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Emergency Provider Analgesic Practices and Attitudes Towards Patients with Sickle Cell Disease

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Abstract

Study Hypothesis—Demographic factors and emergency provider attitudes are associated with adherence to national guidelines for the management of acute SCD pain.

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JAG and PT conceived of the study. JAG, KH and AC acquired the data. JAG supervised data collection and drafted the manuscript. JAG, PT, AC, KH, CH, MRD and LDR were responsible for the full content of the manuscript, analysis and interpretation of data, and critical revision of the manuscript for important intellectual content. All authors had full access to the data and have no competing interests to report. JAG takes responsibility for the paper as a whole.

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Methods—We conducted a cross sectional survey of emergency providers at the 2011 annual American College of Emergency Physicians scientific assembly using a validated instrument to assess provider attitudes and self-reported analgesic practices towards patients with SCD. Multivariable, relative risk regressions were used to identify factors associated with adherence to guidelines.

Results—There were 722 eligible participants with a 93% complete response rate. Most providers self-reported adherence to the cornerstones of SCD pain management including parenteral opioids (90%) and re-dosing opioids within 30 minutes if analgesia is inadequate (85%). Self-reported adherence was lower for other recommendations including use of patient-controlled analgesia (PCA), acetaminophen, NSAIDs and hypotonic fluids when euvoletic. Emergency providers in the highest quartile of negative attitudes were 20% less likely to re-dose opioids within 30 minutes for inadequate analgesia (risk ratio 0.8, 95% CI 0.7 – 0.9). High volume providers (those who see more than one SCD patient per week), were less likely to re-dose opioids within 30 minutes for inadequate analgesia (RR 0.9, 95% CI 0.8 – 0.9). Pediatric providers were 6.6 times more likely to use PCA for analgesia (95%CI 2.6 – 16.6).

Conclusions—The majority of emergency providers report that they adhere to national guidelines regarding use of opioids for SCD-related acute pain episodes. Other recommendations have less penetration. Negative attitudes towards individuals with SCD are associated with lower adherence to guidelines.

Keywords

Sickle Cell; Pain; Emergency

Introduction

Background

Sickle Cell Disease (SCD) is an inherited disorder of hemoglobin that affects approximately 100,000 Americans.¹ The most common manifestation of SCD is the vaso-occlusive painful episode, and with over 230,000 Emergency Department (ED) visits for pain per year, acute care utilization for SCD accounts for over \$1.5 billion in health expenditures annually.² The quality of emergency care for SCD pain has been cited repeatedly as an area in need of improvement.^{3–6} It has been widely proffered that emergency providers do not know how to manage acute SCD pain,^{7,8} and that they are unaware of national guidelines on this topic (published by the American Pain Society (APS)⁹ and National Heart Lung and Blood Institute (NHLBI)).¹⁰ Despite the perceptions of inadequate treatment there have been no large studies to examine the practice patterns of emergency providers, nor has there been a rigorous evaluation of emergency provider attitudes towards persons with SCD.

Importance

High rates of ED recidivism for a small proportion of persons with SCD is thought to contribute to negative provider attitudes.^{11–14} While multiple systematic reviews suggest that negative healthcare provider attitudes towards SCD patients serve as general barriers to the provision of high quality pain management to SCD patients, an association between provider attitudes and practice has not been demonstrated on a large scale. Why select health care providers choose to deviate from accepted guidelines that affect the quality of SCD care is unclear.^{15–17}

Goals of this investigation

The primary goal of this investigation is to identify risk factors for self-reported non-adherence to national guidelines for the treatment of individuals with SCD that present to the ED for acute vasoocclusive pain episodes. We tested the hypothesis that emergency providers with negative attitudes towards individuals with SCD will deviate from national guidelines for the management of acute vasoocclusive pain episodes. We also tested the hypothesis that clinical and demographic characteristics will be associated with non-adherence to the guidelines. Identifying provider-related risk factors associated with non-adherence to national guidelines will provide opportunities for focused strategies to improve patient care.

Methods

Study design and setting

This was a cross-sectional convenience sample survey study. Instrument design and validation are described below. The study was approved by the Mount Sinai School of Medicine Institutional Review Board and granted a waiver from informed consent.

Selection of participants

Emergency providers in attendance at the 2011 American College of Emergency Physician's Scientific Assembly in San Francisco California were approached to participate in a written survey. A booth in the exhibit hall was purchased using funds from the Mount Sinai Department of Emergency Medicine. The booth remained open during all exhibit hall hours. In return for filling out the survey, participants were entered into a raffle to win a gift.

Methods and Measurements

We administered a 33-item instrument containing items developed or adapted from the extant literature (appendix 1). The entire survey was grouped into 3 sections: 1) Demographics (10-items), 2) Provider practice patterns (6-items), and 3) Provider attitudes (17-items).

To measure attitudes, we administered the previously validated 17-item "General Perceptions About Sick Cell Patients" Scale. Subscales of the attitudes survey have been shown to possess good reliability (Cronbach's alpha 0.76 – 0.89).¹⁸

To measure practice patterns, the study team developed 6 new items based on a literature review of analgesic practices for SCD patients. From the NHLBI and APS guidelines, we identified 8 recommendations for the management of SCD pain (table 3).¹⁹ In addition to the 8 guidelines mentioned above, an additional item was designed to assess the use of analgesic prescriptions at ED discharge. Provider practice pattern items were generated with these guidelines in mind to explore analgesic practice patterns including pharmacologic approaches (choice of agent, route, dose and frequency of selection), non-pharmacologic approaches and analgesic prescribing patterns upon discharge.

After a draft set of practice pattern questions were developed we assessed content validity, specifically face and utility validity, from a panel of five experts in emergency medicine and SCD (BL, VT, LR), a sickle cell hematologist (MD), and a patient perspective (CH) (appendix 2). Expert reviews of the survey resulted in 100% agreement that the instrument covered the construct and content validity indices for each domain. Participants filled out paper questionnaires and the data were scanned and entered by two trained abstractors according to a set protocol. Abstractors were blind to the study hypotheses and 5% of questionnaires were double-entered and checked for inter-rater agreement with a mandatory

cutoff of 98.5% agreement. All variables were checked for outliers (below 5th percentile and above 95th percentile) and all implausible values were corrected (appendix 3).

Outcomes

A series of binary outcome variables were created to dichotomize those who do and do not regularly follow 8 pre-specified guideline recommendations (those who indicated 'frequently' or 'always' were scored as 1, those who chose 'rarely' or 'never' were scored as zero) for emergent SCD pain management.²⁰

Analyses

All analyses were performed with SAS version 9.2 (SAS institute, Cary, NC). Descriptive statistics (for demographics, practice patterns and attitude scales) were expressed in medians with interquartile range and proportions as appropriate. T-tests, chi-squares and non-parametric tests were used to compare means and proportions as appropriate. A content validity index was calculated as the mean of all expert scores for each set of items. Preliminary data analyses focused on examination of the distributional characteristics of measures used in the study. This step was to ensure that all assumptions were met for the statistical tests employed (ultimately, transformations were not necessary). For all multivariable models, potential predictors were chosen for inclusion *a priori* based upon conceptually plausible or known associations with the outcome variable. Variables included in the multivariable models were race, level of practice (attending, resident, nurse practitioner), teaching status of the institution, adult vs. pediatric practice, availability of SCD followup services and the volume of SCD patients seen per week. Cases with missing data were excluded from multivariable analyses.

As the provider attitude scales had not previously been validated among EPs, we used factor analysis to assess the underlying factor structure of the attitudinal items using methodology previously described by Haywood et al.¹⁸ To explore the associations between demographic and clinical predictors with provider attitudes, we performed multivariate analyses of variance (MANOVA) to control for potential confounders. Collinearity of the model was assessed (condition index greater than 8) and variables were modeled with linear or quadratic terms when appropriate. Two-sided p-values were used to assess statistical significance. Predictor variables were considered significant if $p \leq 0.05$.

To identify factors associated with provider practices that differ from national guidelines for the management of acute SCD pain, multivariable relative risk (a generalized linear model using a binomial distribution with log link and robust estimation of variance) regressions were performed. Separate multi-variable regressions were performed for each of 8 pre-specified guideline recommendations. Because of the large number of hypotheses tested with regard to provider practices, we chose a Bonferroni correction ($\alpha/8$) to adjust alpha to 0.00625.

In a final set of analyses we explored associations between emergency provider attitudes and guideline adherence. Associations between emergency provider attitudes and 9 practice patterns were assessed (the 8 guidelines mentioned above plus the use of analgesic prescriptions at discharge). Attitudinal scales were recoded into quartiles. Quartile attitude scales were included in multivariable relative risk regressions (one model for each of 9 binary outcome variables). These models were not adjusted for other demographic variables. The decision not to adjust for demographics (or alternatively to include attitude scales in the models mentioned in the prior paragraph) was made because attitudinal scales were highly collinear with demographic predictors which caused the models to perform poorly. For this

set of analyses, we chose a Bonferroni correction as well (/9) with a cutoff of 0.0056 for statistical significance.

Results

Characteristics of study subjects

Of 795 respondents, 722 indicated that they take care of patients with SCD and 671 responded completely to the survey and were included in the analyses. Providers from academic or teaching hospitals were more heavily represented (67.9%). The majority of participants practice in the United States (83.2%). Home-states of emergency providers were distributed similarly to SCD prevalence patterns with good representation from New York, California, Florida and Texas, which are the states with the highest prevalence of SCD (figure 1).¹ Demographics of this sample were similar to estimates of the overall demographic characteristics of American Emergency Physicians^{21–24} (table 1).

Factor analyses

Factor analyses of the attitudes component of the survey resulted in retaining 15 of the 17 original attitude items which separated into 3 factors with good psychometric properties (appendix 5). Six items grouped together to form what we call a negative attitudes scale (mean = 39.5 SD = 21.9, potential range 0–100). Higher scores on this scale indicated more negative views about SCD patients. Four items grouped together in what we call a positive attitudes scale (mean = 37.1, SD = 23.1, potential range 0–100). Higher scores indicated an endorsement of more positive views about SCD patients. Five items grouped together to form what we call the red flag behaviors scale (mean = 58.7, SD = 22.4, potential range 0–100). Higher scores indicate greater belief that certain SCD patient behaviors raise concern that the patient is inappropriately drug-seeking.

Main results

Demographic and Clinical Factors are Associated with emergency provider attitudes towards patients with SCD—Pediatric providers had more positive attitudes, and adult providers had more negative attitudes toward individuals with SCD. Another variable strongly associated with negative attitudes was the number of SCD patients seen per week, with those providers seeing greater numbers of patients expressing more negative attitudes. Race was also significantly associated with provider attitudes. In comparison to white emergency providers, black providers had more positive attitudes and lower scores on the red-flag behavior scale. Variables that were not significantly associated with a difference in attitudes towards SCD patients included age, gender, ethnicity, level of practice, hospital teaching status and the availability of follow-up services. Attitudes of emergency providers at institutions with comprehensive SCD clinics did not differ significantly from other institutions, table 1.

Clinical Factors are Associated with Adherence to Guidelines for the Management of SCD Pain—Morphine and hydromorphone were the most commonly prescribed opioids (used by 95% and 91% respectively – table 2). Over 90% of emergency providers report frequently or always using parenteral opioids and 85% indicated that they are comfortable re-dosing opioids within 30 minutes if analgesia is inadequate. Only a small fraction of emergency providers indicated that they do not give opioids for SCD pain (1.4%) or that they do not re-dose opioids (1.1%). The vast majority of providers (95.1%) avoid using meperidine for SCD pain. Other recommendations were less likely to be followed. Only 19.7% of respondents chose subcutaneous opioids over intramuscular for non-IV administration, 6.4% indicated frequent use of PCA, 24.3% frequently use acetaminophen and 1.1% choose gentle (maintenance or half-maintenance) hypotonic fluids for IV

hydration. In multivariable analyses (table 3), pediatric providers were over 6 times more likely to use PCA for analgesia (Adjusted RR 6.6, 95% CI 2.6 – 16.6). High volume providers (those who see more than one SCD patient per week) were less likely to indicate that they re-dose opioids within 30 minutes for inadequate analgesia (RR 0.9, 95% CI 0.8 – 0.9).

Negative Attitudes are Associated with Lower Adherence to Guidelines for the Management of SCD Pain—Analgesic practices were affected by emergency provider attitudes. Providers in the two highest quartiles of negative attitudes were respectively 10% and 20% less likely to report re-dosing opioids within 30 minutes for inadequate analgesia. Emergency providers with the highest levels of positive attitude scores were 33% more likely than providers with the lowest positive attitudes scores to discharge patients with analgesic prescriptions. Unexpectedly, high scores on both the positive and negative attitudes scales (thought to reflect opposing perceptions of individuals with SCD) were both associated with more frequent use of parenteral opioids. Also unexpectedly, high scores in both positive attitudes and red-flag behavior scales were associated with more use of NSAIDs (table 4).

Limitations

Our study has limitations. The sample included 655 emergency physicians (11.3% of the 5,788 physicians in attendance at ACEP and approximately 2% of the 39,061 physicians in the United States who designate Emergency Medicine as their primary or secondary practice). The selection of providers in attendance at ACEP and furthermore, those willing to participate in this survey may cause differential bias as these providers may be more likely to work in a teaching environment and more likely to be aware of national guidelines. Adherence to national guidelines may be lower, and the effects of negative attitudes may be larger in an unselected population of providers and these effects should be explored separately. There was bias in our sample towards academic providers. The majority of emergency providers do not practice in teaching hospitals, but 67.9% of our sample indicated teaching status. Non-teaching emergency providers were well enough represented (182 participants) to test for differences between the two groups. We did not find any significant differences in practice patterns or attitudes between the two groups; this suggests that within our sample, the selection bias towards academic providers did not substantially alter the results. Finally, practice pattern data was self-reported and may or may not represent actual practice patterns.

Discussion

With this cross-sectional study, we describe emergency providers' self-reported analgesic practices and attitudes towards individuals with SCD. We also report on factors associated with lower adherence to national guidelines for the management of SCD pain. Our data indicate that the majority of emergency providers surveyed are aware of how to use opioids to manage acute vaso-occlusive pain episodes, and that other factors (such as negative attitudes or system issues not measured in this study) play a larger role in contributing to the inadequate care that SCD patients often receive in the ED.

The cornerstones of managing acute vaso-occlusive pain episodes are parenteral opioids and frequent reassessments, yet several published reports indicate that patients do not consistently receive this level of care.^{3,25} Our study suggests that the majority of emergency providers, regardless of teaching status, affiliation with comprehensive SCD clinics or any other demographic predictors, report they practice in line with these fundamentals. Nearly 92% of providers indicated that they frequently or always use parenteral opioids to manage

acute SCD pain and 85% report being comfortable with delivering a second or third dose of opioids within 30 minutes for inadequate analgesia. These data suggest that factors such as deficient knowledge²⁶ or practice preferences that differ from national guidelines do not drive the disparity between emergency provider self-reported practice and the experience of SCD patients in the ED. Emergency provider attitudes were significantly associated with opioid use practices, but the effects were not large enough to fully explain the disparities between self-reported practice and patient experience.

The low level of adherence to most of the 8 recommendations we studied may indicate that emergency providers use opioids properly because this is part of their emergency medicine training, not because they are aware of NHLBI guidelines for SCD. Recommendations that were less accepted included use of subcutaneous over intramuscular opioids, hypotonic fluids, frequent acetaminophen and sparing use of NSAIDs. Intramuscular administration is generally discouraged because it is painful, causes tissue damage, and is associated with unpredictable pharmacokinetics.²⁷ We suspect that emergency providers prefer intramuscular because it is the route of choice for other drugs (e.g. epinephrine in anaphylaxis²⁸) and has been long used in EDs. Low acceptance of these recommendations may be due to the fact that they are less well supported by data or that emergency providers are not aware that such recommendations exist. While we did not include questions about whether clinicians were aware of NHLBI or APS guidelines for SCD, our data indicate that penetration of many of these recommendations into practice is poor. A policy statement from Emergency Medicine professional societies may help expert recommendations to penetrate emergency provider practice.

Our results indicate that providers with negative attitudes, and those who reported caring for more than one SCD patient per week were less likely to adhere to the most important aspect of high quality SCD pain management, willingness to re-dose opioids within 30 minutes for inadequate analgesia. These two factors, negative attitudes and high-volume providers, were highly collinear, and multiple mechanisms may contribute to this finding. A small subset of SCD patients have over representation of ED visits when compared to those that have fewer visits to ED,²⁹ and these patients have been shown to have a higher prevalence of mood, cocaine, and alcohol disorders.^{8,14} Emergency providers who see the highest volumes of SCD patients have more exposure to the “high-utilization” group, which may contribute to more negative attitudes held by these providers toward the entire SCD population. Regardless of the root cause, our data suggest that understanding why emergency providers with the highest patient volumes have the most negative attitudes should be further evaluated because of the potential impact on patient care. Interventions to ameliorate negative attitudes may mitigate this effect.

A range of demographic factors were associated with improved adherence to national guidelines for the treatment of acute vaso-occlusive pain episodes. Our analyses demonstrated that pediatric providers had less negative feelings toward SCD patients than adult providers. This is emblematic of the deterioration of the patient-provider relationship that occurs with the transition of adolescent SCD patients into adult clinics.^{11,13,30} Our analyses also indicated an association between provider race and attitudes toward SCD patients, with black providers exhibiting more positive feelings of affiliation towards SCD patients, and being less likely to endorse certain behaviors as signs of inappropriate drug-seeking. This finding supports previous work by Telfair et al., who found that African-American healthcare providers were more likely than providers of other races to believe that race plays a role in the delivery of quality care to SCD patients.³¹ Together, these findings suggest a role in the promotion of cultural competency training programs for healthcare providers, as well as initiatives to increase the number of underrepresented minorities in medical fields, as ways to improve the quality of care delivered to SCD patients.

Results from this study fill an important gap in our understanding of the challenges confronting emergency management of SCD pain. Specific links between ED clinician attitudes and practice patterns have been identified which may be amenable to intervention. Initiatives to improve ED management of acute SCD pain could promote more efficient ways to manage SCD pain, better dissemination of national guidelines and efforts to improve negative physician attitudes towards SCD patients.

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Homestates of ACEP Survey Participants (n=601)

Figure 1.
Home-states of survey participants.

Table 1

Characteristics of Participants

Variable	Frequency*	Negative attitudes	Red flag behaviors	Positive attitudes
N	722	659	681	661
Age in years (IQR)	36 (32–45)	−0.1 (−0.3–2.0)	−0.0 (−0.3–2.1)	0.3 (0.1–2.4)
Number of years in practice				
Attending (n = 479)	7 years (3–15)	Ref	Ref	Ref
Nurse Practitioner (n = 16)	5 years (4–10)	4.0 (−3.2–9.6)	8.7 (1.1–14.5)	−0.5 (−8.0–5.3)
Medical Student (n = 10)	3 years (2–4)	4.0 (−3.2–9.6)	8.7 (1.1–14.5)	−0.5 (−8.0–5.3)
Resident (n = 176)	3 years (3–4)	2.1 (−2.7–6.5)	5.6 (0.4–10.1)	−0.3 (−5.3–4.3)
Physician Assistant (n = 19)	10 years (4–12.8)	4.0 (−3.2–9.6)	8.7 (1.1–14.5)	−0.5 (−8.0–5.3)
Other (n = 16)	NA	4.0 (−3.2–9.6)	8.7 (1.1–14.5)	−0.5 (−8.0–5.3)
Gender (%male)	64.8% (n = 468)	3.2 (−0.5–7.1)	1.8 (−2.2–5.8)	−3.8 (−7.7–0.2)
Race				
White	73.5% (n = 528)	Ref	Ref	Ref
Black	5.9% (n = 42)	−7.9 (−16.0–1.8)	−8.6 (−17.2–2.3)	14.3 (5.8–20.6)
Asian	16.3% (n = 117)	6.3 (1.4–10.7)	4.7 (−0.5–9.3)	0.9 (−4.2–5.5)
Hawaiian/Pacific Islander	0.3% (n = 2)	3.9 (−25.6–21.0)	0.5 (−30.8–18.4)	−2.3 (−33.2–15.4)
Native American/Alaskan Native	0.3% (n = 2)	−6.9 (−48.8–16.4)	20.6 (−23.8–45.2)	−16.5 (−60.3–7.8)
Other	3.8% (n = 27)	−0.5 (−9.7–6.2)	−5.0 (−14.8–1.9)	0.3 (−9.4–7.1)
Ethnicity				
Hispanic	9.4% (n = 59)	3.0 (−3.6–8.4)	4.1 (−2.9–9.6)	3.4 (−3.5–8.9)
Not Hispanic	90.6% (n = 571)	Ref	Ref	Ref
Number of SCD patients seen/week	1.5 (0.5–4.0)	0.9 (0.5–3.1)	0.5 (0.03–2.7)	−0.6 (−1.1–0.1)
Do you treat?				
Primarily adults	36.6% (n = 264)	6.6 (2.9–10.5)	3.6 (−0.3–7.6)	−7.6 (−11.5–3.6)
Primarily children	1.8% (n = 13)	−16.5 (−29.3–8.0)	14.8 (−28.4–5.9)	11.0 (−2.4–19.8)
Both	61.6% (n = 445)	Ref	Ref	Ref
Location and teaching status				
Rural teaching	7.5% (n = 54)	−3.1 (−7.3–1.0)	−4.5 (−9.0–0.3)	5.4 (1.0–9.6)
Rural non-teaching	7.1% (n = 51)	Ref	Ref	Ref
Urban teaching	60.2% (n = 432)	−3.1 (−7.3–1.0)	−4.5 (−9.0–0.3)	5.4 (1.0–9.6)
Urban non-teaching	17.8% (n = 128)	Ref	Ref	Ref
Are any of the following available to the SCD patients you treat?				
Comprehensive SCD Clinic	8.0% (n = 55)	Ref	Ref	Ref
SCD hematologist	30.7% (n = 211)	1.2 (−5.6–6.7)	−3.3 (−10.5–2.3)	0.1 (−7.0–5.7)
Any hematologist	40.6% (n = 279)	2.9 (−3.9–8.3)	−2.3 (−9.5–3.3)	−2.2 (−9.3–3.3)
Other follow-up services	10.8% (n = 74)	1.1 (−7.2–7.3)	−4.6 (−13.4–1.8)	1.4 (−7.3–7.8)

Variable	Frequency*	Negative attitudes	Red flag behaviors	Positive attitudes
No follow-up services available	9.9% (n = 68)	4.5 (−4.1–10.8)	−1.5 (−10.5–5.1)	−6.3 (−15.2–0.3)
other	7.4% (n = 53)	1.1 (−7.2–7.3)	−4.6 (−13.4–1.8)	1.4 (−7.3–7.8)

* Continuous variables are expressed as medians with inter-quartile range in parentheses. Categorical variables are expressed as a percent of the total respondents with raw value in parentheses. Within-category counts that do not add up to 722 indicate missing responses for that variable.

** Association of demographic variables with attitudinal scales: Each column refers to an attitude scale. Attitude scales are measured from 0 – 100 and the values expressed in this table represent the changes in each attitude scale associated with demographic variables. Values expressed are point estimates with 95% CI in parentheses. For categorical variables, the value expressed indicates the change in attitudinal scale associated with that category in comparison to the reference group (e.g. Black race was associated with a 14.3-point higher score on the positive attitude scale in comparison to White race). For continuous variables, results indicate the change in attitude scale associated with unit change in the explanatory variable (e.g. for each additional SCD patient seen per week, there is a 0.9-point increase in the negative attitude scale). Results were determined by MANOVA. A p value of 0.05 was required for statistical significance. Statistically significant values are highlighted.

Table 2

EP choice of opiate, route and frequency of use for the treatment of SCD pain

Drug	N	Percent who use this drug	PO	IV	Sub- cutaneous	IM	Rarely	Frequently	Always
Acetaminophen	637	66%					63%	30%	7%
Ibuprofen	625	65%					62%	33%	5%
Ketorolac	672	76%	12%	79%	1.40%	37%	44%	49%	7%
Other NSAIDs	501	38%	70%	17%	1%	17%	78%	17%	6%
Morphine	684	95%	5%	94%	5%	22%	16%	67%	18%
Hydromorphone	683	91%	8%	94%	4%	24%	9%	72%	19%
Fentanyl	683	48%	4%	98%			68%	26%	6%
Meperidine	671	19%	8%	78%	2%	34%	74%	21%	5%
Oxycodone/Acetaminophen	656	71%					43%	53%	4%
Hydrocodone/Acetaminophen	629	62%					47%	49%	4%
Oxycodone/oxycotin	612	43%					63%	34%	3%
Codeine	668	26%					82%	18%	1%
Tramadol	679	31%					72%	24%	4%
Methadone	669	13%	76%	20%	4%	4%	93%	7%	0%
Other opiate	586	12%	43%	57%	7%	11%	94%	4%	1%
Other Antihistamine	471	38%	49%	60%	2%	21%	76%	22%	2.00%
Diphenhydramine	676	80%	34%	82%	2%	20%	30%	59%	11%
PCA	684	24%					73%	25%	2%
Intranasal opiate	680	9%					84%	13%	3%
Intranasal NSAID	677	5%					91%	6%	3%

Table 3

Predictors of self-reported adherence to SCD guidelines*

Guideline	Uses parenteral opiates to treat SCD pain (frequently or always)	Redose opiates within 30 minutes for inadequate analgesia	Use of PCA pump (frequently or always)	Uses meperidine to treat SCD pain (frequently or always)	Uses hypotonic fluids for IV hydration (frequently or always)	Uses subcutaneous over IM for opiate administration	Uses NSAIDs to treat SCD pain (frequently or always)	Uses acetaminophen to treat SCD pain (frequently or always)
Race								
Black	0.9 (0.8–1.0)	0.85 (0.7–1.0)	0.8 (0.2–3.4)	2.0 (0.6–6.6)	1.4 (0.2–13.2)	1.9 (0.5–6.6)	1.2 (0.9–1.5)	1.5 (0.9–2.4)
Other	1.0 (0.9–1.0)	1.0 (0.9–1.0)	0.8 (0.4–1.8)	2.1 (1.0–4.3)	0.0 (0.0–0.0)	1.5 (0.7–3.0)	1.1 (0.9–1.3)	1.5 (1.1–2.1)
White	ref	ref	ref	ref	ref	ref	ref	ref
Level of practice								
Resident	1.0 (1.0–1.1)	1.0 (0.9–1.0)	1.9 (1.0–3.7)	0.1 (0.0–1.0)	1.2 (0.2–6.8)	1.2 (0.6–2.3)	0.8 (0.7–1.0)	0.7 (0.5–1.1)
NP, PA, Med student	0.9 (0.8–1.0)	1.0 (0.9–1.1)	1.6 (0.6–4.3)	3.9 (1.9–7.9)	2.2 (0.2–20.9)	0.8 (0.1–5.4)	1.0 (0.7–1.3)	1.4 (0.9–2.1)
Attending	ref	ref	ref	ref	ref	ref	ref	ref
Teaching hospital	1.0 (0.9–1.1)	1.0 (0.9–1.0)	1.7 (0.8–3.7)	1.1 (0.5–2.4)	0.6 (0.1–2.9)	1.4 (0.6–3.1)	1.0 (0.8–1.2)	1.2 (0.9–1.7)
Type of practice								
Adults	1.1 (1.0–1.1)	1.0 (0.9–1.0)	1.5 (0.8–2.7)	0.7 (0.3–1.6)	1.4 (0.3–6.7)	1.4 (0.7–2.6)	1.0 (0.8–1.1)	0.8 (0.6–1.1)
Children	1.0 (0.8–1.2)	1.0 (0.9–1.3)	6.6 (2.6–16.6)	1.6 (0.3–8.7)	6.4 (0.6–68.0)	9.3 (4.4–19.5)	1.2 (0.8–1.9)	1.2 (0.9–1.7)
Both	ref	ref	ref	ref	ref	ref	ref	ref
Availability of follow up								
no follow up	1.1 (1.0–1.2)	0.9 (0.7–1.1)	0.5 (0.1–2.6)	1.4 (0.3–5.7)	0.0 (0.0–0.0)	ref	0.9 (0.6–1.3)	2.1 (0.8–5.5)
other follow up	1.1 (1.0–1.2)	1.0 (0.9–1.2)	1.4 (0.4–4.8)	1.1 (0.3–4.4)	0.7 (0.0–12.3)	0.4 (0.1–2.5)	1.1 (0.7–1.5)	2.3 (0.9–6.0)
any hematologist	1.0 (1.0–1.2)	1.0 (0.9–1.2)	0.9 (0.3–2.6)	0.8 (0.2–2.8)	0.4 (0.0–4.5)	0.4 (0.1–2.5)	1.0 (0.7–1.3)	2.1 (0.9–4.9)
SCD hematologist	1.0 (1.0–1.1)	1.0 (0.9–1.2)	0.8 (0.3–2.4)	0.3 (0.1–1.5)	1.0 (0.1–9.4)	0.4 (0.1–2.5)	1.1 (0.8–1.4)	2.2 (0.9–5.2)
comprehensive center	ref	ref	ref	ref	ref	0.4 (0.1–2.5)	ref	ref
More than 1 pt/week	1.1 (1.0–1.1)	0.87 (0.8–0.9)	0.7 (0.4–1.2)	1.4 (0.7–3.0)	1.3 (0.3–6.0)	1.3 (0.6–2.7)	1.0 (0.9–1.2)	0.8 (0.6–1.0)

* Predictors of adherence to guidelines: values expressed are risk ratio with 95% CI in parentheses. All variables in the model were categorical, thus results indicate the relative risk of adhering to a particular guideline in comparison to the reference group (e.g. in comparison to attendings, NPs PAs and medical students were 3.9 times as likely to self-report use of meperidine for SCD pain). Statistically significant values are highlighted. A p value of 0.00625 was required for statistical significance.

Table 4

Association of EP attitudes with self-reported guideline adherence

Guideline	Uses parenteral opiates to treat SCD pain (frequently or always)	Redose opiates within 30 minutes for inadequate analgesia	Use of PCA pump (frequently or always)	Uses meperidine to treat SCD pain (frequently or always)	Uses hypotonic fluids for IV hydration (frequently or always)	Discharges SCD patients with a pain medication prescription (frequently or always)	Uses subcutaneous opioid for administration	Uses NSAIDs to treat SCD pain (frequently or always)	Uses acetaminophen to treat SCD pain (frequently or always)
Negative attitudes scale									
low quartile	ref	ref	ref	ref	ref	ref	ref	ref	ref
25–50%	1.3 (1.2–1.5)	0.9 (0.8–1.0)	1.2 (0.5–2.9)	1.6 (0.6–4.4)	0.0 (0.0–0.0)	1.0 (0.9–1.2)	0.6 (0.3–1.5)	1.0 (0.8–1.3)	0.7 (0.5–1.0)
50–75%	1.3 (1.2–1.5)	0.9 (0.8–0.9)	0.7 (0.2–1.9)	1.3 (0.4–4.0)	2.1 (0.4–10.7)	1.1 (0.9–1.3)	0.5 (0.2–1.3)	1.1 (0.9–1.4)	0.7 (0.5–1.0)
High quartile	1.4 (1.2–1.5)	0.8 (0.7–0.9)	1.3 (0.4–4.2)	2.3 (0.7–8.2)	1.2 (0.1–9.2)	1.1 (0.9–1.4)	0.8 (0.3–2.1)	1.0 (0.8–1.3)	0.8 (0.5–1.2)
Red-flag behavior scale									
low quartile	ref	Ref	ref	ref	ref	ref	ref	ref	ref
25–50%	1.3 (1.2–1.4)	1.0 (0.9–1.1)	0.8 (0.3–1.9)	0.6 (0.2–1.6)	0.8 (0.1–5.0)	1.0 (0.8–1.2)	1.2 (0.5–3.3)	1.9 (1.5–2.5)	1.6 (1.1–2.3)
50–75%	1.3 (1.2–1.4)	1.1 (1.0–1.1)	0.9 (0.4–2.0)	0.3 (0.1–0.9)	0.3 (0.0–2.7)	1.0 (0.8–1.2)	0.7 (0.3–1.7)	1.4 (1.1–1.9)	1.0 (0.7–1.6)
High quartile	1.3 (1.2–1.4)	1.0 (0.9–1.1)	0.4 (0.1–1.1)	0.6 (0.2–1.7)	0.6 (0.1–3.9)	1.0 (0.8–1.2)	0.9 (0.3–2.4)	1.8 (1.4–2.3)	1.1 (0.7–1.7)
Positive attitudes scale									
low quartile	ref	ref	ref	ref	ref	ref	ref	ref	ref
25–50%	1.2 (1.1–1.3)	1.0 (0.9–1.1)	1.5 (0.5–4.2)	0.7 (0.3–1.9)	0.2 (0.0–1.3)	1.2 (1.0–1.4)	0.5 (0.2–1.2)	1.1 (0.9–1.4)	0.9 (0.6–1.3)
50–75%	1.3 (1.2–1.4)	1.1 (1.0–1.2)	2.7 (1.0–7.3)	0.3 (0.1–1.6)	0.3 (0.0–2.2)	1.2 (1.0–1.4)	1.0 (0.4–2.4)	1.5 (1.2–1.9)	1.4 (0.9–2.2)
High quartile	1.4 (1.3–1.5)	1.0 (0.9–1.1)	2.0 (0.7–5.6)	1.7 (0.6–4.5)	0.3 (0.0–1.9)	1.3 (1.1–1.6)	1.3 (0.6–3.0)	1.6 (1.3–1.9)	1.4 (0.9–2.0)

* Association of EP attitude with guideline adherence. Values expressed as rate ratios (95% CI). Attitude scales were divided into quartiles with the lowest quartile as the reference group. Results indicate the relative risk of guideline adherence (e.g. in comparison to the lowest quartile of the negative attitude scale, those in the highest quartile were 20% (RR = 0.8) less likely to redose opiates within 30 minutes for inadequate analgesia). Statistically significant values are highlighted. A p value of 0.0056 was required for statistical significance.