 residents of any principal city.
- Large fringe metropolitan: Counties in MSAs of 1 million or more population that do not qualify as large central metropolitan. They are considered to be “suburbs” of large cities.
- Medium or small metropolitan: Counties in MSAs of less than 999,999 population.
- Nonmetropolitan: Counties not in MSAs and including counties in OMB-defined micropolitan statistical areas and noncore areas.

Primary diagnosis—Considered to be the main cause or reason for the ED visit from the physician’s perspective. Classified according to the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) (28) coding system (for survey years 2006–2015) and the *International Classification of Diseases, 10th Revision, Clinical Modification* (ICD–10–CM) (29) coding system for survey years 2016 and 2017. Selected diagnoses include common pain conditions presenting to the ED, and were defined as follows:

- Abdominal pain: 789.0 and 789.6 (ICD–9–CM); R10.0, R10.1, R10.3, and R10.8 (ICD–10–CM)
- Back pain: 723.0–9, 724.1–5, and 724.8–9 (ICD–9–CM); M54 (ICD–10–CM)
- Chest pain: 786.5 (ICD–9–CM); R07.1, R07.2, R07.8, and R07.9 (ICD–10–CM)
- Dental pain: 520–523 and 525 (ICD–9–CM); K00–K08 (ICD–10–CM)
- Extremity pain: 337.21–22, 354.4, 355.71, and 719.41–47 (ICD–9–

CM); M79.6 and M25.51–M25.57 (ICD–10–CM)

- Fracture injuries: 800–829 (ICD–9–CM); S02, S12, S22, S32, S42, S49.0–1, S52, S59.0–2, S62, S72, S79.0–1, S82, S89.0–3, S92, and S99.0–2 (ICD–10–CM)
- Headache and migraine: 339, 346, and 784.0 (ICD–9–CM); R51 and G43–G44 (ICD–10–CM)
- Nonfracture injuries: 830–957 and 990–995 (ICD–9–CM); S00–T88 and Y92–Y93 (excluding codes for fracture injuries) (ICD–10–CM)
- Urolithiasis (stones in the kidney, bladder, or urinary tract): 592, 594, and 788.0 (ICD–9–CM); N20–N23 (ICD–10–CM)

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