

# World Journal of *Orthopedics*

*World J Orthop* 2021 September 18; 12(9): 620-726



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**INDEXING/ABSTRACTING**

The *WJO* is now abstracted and indexed in PubMed, PubMed Central, Emerging Sources Citation Index (Web of Science), Scopus, China National Knowledge Infrastructure (CNKI), China Science and Technology Journal Database (CSTJ), and Superstar Journals Database. The 2021 edition of Journal Citation Reports® cites the 2020 Journal Citation Indicator (JCI) for *WJO* as 0.66. The *WJO*'s CiteScore for 2020 is 3.2 and Scopus CiteScore rank 2020: Orthopedics and Sports Medicine is 87/262.

**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: *Lin-YuTong Wang*; Production Department Director: *Xiang Li*; Editorial Office Director: *Jin-Lei Wang*.

**NAME OF JOURNAL**

*World Journal of Orthopedics*

**ISSN**

ISSN 2218-5836 (online)

**LAUNCH DATE**

November 18, 2010

**FREQUENCY**

Monthly

**EDITORS-IN-CHIEF**

Massimiliano Leigheb

**EDITORIAL BOARD MEMBERS**

<http://www.wjgnet.com/2218-5836/editorialboard.htm>

**PUBLICATION DATE**

September 18, 2021

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<https://www.wjgnet.com/bpg/gerinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

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**ONLINE SUBMISSION**

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## Clinical and Translational Research

# Trends and risk factors for opioid administration for non-emergent lower back pain

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**Institutional review board statement:** The present investigation was a retrospective study that utilized a publicly available deidentified database; therefore, no institutional review board.

**Informed consent statement:** The present study utilized a publicly available database. Therefore,

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## Abstract

### BACKGROUND

Non-emergent low-back pain (LBP) is one of the most prevalent presenting complaints to the emergency department (ED) and has been shown to contribute to overcrowding in the ED as well as diverting attention away from more serious complaints. There has been an increasing focus in current literature regarding ED admission and opioid prescriptions for general complaints of pain, however, there is limited data concerning the trends over the last decade in ED admissions for non-emergent LBP as well as any subsequent opioid prescriptions by the ED for this complaint.

### AIM

To determine trends in non-emergent ED visits for back pain; annual trends in opioid administration for patients presenting to the ED for back pain; and factors associated with receiving an opioid-based medication for non-emergent LBP in the ED

### METHODS

Patients presenting to the ED for non-emergent LBP from 2010 to 2017 were retrospectively identified from the National Hospital Ambulatory Medical Care Survey database. The "year" variable was transformed to two-year intervals, and a weighted survey analysis was conducted utilizing the weighted variables to generate incidence estimates. Bivariate statistics were used to assess differences in count data, and logistic regression was performed to identify factors associated

Informed consent statement were not required.

**Conflict-of-interest statement:** Plate FJ has the following disclosures, all of which are not related to the topic of the present investigation: Biocomposites Inc.: Research support; Total Joint Orthopedics: Paid consultant; VisualDX: Publishing royalties, financial or material support; Other authors have nothing to disclose

**Data sharing statement:** All authors had access to the data for the current investigation.

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**Manuscript source:** Invited manuscript

**Specialty type:** Orthopedics

**Country/Territory of origin:** United States

**Peer-review report's scientific quality classification**

Grade A (Excellent): 0  
Grade B (Very good): B  
Grade C (Good): C  
Grade D (Fair): 0  
Grade E (Poor): 0

**Received:** February 25, 2021

**Peer-review started:** February 25, 2021

**First decision:** March 31, 2021

**Revised:** April 8, 2021

**Accepted:** August 24, 2021

**Article in press:** August 24, 2021

**Published online:** September 18, 2021

with patients being discharged from the ED with narcotics. Statistical significance was set to a *P* value of 0.05.

## RESULTS

Out of a total of 41658475 total ED visits, 3.8% (7726) met our inclusion and exclusion criteria. There was a decrease in the rates of non-emergent back pain to the ED from 4.05% of all cases during 2010 and 2011 to 3.56% during 2016 and 2017. The most common opioids prescribed over the period included hydrocodone-based medications (49.1%) and tramadol-based medications (16.9), with the combination of all other opioid types contributing to 35.7% of total opioids prescribed. Factors significantly associated with being prescribed narcotics included age over 43.84-years-old, higher income, private insurance, the obtainment of radiographic imaging in the ED, and region of the United States (all, *P* < 0.05). Emergency departments located in the Midwest [odds ratio (OR): 2.42, *P* < 0.001], South (OR: 2.35, < 0.001), and West (OR: 2.57, *P* < 0.001) were more likely to prescribe opioid-based medications for non-emergent LBP compared to EDs in the Northeast.

## CONCLUSION

From 2010 to 2017, there was a significant decrease in the number of non-emergent LBP ED visits, as well as a decrease in opioids prescribed at these visits. These findings may be attributed to the increased focus and regulatory guidelines on opioid prescription practices at both the federal and state levels. Since non-emergent LBP is still a highly common ED presentation, conclusions drawn from opioid prescription practices within this cohort is necessary for limiting unnecessary ED opioid prescriptions.

**Key Words:** Opioids; Low back pain; Emergency Department; Spine; Complications; Trends

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**Core Tip:** A trend of diminishing opioid prescription for low back pain in the emergency department can be appreciated over a span of eight years. Such a trend may be a reflection of policies and guidelines aiming at opioid regulation. Factors that may increase the likelihood of opioid prescription for low back pain include age over 43.84-years-old, higher income, private insurance, the obtainment of radiographic imaging in the emergency department, and presenting within the Midwest/South/West regions of the United States. Providers should be cognizant of such risk factors given the burden imposed by opioid prescriptions on the healthcare system.

**Citation:** Gwam CU, Emara AK, Chughtai N, Javed S, Luo TD, Wang KY, Chughtai M, O'Gara T, Plate JF. Trends and risk factors for opioid administration for non-emergent lower back pain. *World J Orthop* 2021; 12(9): 700-709

**URL:** <https://www.wjgnet.com/2218-5836/full/v12/i9/700.htm>

**DOI:** <https://dx.doi.org/10.5312/wjo.v12.i9.700>

## INTRODUCTION

Low back pain (LBP) is one of the most common healthcare complaints and musculo-skeletal disorders seen in the emergency department (ED)[1,2]. The prevalence of LBP ranges from 49% to greater than 80% in the United States[3]. While non-emergent LBP can be treated by primary care physicians, studies suggest that patients will visit the ED for evaluation of symptoms, potentially leading to overcrowding and distracting from other serious health complaints[4,5]. Patients presenting to the ED for non-emergent LBP have been found to receive unnecessary imaging with excess radiation, be admitted to the hospital for pain control, or be given prescriptions of opioid pain medication[6-8].

**P-Reviewer:** Reddy RS**S-Editor:** Liu M**L-Editor:** A**P-Editor:** Liu JH

Studies have shown inconclusive results in the efficacy using opioids to treating patients for LBP, with worse outcomes at 6-month follow-up. Furthermore, studies have shown similar efficacy of opioids compared to non-opioid medications in the treatment of both acute and chronic LBP[9-12]. Within the past decade, opioid prescribing for non-cancer pain has increased dramatically, along with an increase in opioid abuse and resulting deaths[13-16]. Davies *et al*[16] analyzed opioid prescribing rates from January 2005 to December 2015, stratifying patients by age. Their findings revealed that opioid prescriptions in patients older than the age of 85 increased nearly 2-fold. The American College of Emergency Physicians recommends utilizing opioids in the ED only when pain is severe, debilitating, or refractory to other treatments[17]. Further guidelines were mandated by the American Academy of Emergency Medicine, recommending opioids as a second-line treatment[18]. Despite the calls for regulation, evidence of deviation from guideline recommendations persists. Indeed, Hayden *et al* [19] reported 5% of previously opioid-naïve patients who present to the emergency department for low back pain become prolonged opioid users.

Temporal trends of ED visits for LBP, opioid prescription patterns for non-emergent LBP, and patient factors associated with receiving an opioid prescription have not been well documented but are necessary to combat the continuing opioid epidemic in the United States. Therefore, the purpose of this study was to determine trends in non-emergent ED visits for back pain; annual trends in opioid prescriptions for patients presenting to the ED for back pain; and factors associated with receiving an opioid based prescription for non-emergent LBP in the ED

## MATERIALS AND METHODS

### **Database and Patient Selection**

This was a retrospective study. The National Hospital Ambulatory Medical Care Survey (NHAMCS) was reviewed between the years 2010 and 2017. The NHAMCS is publicly available and is designed to collect data on the utilization and provision of ambulatory care services in hospital, emergency, and ambulatory care departments. Data is obtained from a sample of visits to non-federally employed office physicians. Prior to 2012, NHAMCS relied on paper instruments; the survey switched to computerized data collection in 2012. Each physician is randomly assigned to a one-week reporting period. During this period, data for a systematic random sample of visits are recorded by United States Census interviewers using a computerized Patient Record form. The survey uses a four-stage probability design with samples of primary sampling units (PSUs), hospitals within PSUs, clinics and emergency service areas within hospitals, and patient visits within clinics and emergency service areas. More details on NHAMCS can be found at [cdc.gov](http://cdc.gov).

Patients were included if they presented to one of the aforementioned ambulatory care settings captured by the NHAMCS with a complaint of back pain. Patients with back pain were identified using the following string codes as a chief complaint: (1) "Back symptoms"; (2) "Back pain, ache, soreness, discomfort"; (3) "Back cramps, contractures, spasms"; (4) "Low back pain, ache, soreness, discomfort"; and (5) "Low back cramps, contractures, spasms". Patients were excluded if they were under the age of 18 or were admitted for inpatient hospital stay.

### **Statistical analysis**

A weighted survey analysis was conducted utilizing the weighted variables to generate incidence estimates. A chi-square analysis was performed to assess differences in count data. The "year" variable was transformed to two-year intervals as per the recommendations by the Center for Disease Prevention and Control[20]. Logistic regression analysis was conducted to identify factors associated with patients being discharged from the ED with narcotics. Group variables entered into our logistic regression model were removed if all group level's *P*-value exceeded 0.1. Presenting pain was discretized to the following categories: "Low" = 0 to 3; "moderate" = 4 to 6; and "severe" = 7 or more. A *P* value of 0.05 was set as the threshold for statistical significance. All statistical analysis was conducted using R statistical software (Vienna, Austria). The 'survey' package was utilized to analyze survey data.

## RESULTS

### **Trends in presentation to the ED for non-emergent back pain**

After implementation of inclusion and exclusion criteria, the study group included 7726 cases, which was 3.8% of the 41658475 total ED visits [95% confidence interval (CI): 34317928 to 48999021] (95%CI: 3.65% to 3.99%). There was a decrease in the rates of non-emergent back pain to the ED from 4.05% of all cases (95%CI: 3.81 to 4.31) during 2010 and 2011 to 3.56% (95%CI: 3.21 to 3.91) during 2016 and 2017 (Figure 1).

### **Incidence of opioid prescription at discharge for non-emergent LBP**

Fifty-two percent of all cases that presented to the ED for non-emergent LBP were prescribed an opioid-based medication between 2010 and 2017 (95%CI: 49.9% to 54.0%). However, the rates of opioid-based prescriptions decreased between the period of 2010 and 2011 (55.9%; 95%CI: 52.9% to 58.9%) and the period of 2016 and 2017 (45.0%; 95%CI: 39.86% to 50.22%) (Figure 2). The most common opioids prescribed included hydrocodone-based medications (49.1% of all opioids prescribed; 95%CI: 46.3% to 52.0%) and tramadol-based medications (16.9% of all opioids prescribed; 95%CI: 14.8% to 19.0%), with the combination of all other opioid types contributing to 35.7% (95%CI: 32.6% to 39.0%) of total opioids prescribed.

Trend analysis revealed a decrease in the prescriptions of hydrocodone-based medications for non-emergent LBP patients presenting to the ED between the period of 2010 and 2011 (28.0%; 95%CI: 25.3% to 30.7%) to the period of 2016 and 2017 (19.3%; 95%CI: 15.6% to 23.1%). However, there was no notable change in the rates of non-emergent LBP patients that received tramadol or other opioid types (Figure 3).

### **Factors associated with opioid prescriptions**

Estimated household income was associated with receiving an opioid base narcotic. When compared to patients coming from the lowest income quartile (below 32793 dollars annually), patients belonging to the third income quartile (40627 dollars to 52387 dollars annually) had higher odds of receiving an opioid based medication [odds ratio (OR): 1.35; 95%CI: 1.13 to 1.61;  $P \leq 0.001$ ] (Table 1). Patients who were privately insured (OR: 1.29; 95%CI: 1.04 to 1.58;  $P = 0.018$ ) or were self-payers (OR: 1.25; 95%CI: 1.00 to 1.56;  $P = 0.048$ ) had higher odds of receiving an opioid based medication when compared to Medicaid patients. Other factors associated with being discharged with opioid based medications included if radiographic images were obtained (OR: 1.47; 95%CI: 1.30 to 1.66;  $P < 0.001$ ), age greater than 43.94-years (OR: 1.01; 95%CI: 1.00 to 1.01;  $P = 0.001$ ), and if patients reported having severe back pain (OR: 2.14; 95%CI: 1.63 to 2.81;  $P < 0.001$ ). ED location was also significantly associated with opioid prescription for back pain. Emergency departments located in the Midwest (OR: 2.42; 95%CI: 1.94 to 3.01;  $P < 0.001$ ), South (OR: 2.35; 95%CI: 1.91 to 2.88;  $P < 0.001$ ), and West (OR: 2.57; 95%CI: 1.94 to 3.42;  $P < 0.001$ ) all yielded greater odds of prescribing opioid-based medications for non-emergent LBP when compared to EDs in the Northeast region.

## DISCUSSION

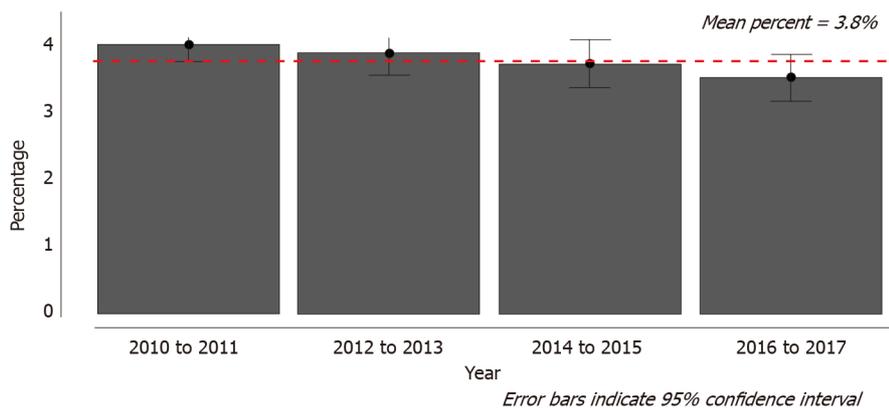
While it has been shown that the overall prescription rates of opioids within the United States are gradually decreasing over the past five years, there is a paucity of literature evaluating trends in opioid prescriptions specifically in patients presenting to the ED with non-emergent LBP[21]. Overall, our study reports a significant decrease in the number of non-emergent LBP ED visits from 2010 to 2017, as well as a decrease in opioids prescribed at these visits. Furthermore, we noted several independent risk factors for increased opioid prescription following non-emergent LBP, including age over 43.84-years-old, higher income, private insurance, the obtainment of radiographic imaging in the ED, and region of the United States.

Our findings are consistent with previous literature demonstrating an overall decrease in ED opioid prescriptions[22-25]. Marra *et al*[22] analyzed NHAMCS information from 2005 to 2015 for patients presenting to the ED with pain of all causes, finding that prescribing rates at discharge decreased significantly by 32% during the study duration[22]. Since pain is one of the most common reasons for ED visits, a major limitation of Marra *et al*[22] study was grouping pain causes into a single cohort. The decrease in opioid prescriptions for non-emergent LBP found in our study was representative of the overall decrease in ED opioid prescriptions for general pain over a similar time interval as established by Marra *et al*[22]. As such, our findings provide

**Table 1 Risk factors associated with emergency department opioid-based medication prescription for non-emergent low back pain**

	Odds ratio	Lower 95%CI	Upper 95%CI	P value
Home income [quartile 1 (below 32793 dollars)]	Reference			
Home income [quartile 2 (32794-40626 dollars)]	1.17	0.98	1.40	0.078
Home income [quartile 3 (40627-52387 dollars)]	1.35	1.13	1.61	0.001
Home income [quartile 4 (52388 dollars or more)]	1.11	0.91	1.34	0.318
Insurance				
Medicaid	Reference			
Medicare	1.03	0.84	1.28	0.753
Other	1.38	0.71	2.67	0.337
Private insurance	1.29	1.04	1.58	0.018
Self-pay	1.25	1.00	1.56	0.048
Workers compensation	1.10	0.72	1.70	0.660
Images obtained	1.47	1.30	1.66	< 0.001
Mean centered age	1.01	1.00	1.01	0.001
Pain-low				
Pain-moderate	1.28	0.96	1.71	0.093
Pain-severe	2.14	1.63	2.81	< 0.001
Seen in ED within the last 72 hr	0.77	0.56	1.06	0.106
United States Census Region				
Northeast	Reference			
Midwest	2.42	1.94	3.01	< 0.001
South	2.35	1.91	2.88	< 0.001
West	2.57	1.94	3.42	< 0.001

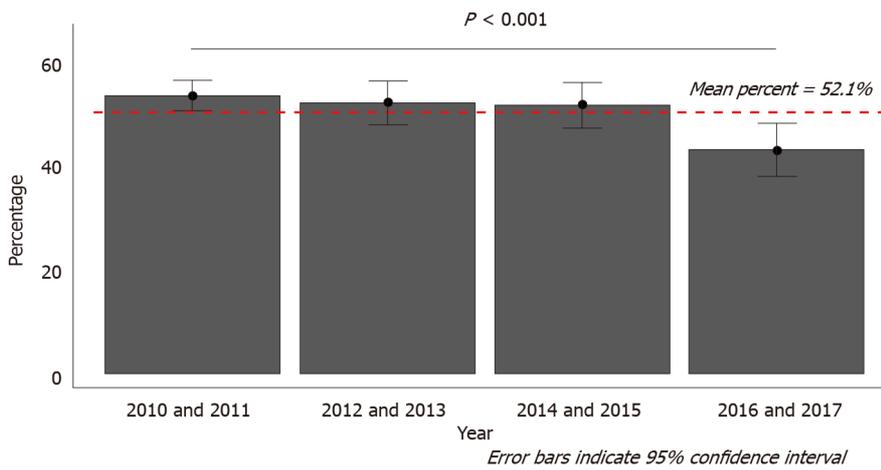
ED: Emergency department; CI: Confidence interval.



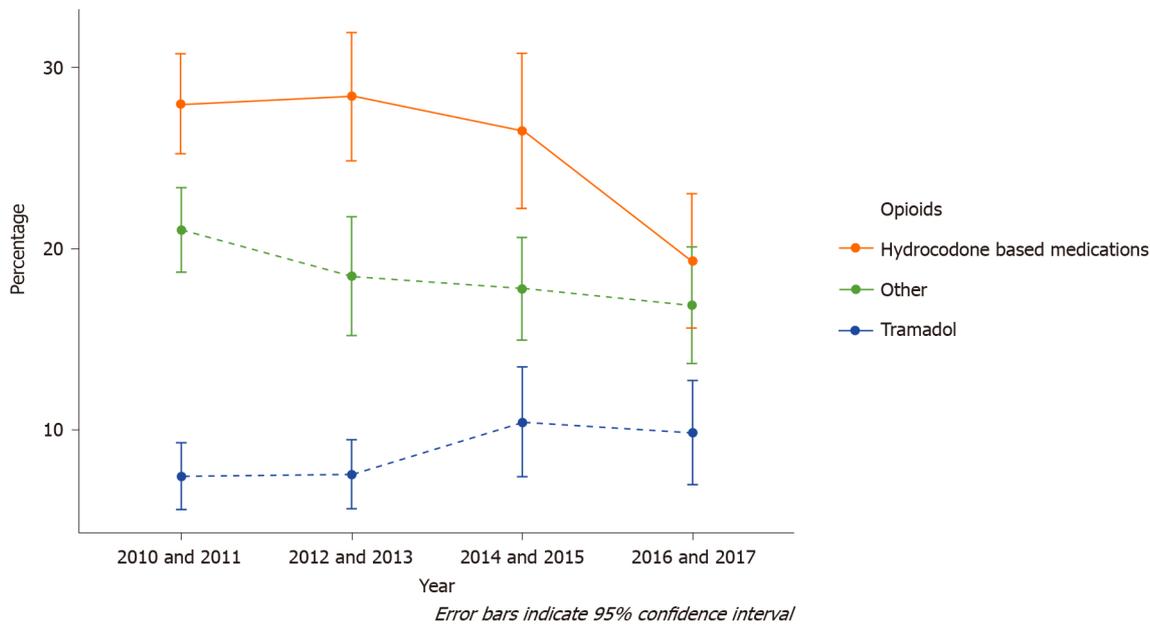
**Figure 1 Incidences of non-emergent lower back pain that present to the emergency department between 2010 and 2017.**

needed granularity in terms of specifically the non-emergent LBP population presenting to the ED

In elderly individuals, non-emergent LBP has been shown to have a prevalence ranging from 21.7% to 75%, with a direct correlation between age and LBP[26]. Our findings suggest that older age is an independent risk factor for increasing opioid prescriptions following ED admission for LBP, which may perhaps be due to older individuals presenting with increased severity of back pain. Severity of non-emergent



**Figure 2** Percent of cases who presented to the emergency department with non-emergent back pain, that were prescribed opioid based medications upon discharge between 2010 and 2017.



**Figure 3** Types of opioids prescribed for non-emergent back pain that presented to the emergency department.

LBP is known to be highly correlated with increasing age, particularly relative to other common causes of opioid prescriptions following ED admission such as pain secondary to trauma[27,28]. This increased LBP severity in older patients likely contributed to the increased opioid prescriptions in older patients shown in our analysis.

In particular, our study found age over 43.84-years to be an independent risk factor for opioid prescriptions in non-emergent LBP patients. However, the direct relationship between age and ED opioid prescriptions found in our study has not been demonstrated for all chief complaints presenting to the ED. For instance, Ward *et al*[24] utilized the Data to Intelligence database aggregating electronic health record data from EDs within the United States from January 1, 2014 to May 31, 2014, and found no direct relationship between increasing age and opioid prescription. In their study, patients between the ages of 18 to 27 had the highest adjusted odds ratio (OR: 1.09) of being discharged with an opioid prescription, followed by patients between the ages of 40 to 54 (OR: 1.08), and lastly between the ages of 28 to 39 (OR: 1.02)[24]. Ward *et al* [24] studied all ED admissions, not limited to back pain, and attempted to account for variations in chief complaints utilization a categorization approach, however, the authors acknowledged remaining heterogeneity in terms of the chief complaints in their dataset. In comparison, our study only included patients presenting with non-

emergent LBP, such that the chief complaints were entirely homogenous, which contributed to the direct correlation we found between age and ED opioid prescriptions in non-emergent LBP patients.

With respect to insurance status, Ali *et al*[29] reported that 8% of patients with private insurance had potentially problematic opioid prescriptions, compared to 14% of patients with Medicaid. Problematic opioid prescription was defined in their study as opioid prescriptions which did not match the indication severity based on protocol established in previous literature[29]. Although our study did not address problematic opioid prescriptions, we did find that patients with private insurance or who were self-payers were more likely to be prescribed an opioid for non-emergent LBP compared to Medicaid patients.

In terms, of the Medicaid population specifically, Janakiram *et al*[25] performed a multistate analysis utilizing the Truven MarketScan Database from 2013 to 2015 and found Medicaid patients were more likely to receive prescriptions from an ED provider compared to a general practitioner, with back pain (14%) being the third leading cause for receiving an opioid prescription. Implementation of prior authorization plans within Medicaid plans has shown to not only minimize opioid-related morbidity within this cohort, but also discourage the initiation of long-acting opioid therapy[30,31]. Interestingly, studies have shown patients who present to the ED could be more appropriately managed by their primary care physician, which would potentially driving down ED visits. These studies demonstrate that adequate care reduces annual ED visits and decreases healthcare expenditure[32-34], therefore, lack of access to primary care may be the driving force of increasing patient visits to the ED especially for non-emergent indications such as LBP[35-37]. In other words, limited access to various primary care is likely associated with increased ED visits in patients with underlying mental and physical comorbid conditions.

Extended access primary care services have also been shown to decreased the amount of ED visits as well as pain prescriptions for non-emergent presentations[33]. Extended access primary care services offer patients the ability to book appointments outside of core contractual hours, either in the early morning, evening or at weekends. Whittaker *et al*[33] measured the impact of extended access in 56 primary care practices by offering seven-day extended access through providing care during the evenings and weekends, compared to 469 primary care practices with routine working hours. Implementing this extended access of care demonstrated a reduction in both the frequency and cost of patient-initiated ED visits for “minor” problems[33]. The majority of non-emergent LBP fits within this categorization of “minor” problems, so it is possible that more widespread extended access primary care services have the potential to reduce ED admissions and opioid prescriptions.

LBP has also been shown to be more prevalent and severe in older men compared to older women. Interestingly, our study found no difference in opioid prescriptions between men and women presenting to the ED with non-emergent LBP[38].

Finally, numeric pain scores have been implicated in contributing to the prescribed opioid epidemic, with opioids being administered to those who report higher pain scores[39]. In a recent cross-sectional study, Monitto *et al*[40] explored the association of patient factors with opioid dispensing, consumption, and medication remaining on completion of therapy after hospital discharge. Their findings suggest higher discharge pain scores can predict higher opioid dispensing and consumption. This is consistent with our findings as increasing pain scales was significantly associated with discharge from the ED with an opioid prescription. With further validation, these pain scales can be potentially utilized to predict and ultimately standardize the number of opioids patients presenting to the ED with non-emergent LBP should be prescribed.

This study has a few limitations which must be considered when interpreting our results, most of which are inherent to the use of an administrative database. First, recent studies have addressed concern regarding the validity of the NHAMCS database due to slight variability in documentation across the years[41]. Our study limited this potential issue by purposely utilizing variables that were collected in a consistent fashion over the years studied. Second, since information from the database is ascertained from individual ED visits, the study did not allow for longitudinal information on these patients or allowing us to determine the appropriateness of therapy[22]. For example, we were unable to identify patients with a history of substance abuse. However, this limitation does not preclude the validity of our findings as our study methodology included only cases of non-emergent back pain that presented to the ED and did not warrant admission. Finally, our study assessed data from 2010 to 2017, as this was the only time interval available from NHAMCS. Despite these limitations, the study provides valuable information regarding annual trends in ED visits for back pain, prescribing patterns, and patient risk factors for

being discharged with an opioid prescription.

## CONCLUSION

Despite legislative efforts to improve access to care, ED continue to be burdened by non-emergent maladies such as LBP. Our study demonstrated a significant decrease in number of patients presenting to the ED with non-emergent LBP between 2010 and 2017, as well as a significant decrease in opioids prescribed in the ED for this indication of the same time period. Regression analysis identified age over 43.84-years-old, higher income, private insurance, the obtainment of radiographic imaging in the ED, and region of the United States as independent risk factors for being discharged with prescription narcotics after presenting to the ED for LBP. Emergency departments located in the Northeast region were the least likely to discharge patients with narcotics. Ultimately, physician-directed patient education is necessary to minimize ED burden by non-emergent LBP, and a heightened awareness of previous narcotic prescribing practices is needed to mitigate narcotic prescriptions for patients presenting to the ED with non-emergent LBP. Future prospective studies are necessary to determine the impact of state and federal legislative mandates on the influence of opioid prescriptions given at discharge.

## ARTICLE HIGHLIGHTS

### **Research background**

Low back pain a major cause of emergency department (ED) visits and ranges in incidence between 49% and 80% in the United States. Patients presenting to the ED for non-emergent LBP often receive unnecessary prescriptions of opioid pain medication.

### **Research motivation**

Several guidelines have been implemented to mitigate opioid prescription for low-back pain. However, the impact of such guidelines is yet to be ascertained.

### **Research objectives**

This study aimed to outline the trends of annual opioid prescriptions for patients presenting to the ED with non-emergent back pain; and risk factors associated with being prescribed an opioid based prescription for non-emergent LBP in the ED.

### **Research methods**

We reviewed the National Hospital Ambulatory Medical Care Survey for all patients who presented to the ED with low back pain. Patients over 18 years of age who were not subsequently admitted were included. The primary outcome was opioid-based medication prescription. Trends and factors of opioid-based medication prescription were evaluated to identify chronological and patient-specific risk factors.

### **Research results**

We reviewed the National Hospital Ambulatory Medical Care Survey for all patients who presented to the ED with low back pain. Patients over 18 years of age who were not subsequently admitted were included. The primary outcome was opioid-based medication prescription. Trends and factors of opioid-based medication prescription were evaluated to identify chronological and patient-specific risk factors.

### **Research conclusions**

Overall opioid prescription demonstrated a mild decrease over the past decade; however, a pattern of diminished hydrocodone-based medications is associated with a mild increase in tramadol-based medication prescription. This pattern may be due to recent legislative guidelines.

### **Research perspectives**

Further research is required to identify future trends that may be a more veritable reflection of more recent policies regulating opioid prescription for low back pain – particularly tramadol based medications.

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