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Variation in opioid analgesia administration and discharge prescribing for emergency department patients with suspected urolithiasis

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Abstract

OBJECTIVE.—Previous research has suggested caution about opioid analgesic usage in the emergency department (ED) setting and raised concerns about variations in prescription opioid analgesic usage, both across institutions and for whom they are prescribed. We examined opioid analgesic usage in ED patients with suspected urolithiasis across fifteen participating hospitals.

METHODS.—This secondary analysis of a clinical trial including adult ED patients with suspected urolithiasis. In multilevel models accounting for clustering by hospital, we assessed demographic, clinical, state-level, and hospital-level factors associated with opioid analgesic administration during the ED visit and prescription at discharge.

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RESULTS.—Of 2,352 participants, 67% received an opioid analgesic during the ED visit and 61% were prescribed one at discharge. Opioid analgesic usage varied greatly across hospitals, ranging from 46% to 88% (during visit) and 34% to 85% (at discharge). Hispanic patients were less likely than non-Hispanic white patients to receive opioid analgesics during the ED visit (OR 0.72, 95% CI 0.55–0.94). Patients with higher education (OR 1.29, 95% CI 1.05–1.59), health insurance coverage (OR 1.27, 95% CI 1.02–1.60), or receiving care in states with a prescription drug monitoring program (OR 1.64, 95% CI 1.06–2.53) were more likely to receive an opioid analgesic prescription at ED discharge.

CONCLUSION.—We found marked hospital-level differences in opioid analgesic administration and prescribing, as well as associations with education, healthcare insurance, and race/ethnicity groups. These data might compel clinicians and hospitals to examine their opioid use practices to ensure it is congruent with accepted medical practice.

Keywords

opioid prescribing; acute pain; urolithiasis; emergency departments; opioid epidemic

1. Introduction

Emergency departments (EDs) contribute a small share of total US opioid prescriptions [1], but the potential for any contribution to opioid use, disorder, or overdose is of great concern. In one study of ED patients with opioid use disorder, 29% indicated that their first exposure to opioids was from an ED visit [2]. Another found that 42% of ED patients discharged with a prescription opioid analgesic reported using them inappropriately within 30 days [3]. Variations in opioid analgesic prescribing at ED discharge across institutions [4-7] and individual physicians [1,8,9] have been raised as potential intervention areas.

Between 2006 and 2017, opioid analgesic prescribing at ED discharge decreased significantly for many diagnoses (e.g. back pain, dental pain), but not for urolithiasis (when calculi obstruct the ureter and cause extreme acute pain) [10,11]. Opioid analgesics and NSAIDs are standard care for acute renal colic [12-18], and treatment guidelines range from primarily recommending NSAIDs [14-17] to suggesting the physician "titrate up the analgesic ladder according to pain" [18,19]. It is not known if ED renal colic patients should be prescribed an opioid analgesic for use after leaving the ED. Practitioners may rely on their assessment of a patient's abuse potential, which is challenging in a busy ED setting where providers typically do not have an existing relationship with patients [1,20]. In addition, white Americans may be more likely to be prescribed opioid analgesics in the ED than other racial and ethnic groups [21-28]. Clinicians could be worse at perceiving pain in black patients [29,30], and might believe stereotypes that black patients are more resistant to pain [31] or more likely to misuse prescription opioids [32].

We examined predictors of opioid analgesic administration for acute pain using data from a trial of ED patients with suspected urolithiasis. These data were collected at a time when there was not clear guidance on which form of analgesia was preferred for ED urolithiasis treatment, and opioid prescribing was just beginning to decrease in response to the opioid epidemic [33]. Our objective was to assess clinical predictors, demographic characteristics, and hospital attributes to determine which patients were more likely to be: 1) administered an opioid analgesic during their visit; and 2) discharged with a prescription for an opioid analgesic. In addition, we compared both outcomes among racial and ethnic groups.

2. Methods

2.1 Study design, setting, and population

This is a secondary analysis of randomized trial data, described previously [34]. For this trial, 18–75-year-old ED patients with suspected urolithiasis were enrolled if they had no kidney-related disease and were not pregnant or obese. This analysis excluded patients admitted to the hospital and patients who received a cancer or psychiatric diagnosis because opioid analgesic use in these patients is unique. The Brown University Institutional Review Board determined that this study did not involve human subjects. Neither of the funding sources played any role in the conduct or reporting of the study.

2.2 Study protocol and key outcome measures

In the parent study, patients were randomly assigned to one of three imaging study arms to evaluate the presence of urolithiasis: point-of-care ultrasound in the ED, ultrasound in radiology, or CT. Trained research coordinators interviewed participants to collect demographics, symptoms, general health status, and pain severity data, and consulted the physician and medical records for information on diagnosis, treatment, and discharge medications. The key outcome for this current investigation was administration of opioid analgesics (e.g., morphine, codeine, oxycodone, hydrocodone) during the visit and the secondary outcome was receiving an opioid analgesic prescription at discharge.

2.3 Statistical analysis

The primary analysis compared patients who received an opioid analgesic during the visit to those who did not. The secondary analysis compared the group receiving an opioid analgesic prescription at discharge to those discharged without an opioid analgesic prescription. We summarized characteristics of the study population as stratified by each outcome and summarized attributes of the participating hospitals and the population in the trial at each hospital.

We constructed models with random effects to account for clustering within hospitals and adjusting for potential confounding variables. (See appendix for model selection details.) We included the ED clinician’s perceived likelihood that the patient had urolithiasis (greater than 50% likely or 50% likely or less) as a predictor for in-ED opioid administration, and final diagnosis of urolithiasis as a predictor of opioids prescribed at discharge. The models were adjusted for demographics, clinical characteristics, education as a measure of socioeconomic status, and prescription drug monitoring plan (PDMP) available via online access in the state at the time of the visit [35].

We estimated odds ratios (ORs) and 95% confidence intervals for each predictor variable. Based on evidence in previous studies, we tested for interactions on the additive and multiplicative scale between race/ethnicity and the following variables: health care coverage, education, age, gender, and calendar time [28,36]. As a sensitivity analysis, and in order to generate results comparable to studies in populations of ED patients with urolithiasis, we repeated the analysis in the population of patients who were diagnosed with urolithiasis at the end of the ED visit.

3. Results

3.1 Participant characteristics and opioid analgesic prescriptions

Figure 1 depicts the selection of the 2,776 participants in the STONE trial. Over half of the study population (N=1,267; 53.9%) was diagnosed with urolithiasis at the end of the ED visit. Patients reported a high level of pain at arrival to the ED, with 1,205 (51.2%) reporting a nine or ten on the 0–10 pain scale (Table 1). Patients who received opioid analgesics in the ED differed according to all variables in Table 1 except for sex, age, education, and the year of the visit. Those who received a prescription for an opioid analgesic at ED discharge differed from those who did not in all variables except for age (Table 1).

Across the fifteen STONE study participating EDs, there was a wide range in opioid analgesic administration during the ED visit and at discharge – within individual hospitals, 46% to 88% of patients received an opioid analgesic during the visit and 34% to 85% of patients received an opioid analgesic prescription at discharge (Table 2). Approximately 76% of patients diagnosed with urolithiasis were discharged with an opioid analgesic prescription. Of the patients without a urolithiasis diagnosis, 42% were discharged with an opioid analgesic prescription. The percentages receiving an opioid analgesic at discharge for patients fitting other diagnostic categories were as follows: 51% genitourinary, 49% gynecological, 43% gastrointestinal, 46% cardiovascular, 49% pain, and 69% pulmonological diagnoses.

3.2 Factors associated with opioid analgesics in the ED and at discharge

In multivariable analysis, the odds of receiving an opioid analgesic during the ED visit were higher for patients for whom there was a high likelihood of urolithiasis diagnosis, those with a greater pain severity at arrival to the ED, and for those who rated their health as “poor” or “fair” (Table 3). In addition, Hispanic patients were significantly less likely to receive an opioid analgesic during the visit than non-Hispanic white patients.

Provision of a prescription for an opioid analgesic at ED discharge was much more likely for patients diagnosed with urolithiasis. Greater pain severity at arrival to the ED, pain duration < 24 hours prior to ED presentation, health care insurance, completion of any years of formal education after high school, and being in a state with an online accessible PDMP also were associated with higher odds of receiving an opioid analgesic prescription at ED discharge. The sensitivity analyses in a sample limited to patients with a definitive diagnosis of urolithiasis yielded similar results (Table 4). We identified a significant multiplicative interaction between race/ethnicity and health care insurance in the model predicting opioid analgesic prescription at ED discharge: having health care insurance was associated with increased odds of receiving an opioid analgesic at discharge only among Hispanic patients (OR=1.79, 95% CI 1.29–2.49).

4. Discussion

This study aimed to identify variations in opioid analgesic administration during the ED visit and prescribing at ED discharge across hospitals, as well as predictors of opioid analgesic administration during the visit and at discharge. Opioid administration and prescription at discharge was high among ED patients with suspected urolithiasis, and across hospitals there was a wide range of opioid analgesic administration and prescription. Consistent with the ongoing national efforts to decrease opioid prescribing, the adjusted odds of being discharged with an opioid analgesic prescription decreased by a small amount over time; however, in-ED opioid analgesic administration did not change over time. As expected, greater pain severity at ED presentation was associated with higher odds of receiving opioid analgesics during the visit and prescribed at discharge. Also, those with longer courses of pain prior to the ED were less likely to receive an opioid analgesic prescription at discharge, possibly because they had an alternative diagnosis or passed the stone.

Of concern, having health care insurance and greater years of education were associated with receiving an opioid analgesic prescription at ED discharge. It is possible that participants with more education or who had health care insurance were more likely to request a prescription for an opioid analgesic. It is also possible that pain treatment decisions were made differently based on these patient characteristics as socioeconomic markers. Unfortunately, we do not have data on patient preference for pain treatment and cannot evaluate whether patients were treated differentially based on their ability to pay or their educational levels.

A recent meta-analysis by Lee et al. found that black and Hispanic patients may be less likely than white patients to receive opioid analgesia for acute pain in the ED [37]. Another study identified racial/ethnic disparities in both in-ED administration and discharge prescribing of opioid analgesics for “non-definitive” conditions (back pain and abdominal pain), but not for conditions with a clear diagnosis (long-bone fractures, urolithiasis) [26]. In our results, Hispanic patients were less likely than non-Hispanic white patients to receive opioid analgesia during the ED visit – when the diagnosis was not yet established. Contrary to the hypothesis that these disparities are more common for discharge prescriptions than in-ED opioid analgesia, we found no disparities in opioid analgesic prescribing at discharge after adjustment.

In spite of a large amount of variation in opioid analgesic administration and prescribing practices across hospitals, PDMP was the only hospital-level predictor of opioid analgesic administration or discharge prescribing we identified. The association between a PDMP and opioid analgesic at discharge could be due to reverse causation, where states that had identified opioid prescribing as an issue established PDMPs earlier. We were not able to assess other hospital-level factors such as provider culture, group practice patterns, or hospital policies.

5. Limitations

This study has several strengths and limitations. We do not have data on factors that could affect our findings, including: prior psychiatric conditions, analgesic use, or substance-related diagnoses; patient preference for analgesia; and contraindications for NSAIDs. These data also lack information on individual clinician training/philosophy on urolithiasis treatment and opioid analgesic administration and prescribing, but we did use hospital-level information and GEE estimation to account for clustering patterns within institutions. We were able to use information on whether there was an online-accessible state-level PDMP at the time of the visit, but not on individual hospital policies. Important strengths of this study include uniquely detailed information not typical in studies on this topic (e.g., including self-rated health), and that we could examine these outcomes among patients with an acute pain condition, namely, suspected urolithiasis.

6. Conclusions

In conclusion, we identified hospital-level and patient-level variations in opioid analgesic administration and discharge prescribing for ED patients presenting with possible urolithiasis. Hospitals should examine prescribing patterns with regard to socio-economic class markers, including education, health care insurance status, and race/ethnicity. Reasons for variation at the hospital level should be explored and interventions designed to address its potential causes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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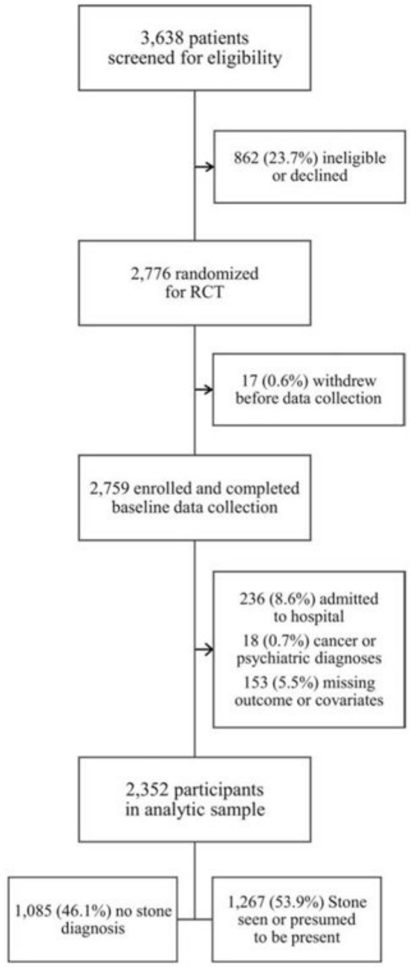

Figure 1.

Enrollment and retention in the Study of Tomography Of Nephrolithiasis Evaluation and analytic sample selection.

Table 1.

Descriptive statistics of suspected urolithiasis patients by opioid analgesic administration during ED visit and prescribed at ED discharge, United States, 2011–2013.

		Opioid analgesic administered during visit			Opioid analgesic prescribed at discharge		
	Total (n=2,352) n (%)	No (n=766) n (%)	Yes (n=1,576) n(%)	Chi2 p-value	No (n=909) n (%)	Yes (n=1,443) n (%)	Chi2 p-value
Opioid analgesic during visit	1576 (67.0)	0 (0.0)	1576 (100)		393 (43.2)	1183 (82.0)	<0.01
Opioid analgesic at discharge	1443 (61.4)	260 (33.5)	1183 (75.1)	<0.01	0 (0.0)	1443 (100)	
Sex				0.08			<0.01
Female	1124(47.8)	351 (45.2)	773 (49.1)		466 (51.3)	658 (45.6)	
Male	1228 (52.2)	425 (54.8)	803 (51.0)		443 (48.7)	785 (54.4)	
Age (years), median (IQR)	40 (29-50)	39 (29-51)	40(30-49.5)	0.86[a]	40 (29–50)	39 (29–50)	0.97[a]
More than high school education[b]	1140 (48.5)	356 (45.9)	784 (49.8)	0.08	372 (40.9)	768 (53.2)	<0.01
Race/ethnicity				<0.01			<0.01
Black or African American	594 (25.3)	229 (29.5)	365 (23.2)		294 (32.3)	300 (20.8)	
Hispanic	579 (24.6)	230 (29.6)	349 (22.1)		246 (27.1)	333 (23.1)	
Non-Hispanic white	958 (40.7)	241 (31.1)	717 (45.5)		286 (31.5)	672 (46.6)	
Mixed or other race	221 (9.4)	76 (9.8)	145 (9.2)		83 (9.1)	138 (9.6)	
Has health care insurance	1551 (65.9)	454 (58.5)	1097 (69.6)	<0.01	535 (58.9)	1016 (70.4)	<0.01
Year				0.33			<0.01
2011	323 (13.7)	102 (13.1)	221 (14.0)		101 (11.1)	222 (15.4)	
2012	1955 (83.1)	644 (83.0)	1311 (83.2)		767 (84.4)	1188 (82.3)	
2013	74 (3.2)	30 (3.9)	44 (2.8)		41 (4.5)	33 (2.3)	
Diagnosed with urolithiasis	1267 (53.9)	343 (44.2)	924 (58.6)	<0.01	285 (31.4)	982 (68.1)	<0.01
Likelihood of urolithiasis				<0.01			<0.01
Low (<=50% chance)	827 (35.2)	366 (47.2)	461 (29.3)		465 (51.2)	362 (25.1)	
High (>50% chance)	1525 (64.8)	410 (52.8)	1115 (70.8)		444 (48.8)	1081 (74.9)	
Baseline pain				<0.01			<0.01
Low (0-3)	117 (5.0)	86 (11.1)	31 (2.0)		63 (6.9)	54 (3.7)	
Medium (4-8)	1030 (43.8)	413 (53.2)	617 (39.2)		451 (49.6)	579 (40.1)	
High (9 or 10)	1205 (51.2)	277 (35.7)	928 (58.9)		395 (43.5)	810 (56.1)	
Pain for >24 hrs before ED arrival	1070 (45.5)	415 (53.5)	655 (41.6)	<0.01	528 (58.1)	542 (37.6)	<0.01
Self-rated health				<0.01			0.02
Excellent, very good, good	1801 (76.6)	628 (80.9)	1173 (74.4)		673 (74.0)	1128 (78.2)	
Fair or poor	551 (23.4)	148 (19.1)	403 (25.6)		236 (26.0)	315 (21.8)	
Hospital prescribing level				<0.01			<0.01
Low (<60%)	748 (31.8)	386 (49.7)	362 (23.0)		431 (47.4)	317 (22.0)	
Medium (60–70%)	834 (35.6)	235 (30.3)	602 (38.2)		306 (33.7)	531 (36.8)	
High (>70%)	767 (32.6)	155 (20.0)	612 (38.8)		172 (18.9)	595 (41.2)	
Ownership Type				<0.01			<0.01
Non-government	1281 (54.5)	384 (49.5)	897 (56.9)		442 (48.6)	839 (58.1)	

		Opioid analgesic administered during visit			Opioid analgesic prescribed at discharge		
	Total (n=2,352) n (%)	No (n=766) n (%)	Yes (n=1,576) n(%)	Chi2 p-value	No (n=909) n (%)	Yes (n=1,443) n (%)	Chi2 p-value
Government	1071 (45.5)	392 (50.5)	679 (43.1)		467 (51.4)	604 (41.9)	
Online access to state PDMP	1091 (46.4)	247 (31.8)	844 (53.6)	<0.01	305 (33.6)	786 (54.5)	<0.01
Region				<0.01			<0.01
Midwest	488 (20.8)	170 (21.9)	318 (20.2)		228 (25.1)	260 (18.0)	
Northeast	871 (37.0)	345 (44.5)	526 (33.4)		370 (40.7)	501 (34.7)	
South	363 (15.4)	124 (16.0)	239 (15.2)		130 (14.3)	233 (16.2)	
West	630 (26.8)	137 (17.7)	493 (31.3)		181 (19.9)	449 (31.1)	

Adult emergency department (ED) patients at 15 hospitals across the US with suspected urolithiasis. Sample excludes patients receiving cancer or psychiatric diagnoses, those who were admitted to the hospital, and those with missing data (final sample from Figure 1).

[a]P-value for nonparametric Mann-Whitney two-sample test.

[b]Any years of formal education beyond high school vs. a high school diploma or less.

Abbreviations: IQR, inter-quartile range; ED, emergency department; hrs, hours; PDMP, prescription drug monitoring program.

Table 2.

Attributes of participating hospital sites and participants at each hospital.

Hospital site	N	Received opioid analgesic during visit, % (95% CI)	Discharged with opioid analgesic prescription, % (95% CI)	Ownership type	Visits under online PDMP access, %[a]	Annual ED volume[b]	Region	Health care coverage, %	Safety Net hospital	Median baseline pain level (IQR)	Urolithiasis diagnoses, %	Opioid at discharge, % of those with urolithiasis diagnosis
1	238	46 (39–52)	34 (28–41)	Gov't	0	High	Midwest	5	Yes	8 (7–10)	48	53
2	208	54 (47–61)	42 (35–49)	Non-govt	0	Medium	Northeast	83	No	8 (7–10)	48	64
3	302	47 (41–52)	49 (43–55)	Gov't	0	High	Northeast	73	Yes	9 (8–10)	56	69
4	105	84 (75–90)	63 (53–72)	Gov't	100	Low	West	73	No	8 (7–9)	56	76
5	200	62 (55–69)	63 (55–69)	Non-govt	0	Medium	South	25	Yes	8 (6–10)	40	81
6	150	77 (70–84)	61 (53–69)	Gov't	100	Low	West	83	No	9 (7–10)	56	74
7	78	59 (47–70)	62 (50–72)	Non-govt	100	Low	Northeast	96	No	8 (7–10)	51	83
8	141	80 (73–86)	65 (57–73)	Non-govt	0	Medium	Midwest	82	No	9 (7–10)	43	85
9	163	71 (63–77)	66 (58–73)	Non-govt	40	High	South	61	No	9 (8–10)	54	78
10	173	76 (69–82)	72 (65–79)	Non-govt	100	Medium	Northeast	91	No	8 (6–10)	73	83
11	104	66 (56–75)	75 (66–83)	Non-govt	100	Low	West	93	No	8 (7–10)	63	88
12	167	77 (70–83)	78 (71–84)	Gov't	100	Low	West	70	No	8 (7–10)	48	91
13	109	88 (80–93)	79 (70–86)	Gov't	100	Medium	Midwest	73	Yes	9 (8–10)	51	95
14	104	88 (80–93)	80 (71–87)	Non-govt	100	Medium	West	68	No	9 (8–10)	62	89
15	110	86 (79–92)	85 (76–91)	Non-govt	32	High	Northeast	76	No	9 (8–10)	74	86

Abbreviations: IQR, inter-quartile range; ED, emergency department; PDMP, prescription drug monitoring program; Govt, government; CI, confidence interval.

[a]Percent of visits during study period when the state had a prescription drug monitoring program that could be accessed online (two hospitals were in states that gained online PDMP access during the study period).

[b]Annual ED volume: Low is 35–65k patients/year, medium is 66–111k patients/year, high is 112–175k patients/year.

Table 3.

Multivariable regression results. Adjusted odds of (1) receiving an opioid analgesic during the ED visit or (2) being discharged from the ED with a prescription opioid analgesic in a population of 2,352 adult ED patients with suspected urolithiasis.

Predictor variables	(1) Opioid analgesic during visit OR[a] (95% CI)	(2) Opioid analgesic at ED discharge OR[a] (95% CI)
Likelihood of urolithiasis diagnosis >50%	1.70 (1.40–2.07)	–[b]
Urolithiasis diagnosis	–[b]	4.24 (3.48–5.18)
Pain severity at arrival to ED (0–10)		
Low (0–3)	1.00 (ref)	1.00 (ref)
Medium (4–8)	4.19 (2.81–6.26)	1.87 (1.36–2.56)
High (9 or 10)	9.06 (6.23–13.18)	2.55 (1.94–3.36)
>24 hours in pain before arrival	0.82 (0.67–1.01)	0.74 (0.59–0.92)
Has health care insurance	1.23 (0.99–1.53)	1.27 (1.02–1.60)
Race/ethnicity		
Non-Hispanic white	1.00 (ref)	1.00 (ref)
Non-Hispanic Black or African American	0.80 (0.58–1.10)	0.82 (0.60–1.13)
Hispanic	0.72 (0.55–0.94)	0.96 (0.73–1.25)
Mixed or other race	0.88 (0.63–1.24)	1.07 (0.83–1.37)
More than high school education	0.99 (0.84–1.16)	1.29 (1.05–1.59)
Self-rated health		
Excellent, very good, good	1.00 (ref)	1.00 (ref)
Fair or poor	1.43 (1.11–1.85)	0.94 (0.76–1.16)
Male gender	0.88 (0.74–1.04)	0.95 (0.76–1.19)
Age (continuous, years)	1.00 (1.00–1.01)	1.01 (1.00–1.02)
Months since August 2011	0.98 (0.96–1.01)	0.96 (0.94–0.99)
Online access to state PDMP	1.29 (0.82–2.02)	1.64 (1.06–2.53)

[a]Odds ratios estimated by a multivariable model with GEE estimation, a logit link, and robust standard errors clustered within each of 15 hospitals in the study sample of 2,352 adults with suspected urolithiasis with non-missing data for outcomes and variables in model (final sample from Table 1).

[b]Variable not included in model. Diagnosis was recorded at the end of the visit, temporally after the first outcome, so the physician's initial assessment of the likelihood of having urolithiasis was used instead to predict opioid analgesic administration during the visit.

Abbreviations: ED, emergency department; OR, odds ratio; CI, confidence interval; PDMP, prescription drug monitoring program; GEE, generalized estimating equation.

Table 4.

Multivariable regression results as in Table 3, restricted to only those patients with a urolithiasis diagnosis. Adjusted odds of (1) receiving an opioid analgesic during the ED visit or (2) being discharged from the ED with a prescription opioid analgesic in a population of 1,296 adult ED patients diagnosed with urolithiasis.

Predictor variables	(1) Opioid analgesic during visit OR[a] (95% CI)	(2) Opioid analgesic at ED discharge OR[a] (95% CI)
Likelihood of urolithiasis diagnosis >50%	1.69 (1.28-2.23)	–[b]
Pain severity at arrival to ED (0-10)		
Low (0-3)	1.00 (ref)	1.00 (ref)
Medium (4-8)	3.74 (2.34-5.96)	1.32 (0.84-2.08)
High (9 or 10)	7.54 (5.15-11.06)	1.50 (0.95-2.37)
>24 hrs in pain before arrival	0.75 (0.57-1.00)	0.66 (0.49-0.89)
Has health care coverage	1.34 (1.02-1.77)	1.19 (0.79-1.78)
Race\ethnicity		
Non-Hispanic white	1.00 (ref)	1.00 (ref)
Non-Hispanic Black or African American	0.97 (0.54-1.75)	0.76 (0.47-1.24)
Hispanic	0.68 (0.48-0.97)	0.88 (0.59-1.32)
Mixed or other race	0.66 (0.41-1.08)	0.92 (0.59-1.44)
More than high school education	1.06 (0.80-1.39)	1.27 (1.00-1.60)
Self-rated health fair or poor		
Excellent, very good, good	1.00 (ref)	1.00 (ref)
Fair or poor	1.76 (1.16-2.67)	0.84 (0.60-1.16)
Male gender	0.77 (0.63-0.95)	1.12 (0.84-1.50)
Age	1.01 (1.00-1.02)	1.01 (1.00-1.02)
Months since August 2011	0.98 (0.96-1.01)	0.94 (0.91-0.97)
Online access to state PDMP	1.32 (0.85-2.06)	1.78 (1.10-2.89)

[a]Odds ratios estimated by a multivariable model with GEE estimation, a logit link, and robust standard errors clustered within each of 15 hospitals in the study sample of 1,296 adult ED urolithiasis patients with non-missing data for outcomes and variables in model (final sample from Table 1).

[b]Variable not included in model.

Abbreviations: ED, emergency department; OR, odds ratio; CI, confidence interval; PDMP, prescription drug monitoring program.