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Variability in opioid pain medication prescribing for adolescent trauma patients in a sample of US pediatric trauma centers

Michael J Mello ,[1,2] Janette Baird,[1,2] Julie R Bromberg ,[1,2] Anthony Spirito,[3] Mark R Zonfrillo,[1,4] Lois K Lee,[5] Emily R Christison-Lagay,[6] Stephanie M Ruest,[1,4] Charles W Pruitt,[7] Karla A Lawson,[8] Andrew W Kiragu,[9] Isam Nasr,[10] Jeremy T Aidlen,[11] Beth E Ebel,[12] R Todd Maxson,[13] Kelli Scott ,[14] Sara J Becker[14]

For numbered affiliations see end of article.

Correspondence to
Julie R Bromberg; jbromberg@lifespan.org

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ABSTRACT

Objectives The primary objective of this study was to examine opioid prescription frequency and identify differences across a national cohort of pediatric trauma centers in rates of prescribing opioids to injured adolescents at discharge.

Methods This was a retrospective observational study using electronic health records of injured adolescents (12–17 years) admitted to one of 10 pediatric trauma centers.

Results Of the 1345 electronic health records abstracted, 720 (53.5%, 95% CI 50.8 to 56.2) patients received opioid prescriptions at discharge with variability across sites (28.6%–72%). There was no association between patient factors and frequency of prescribing opioids. Center's trauma volume was significantly positively correlated with a higher rate of opioid prescribing at discharge (r=0.92, p=0.001). There was no significant difference between the frequency of opioid prescriptions at discharge among alcohol and other drugs (AOD)-positive patients (53.8%) compared with AOD-negative patients (53.5%).

Conclusions Across a sample of 10 pediatric trauma centers, just over half of adolescent trauma patients received an opioid prescription at discharge. Prescribing rates were similar for adolescent patients screening positive for AOD use and those screening negative. The only factor associated with a higher frequency of prescribing was trauma center volume. Consensus and dissemination of outpatient pain management best practices for adolescent trauma patients is warranted.

Level of evidence III—prognostic.

Trial registration number NCT03297060.

Key messages

What is already known on this topic

- There is currently limited data on frequency of opioids prescribed at discharge from pediatric trauma centers to guide best practices.

What this study adds

- Just over half of adolescent trauma patients received an opioid prescription at discharge with similar prescribing rates for adolescent patients screening alcohol and other drugs-positive and those screening negative.

How this study might affect research, practice and/or policy

- This study highlights the need to develop and disseminate best practices for adolescent trauma patient pain management.

The US opioid epidemic has resulted in various recommendations and policies by institutions, state health departments and professional societies over the last several years to address excessive opioid prescribing.[1] The American College of Surgeons (ACS) has developed expert opinion recommendations on safe opioid prescribing practices for common adult surgical procedures including

> identify patients at high risk for opioid addiction, substance use disorder, or an opioid-related adverse drug event; establish guidelines for acute pain management of the opioid-addicted patient; set expectations and educate patients and caregivers prior to surgery, during discharge, and throughout follow-up; provide evidence-based education and evaluation training programs on opioid and nonopioid alternatives for pain management for the entire surgical team—surgeons, residents, and other health professionals and strengthen postoperative surveillance by both patients and providers to expand the evidence on use, response to alternative therapies, and potential issues with long-term use in acute surgical and palliative care patients.[2]

Additionally, an expert panel provided guidelines for opioid prescribing in children and adolescents after surgery that has been endorsed by ACS Board of Regents and American Pediatric Surgical Association Board of Governors.[3] This panel recommended that providers recognize the risks of opioid misuse associated with prescription opioids, optimize use of non-opioid analgesic use during the perioperative period and educate the patient and family about pain management and safe opioid use.[3]

A study using data from the 2019 National Survey on Drug Use and Health found that 2.3% of adolescents report opioid misuse.[4] Among those misusing opioids, the adolescent's own prescription and diversion from friends or families were the most common sources for obtaining opioids.[3] Adolescents using alcohol or other drugs (AOD) have been identified at increased risk of sustained opioid use (>90 days)[5] and later developing opioid

misuse.[6 7] Additionally, injured adolescents who continue to receive opioid prescribing after discharge from a trauma center had higher likelihood of negative consequences.[8]

Prior research has documented wide variation in prescribing of opioids for postsurgical pediatric patients with umbilical hernia repair,[9] otolaryngology procedures[10] and ambulatory surgical procedures.[11] Although adolescent trauma patients are commonly treated for painful injuries that will frequently require continued outpatient pain management after discharge, there are not any data on variability of prescribed opioids at discharge from pediatric trauma centers that will help inform guidelines for best practices.

Our primary research aim was to identify any differences across a national cohort of pediatric trauma centers in rates of prescribing opioids to injured adolescents at discharge and to determine characteristics of the center (eg, patient volume) or patient (age, gender, race, ethnicity, AOD screening status) associated with any discovered variations in prescribing. Additionally, our secondary objectives were to identify how often adolescents who screened positive for AOD use on admission were discharged with opioid pain medications, and the frequency of adolescent trauma patients receiving additional opioid prescriptions in the 30 days after discharge.

METHODS

This was a retrospective observational study using electronic health records (EHR) across a national cohort of 10 level 1 pediatric trauma centers. Centers were distributed throughout the USA: Northeast (n=4), Midwest (n=1), South (n=3) and West (n=2). Data extracted for this study were nested within a larger implementation study examining an implementation model for screening, brief intervention and referral to treatment[12] at all sites. The Strengthening the Reporting of Observational Studies in Epidemiology guidelines were used to report this observational study.[13]

Study research staff at the 10 centers were trained in the EHR data abstraction protocol through a webinar conducted by the coordinating research center. While all participating centers treat both injured and non-injured patients, only injured patients admitted to the trauma center were included in this study. Centers identified from their institutional trauma registry all adolescent (ages 12–17 years) trauma patients admitted to their institution between March 1, 2018 and November 30, 2018 (before any interventions were initiated for the parent study). At each center, a research staff member reviewed all EHRs and abstracted all data and then the Principal Investigator at each site independently abstracted data from 10% of the patient records. Any discrepancies were identified by the coordinating research center and returned to the site's research staff for resolution. All data were entered into a Research Electronic Database Capture database.[14]

Data abstracted from the EHR included: birth year, gender, race and ethnicity (as defined in the site's EHR), results of biological screening tests for substance use, results of screening questions for substance use, opioid prescribing at discharge and opioid prescribing at follow-up appointments within 30 days of hospital discharge.

Data were downloaded and cleaned by the coordinating research center and then analyzed using SAS (V.9.4, Cary, North Carolina, USA). Descriptive analyses were conducted and used to describe opioid prescribing practices and screening practices across centers, as well as bivariate associations between variables. Descriptive analyses were reported as frequencies with 95% CIs. Multivariable logistic regression was conducted to assess difference in odds of prescribing opioid medications at discharge examining potential factors at the site-level (volume) and patient-level (age, gender, race/ethnicity, AOD screening status). In all analyses, trauma centers were blinded and referred to as centers A through J with center A used as the reference group in the multivariable logistic regression analysis.

RESULTS

There were 1345 EHRs abstracted across the 10 participating centers during the study period. In total, 5301 injury-related 10th revision of the International Statistical Classification of Diseases codes were documented across the patient sample. Trauma centers contributed a range of data due to varying patient volume, range 44–246 patient EHRs, with an average of 135 patient EHRs per center. In this group of adolescents aged 12–17 years, nearly a quarter of patients were 17 years old (23%); 9% of patients were 12 years of age. Most of the patients were male (73%) and non-Hispanic (81%) with race identified in the EHR as 72% white, 14% black and 14% other races. Centers did not significantly vary on patient identification by gender (p=0.07) but did on race (p<0.001) and ethnicity (p<0.001). Center H reported a greater proportion of patients identified as black or African-American (40.7%, 95% CI 30.6% to 50.8%) compared with center E reporting the lowest (4.6%, 95% CI 0% to 10.8%). Center C reported a greater proportion of patients identified as Hispanic (38.0%, 95% CI 30.2% to 45.8%) compared with center A reporting the lowest (2.0%, 95% CI 0.8% to 3.2%).

Opioid prescribing practices

In total, 720 (53.5%, 95% CI 50.8 to 56.2) patients across all sites received opioid prescriptions at discharge. Frequency of opioid prescribing at discharge by center are described in table 1. Two centers (A and D) had significantly higher prescribing rates (72.0%, 95% CI 66.4%, 77.6% and 70.0%, 95% CI 63.2% to 76.8%) while two sites (C and I) had significantly lower rates (28.6%, 95% CI 18.0%, 39.2%, and 32.7%, 95% CI 25.2% to 40.7%) when compared with their peer centers. There were no differences in opioid prescription frequency at discharge by age, gender, race or ethnicity. Center's trauma volume was significantly positively correlated with a higher rate of opioid prescribing at discharge with higher volume sites having higher prescribing rates (r=0.92, p=0.001).

Table 1 Frequency of opioid medication prescribed at discharge by trauma center

Trauma center	Prescribed (%, 95% CI)	Patient volume n (% of total)
A	72.0 (66.4 to 77.6)	246 (18.3)
B	48.7 (40.8 to 56.6)	152 (11.3)
C	32.7 (25.2 to40.2)	150 (11.1)
D	70.0 (63.2 to 76.8)	180 (13.4)
E	47.7 (33 to 52.4)	44 (3.3)
F	38.4 (29.9 to 46.9)	125 (9.3)
G	52.9 (46.4 to 59.4)	227 (16.9)
H	56.0 (45.8 to 66.2)	91 (6.8)
I	28.6 (18.0 to 39.2)	70 (5.2)
J	56.7 (44.2 to 69.2)	60 (4.5)
All trauma centers	53.5 (50.8 to 56.2)	1345

Table 2 Logistic regression model predicting odds of opioid prescribing at discharge

Parameter	Adjusted OR (95% CI)
Gender (non-male vs male)	1.03 (0.80 to 1.32)
Age	1.03 (0.94 to 1.08)
Race (non-white vs white)	1.19 (0.92 to 1.54)
Ethnicity (non-Hispanic vs Hispanic)	1.04 (0.76 to 1.43)
Positive AOD test	1.01 (0.67 to 1.52)
Trauma center*	
B versus A	0.51 (0.32 to 0.79)
C versus A	0.26 (0.16 to 0.42)
D versus A	1.19 (0.79 to 1.81)
E versus A	0.79 (0.35 to 1.80)
F versus A	0.38 (0.23 to 0.63)
G versus A	0.47 (0.32 to 0.67)
H versus A	0.86 (0.54 to 1.84)
I versus A	0.30 (0.16 to 0.66)
J versus A	0.43 (0.14 to 1.15)
Trauma center volume (median centered)	1.01 (1.00 to 1.01)

*Trauma center A is referent site.

Predicting opioid prescribing at discharge

A logistic regression was conducted to estimate the effect of center and patient characteristics on being prescribed an opioid medication at discharge. Variables in the analysis included center volume (median centered) and patient characteristics (age, gender, race and ethnicity and positive AOD testing status). Site was entered as a variable in the model comparing site A (highest opioid prescribing site as the referent) with all others. The overall model was significant (Wald $\chi^2=54.1$, $p<0.0001$), and the parameter estimates with 95% CIs are shown in table 2. Patient characteristics had no significant adjusted odds of increased or decreased opioid prescribing. After adjusting for these patient variables, significant differences by site in the odds of prescribing opioids at discharge remained. Patients discharged from site A were significantly more likely to be prescribed an opioid at discharge than sites B, C, F, G or I.

Alcohol and other drug use and opioid prescribing

Across the centers, AOD use was screened for in 942 patients (70%, 95% CI 67.6% to 72.4%) by either biological testing only (n=161) or screening questions (n=545) or a combination of both (n=236). Of those screened with questions, 72% (n=392) used only non-validated screening questions (eg, yes/no drink alcohol) in asking patients about AOD use. Optimal combination screening of biological screen and use of a validated screening tool (CRAFFT[15]) was administered to 8.4% (n=79) of screened patients. Among those screened (n=942), 119 unique patients screened positive for AOD use (12.6%; 95% CI 10.5% to 14.7%).

Overall, there was no significant difference between the frequency of opioid prescriptions at discharge among AOD-positive patients (53.8%; 95% CI 44.8% to 62.8%) compared with AOD-negative patients (53.5%, 95% CI 50.1% to 56.9%) across all sites. There were no significant differences in the frequency of prescribing between AOD-positive patients for site A (positive AOD receiving opioid at discharge=71%, negative AOD=81%, p=0.29) or site D (positive AOD receiving opioid at discharge=60%, negative AOD=72%, p=0.15). There were no significant differences in the proportion of patients prescribed an opioid at hospital discharge by type of positive AOD screening testing used; CRAFFT only (n=35, 57.2% prescribed opioid, 95% CI 40.8% to 73.6%), biological testing only (n=76, 52.4% prescribed opioid, 95% CI 41.2% to 63.6%) or combined testing (n=8, 25% prescribed opioid, 95% CI 0% to 55.0%).

Opioid prescribing after discharge

EHR data for follow-up visits were available for 47.5% (n=639) of all patients. Of those patients, 15.6% (n=100, 95% CI 12.8% to 18.4%) were EHR notes from visits with their primary care provider within 30 days of hospital discharge. Seventeen of these patients received an opioid prescription by the primary care provider within 30 days of discharge and all these patients had also received an opioid at hospital discharge.

Eighty-four per cent of patients (n=537) with postdischarge records visited a specialty clinic, for example, orthopedics, within 30 days of hospital discharge. Twenty-nine of these patients received an opioid prescription at the specialty clinic with the majority of these patients (82.8%, 95% CI 69.1% to 96.5%) also having received an opioid prescription at hospital discharge. None of these patients screened positive for risk alcohol or drug use during their trauma visit.

DISCUSSION

We found variation in the frequency of opioid pain medication being prescribed at discharge to adolescent trauma patients at 10 US pediatric trauma centers. We were surprised at the magnitude of variability across these 10 sites, with prescribing ranging from as low as 28.6% to as high as 72%. We did not identify any patient variables associated with receiving an opioid prescription including age, gender, race, ethnicity or AOD use. The fact that demographic differences in prescribing patterns were not detected is encouraging, suggesting, although not confirming, that bias did not play a role in prescribing at these trauma centers.

An additional finding of concern is that rates of prescribing were similar for those adolescent patients screening positive for AOD use and those who screened negative. While identifying patients at high risk for opioid addiction is recommended by the ACS,[2] this finding raises the possibility that AOD use was not considered in clinicians' decisions to prescribe an opioid. Adolescents using AOD are at increased risk of later developing opioid misuse[6] and prescriptions from healthcare providers are one of the most common sources of opioids for adolescents who misuse them.[3] Also, of concern was that AOD screening was limited and when performed, was often reported as being conducted through a non-validated screening tool potentially resulting in an under-reporting of risk. Comprehensive screening, using both biologics and a validated screening instrument, has been advocated by the Pediatric Trauma Society Guidelines Committee.[16]

Interestingly, opioid prescribing was related to the site's volume of adolescent trauma patients, with larger volume centers more often prescribing compared with lower volume centers. Our data do not allow for more granular evaluation of factors that contributed to clinicians prescribing an opioid (or not) at these sites or if there was variability in who (attending pediatric trauma surgeon, other attending physician, physician in-training, advance practice provider) prescribed them across sites. Nonetheless, it is possible that larger trauma centers have larger referral area with patients that are more geographically isolated from the trauma center and therefore, clinicians prescribe opioids more often in case they are subsequently needed. Indeed, a survey of adult trauma surgeons found that

surgeons self-report prescribing more opioids if patients lived far from the treating hospital.[17]

Our finding of variability in prescribing opioids across sites does not establish appropriate best practice standards for prescribing. Determining if sites with high frequency of prescribing were overprescribing or whether lower prescribing sites were undertreating patients is not possible in this observational study. However, the variability found does point toward the need for guidance to promote greater consistency across centers. The recently published expert panel opinion,[3] although not specific for adolescent trauma patients, may assist in developing best practices regarding the use of opioids, opioid-free analgesics and other non-pharmacological treatments for outpatient pain management after discharge from the pediatric trauma center. In addition, best practice recommendations should include recommendations for universal adolescent AOD screening using a validated tool, anticipatory guidance for patients and families about their outpatient pain management and how to safely store and then dispose of opioids after discharge.

LIMITATIONS

Our study was limited in being a cohort of US pediatric trauma centers that although diverse in size, trauma volume and geographic location was not chosen to be a representative sample of all US pediatric trauma centers. Our total sample consisted of a racial and ethnic composition similar to the USA, but there was variability by site that may have resulted in some sites differentially affecting our analysis of sociodemographic factors related to opioid prescribing. We were not able to examine any other potentially important sociodemographic factors which could be associated with opioid prescribing patterns. We did not collect data on inpatient pain management or use of opioids thus cannot comment on if this was continued or new use of opioids at discharge. Our data on those prescribed opioids at discharge and follow-up prescriptions after discharge were limited by our ability to obtain medical records on follow-up appointments with providers. Most pediatric trauma centers in our sample treated patients who received primary pediatric care outside the larger health system's network and so linkage between trauma centers EHR and primary care providers medical records was limited to approximately half of our sample (48%). This significantly encumbered attempts to longitudinally follow opioid use and pain management.

CONCLUSIONS

Across a sample of 10 pediatric trauma centers, 53.5% of adolescent trauma patients received an opioid prescription at discharge with variability across sites (72%–28.6%) in the frequency of prescribing. There was no association between patient factors, including age, gender, race, ethnicity or AOD screening status, and the frequency of prescribing opioids. The only factor associated with a higher frequency of prescribing was trauma center volume, a finding that cannot be explained with the available data for this study. Of concern, screening for AOD was limited among admitted trauma adolescent trauma patients, and those patients screening positive had a similar frequency of being prescribed an opioid at discharge. Consensus and dissemination of best practices for outpatient pain management of the adolescent trauma patients is warranted.

Author affiliations
[1]Emergency Medicine, Brown University, Providence, Rhode Island, USA
[2]Emergency Medicine, Rhode Island Hospital, Providence, Rhode Island, USA
[3]Psychiatry and Human Behavior, Brown University, Providence, Rhode Island, USA
[4]Emergency Medicine, Hasbro Children's Hospital, Providence, Rhode Island, USA
[5]Emergency Medicine, Boston Children's Hospital, Boston, Massachusetts, USA
[6]Surgery, Yale-New Haven Hospital, New Haven, Connecticut, USA
[7]Pediatrics, Primary Children's Hospital, Salt Lake City, Utah, USA
[8]Dell Children's Trauma and Injury Research Center, Austin, Texas, USA
[9]Pediatrics, Hennepin County Medical Center, Minneapolis, Minnesota, USA
[10]Surgery, Johns Hopkins Children's Center, Baltimore, Maryland, USA
[11]Pediatric Surgery, UMass Memorial Medical Center, Worcester, Massachusetts, USA
[12]Pediatrics, Harborview Medical Center, Seattle, Washington, USA
[13]Pediatric Surgery, Arkansas Children's Hospital, Little Rock, Arkansas, USA
[14]Behavioral and Social Sciences, Brown University School of Public Health, Providence, Rhode Island, USA

Contributors MJM: guarantor, study design, data analysis, data interpretation, writing, critical revision. JB: study design, data analysis, data interpretation, writing, critical revision. JRB: study design, data collection, data analysis, data interpretation, writing, critical revision. AS: study design, data analysis, data interpretation, writing, critical revision. MRZ: study design, data analysis, data interpretation, writing, critical revision. LKL: data collection, writing, critical revision. ERC-L: data collection, writing, critical revision. SMR: data collection, writing, critical revision. CP: data collection, writing, critical revision. KAL: data collection, writing, critical revision. AWK: data collection, writing, critical revision. IN: data collection, writing, critical revision. JTA: data collection, writing, critical revision. BE: data collection, writing, critical revision. TM: data collection, writing, critical revision. KS: study design, data collection, data analysis, data interpretation, writing, critical revision. SJB: study design, data collection, data analysis, data interpretation, writing, critical revision.

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ORCID iDs
Michael J Mello http://orcid.org/0000-0001-9683-6889
Julie R Bromberg http://orcid.org/0000-0003-3138-4521
Kelli Scott http://orcid.org/0000-0002-4511-8825

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