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# BMJ Open

## Epidemiology of pediatric pain-related visits to emergency departments in the United States: a cross-sectional study

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3 **Epidemiology of pediatric pain-related visits to emergency departments in the United**  
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5 **States: a cross-sectional study**  
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10 **Authors**

11 Jana L. Anderson<sup>1</sup> MD, Lucas Oliveira J. e Silva<sup>1</sup> MD, Shealeigh A. Funni<sup>2</sup>, Fernanda Bellolio<sup>1,2</sup>  
12  
13 MD MS, Molly M. Jeffery<sup>1,2</sup> PhD.  
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19 **Author Affiliations**

20  
21 <sup>1</sup>Department of Emergency Medicine, Mayo Clinic, Rochester, Minnesota, USA;

22  
23 <sup>2</sup>Department of Health Sciences Research, Mayo Clinic, Rochester, Minnesota, USA.  
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28 **Corresponding Author**

29  
30 Jana L. Anderson, MD

31  
32 Department of Emergency Medicine

33  
34 Mayo Clinic

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36 Phone: 507-775-5388, Email: Anderson.Jana@mayo.edu  
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42 **Author Contributions**

43  
44 Conceptualization: JLA, FB and MMJ. Formal analysis: SAF, MMJ. Investigation: JLA, LOJS,

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46 FB, MMJ. Methodology: LOJS, FB, MMJ. Project administration: JLA. Supervision: MMJ.

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48 Validation: FB MMJ. Writing-original draft: JLA. Writing-review and editing: JLA, LOJS, SAF,

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50 FB, MMJ. Guarantor: JLA, MMJ. All authors provided critical revision and contribution for

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52 important intellectual content.  
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**Competing interests**

None.

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Not applicable / Not required.

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## ABSTRACT

**Objective:** To describe the current epidemiology of pediatric pain-related visits to emergency departments (EDs) across the United States (US).

**Design:** Cross-sectional study.

**Setting:** A representative sample of US ED visits using data from the National Hospital Ambulatory Medical Care Survey (NHAMCS).

**Participants:** We analyzed all pediatric (age  $\leq 18$  years) ED visits in the 2017 NHAMCS dataset.

**Data analysis:** Each visit was coded as pain- or non-pain-related using the “reason for visit” variable. Weighted proportions were calculated with 95% confidence intervals, and t-tests were used to compare baseline characteristic proportions between pain- and non-pain-related visits.

**Outcome measures:** Prevalence of pain-related visits among all pediatric ED visits, and baseline demographic differences between pain- and non-pain-related visits.

**Results:** There were an estimated 35 million pediatric ED visits in the US in 2017, 55.6% (95% CI 53.3% to 57.8%) were pain related, which equates to 19.7 million annual visits. The prevalence of pain-related visits reached 50% of visits at age 7 and plateaued at relatively high proportions. White children were more likely to have non-pain-related visits (70.9% vs. 63.8%,  $p = 0.001$ ), while children with private insurance were more likely to have pain-related visits (26.1 vs. 18.3%,  $p < 0.001$ ). Children with races other than black and white were more likely to have pain-related visits (5.9% vs. 2.6%,  $p = 0.001$ ). Trauma represented 46.5% (95% CI, 42.0% to 51.0%) of pain-related visits. Pain scores were reported in less than 50% of pain-related visits.

**Conclusion:** Pain is the reason for visit in 55.6% of pediatric ED visits across the US. The prevalence of pain-related visits peak before adolescence and it continues relatively high until

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2  
3 the age 18. Trauma prevention, racial disparities in pain, and poor pain score reporting should  
4  
5 remain major topics of study in the pediatric population.  
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7 Keywords: Prevalence, Acute Pain, Pediatrics, Emergency Departments.  
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## ARTICLE SUMMARY

### Strengths and limitations of this study

- This study used data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), which uses a multistage probability design to achieve a representative sample of Emergency Department visits in the United States.
- We have used up to five “reason for visit” variables to define the painful nature of visits and to identify pain-related visits.
- Tracking use among individual patients is not possible in the NHAMCS dataset.
- The National Center for Health Statistics standardizes data collection and processing, however some inconsistencies may remain across different participating Emergency Departments.



## INTRODUCTION

Acute pain is known to be one of the most frequent reasons for visiting the Emergency Department (ED).[1] Given that pain is a driving factor for the majority of visits, it is important to understand the epidemiology of the disease. There is little up-to-date information on pediatric ED visits for acute pain, as the majority of acute pain ED epidemiology studies have excluded children, were limited to one institution, or are now outdated.[2–5]

One of the first pediatric pain ED epidemiology studies was performed in Canada in 1996.[3] This study utilized pain scale responses rather than chief complaint to define a pain-related visit. Also, some limitations of this study were its short time period of enrollment and the limited setting including only two hospitals and excluding the critical area of the ED. In 2000, the first ED pain study with consecutive enrollment was published.[4] This study was performed at a single large urban center and utilized chief complaint to identify a pain visit. Children were not the focus of this study, but children less than 5 years of age did comprise 14% of the study population. The first pediatric national level epidemiology study on acute pain in United States (US) EDs was performed using data from 1997 to 2000.[5] This study utilized the National Hospital Ambulatory Medical Care Survey (NHAMCS) database and it used the “reason for visit” variable to define a pain-related visit. As the last US-based national study on the prevalence of pain-related visits, this data is outdated by two decades. It is unclear if pain remains a major driver of ED visits in the pediatric population.

Our goal in this study was to examine the current prevalence of pain-related visits among children presenting to EDs in the US. This information will help to build foundational knowledge about the dimension of this clinically important condition and to focus future preventative, home and ED therapy to hopefully decrease the incidence of pain. In addition, this

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3 study will provide a background for trends in pediatric pain prevalence looking towards the  
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5 utilization and optimization of analgesics.  
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## 10 **METHODS**

### 11 **Study design, setting, and participants**

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14 This was a cross-sectional study of all children (age  $\leq 18$  years) in the 2017 National  
15 Hospital Ambulatory Medical Care Survey (NHAMCS), which was released in 2019. This de-  
16 identified data is publicly available from the National Center for Health Statistics (NCHS) and  
17 provides a representative sample of all US ED visits.[6] Because this study used pre-existing, de-  
18 identified data, the Institutional Review Board deemed this study exempt. We followed the  
19 STrengthening the Reporting of OBServational studies in Epidemiology (STROBE) guidelines  
20 for reporting observational studies.[7]  
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### 33 **Data source, variables, and measurements**

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35 The NHAMCS ED data set has been collected yearly since 1992 to describe US ED visits  
36 and utilization.[8] It is a national survey conducted by the NCHS division of the Center for  
37 Disease Control and Prevention with detailed methods publicly available.[6] Emergency  
38 departments are sampled using a multistage probability design with stages including primary  
39 sampling units (PSUs), hospitals within PSUs, emergency service areas within EDs, and patient  
40 visits within emergency service areas. It includes 112 PSUs from which eligible EDs are selected  
41 for participation in the database. Detailed surveys are obtained by trained personnel over a  
42 randomly selected 4-week period that rotates each survey year. These surveys are then weighted  
43 using population statistics to estimate visits on a national level.  
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3 Data was collected through a patient record form (PRF) which can be viewed on the  
4 NCHS website.[9] The PRF lists up to five “reasons for visit” (RFV), including the first-listed  
5 RFV and up to four additional symptoms, problems or issues. We used these five RFV variables  
6 to categorize visits as pain- or non-pain-related. The list of RFV codes were reviewed by two  
7 independent board-certified emergency physicians to determine which ones were likely to be  
8 pain-related. Certain criteria such as the presence of the word “pain” or “ache” were considered  
9 when determining whether the RFV code was pain-related or not, along with painful conditions  
10 such as fractures, dislocations, burns, and lacerations. Pain-related ED visits were defined as any  
11 visit with at least one pain-related RFV code, including those either categorized as “definitely  
12 painful” or “probably painful”. Pain-related ED visits with a painful chief complaint were  
13 defined as any visit with at least one pain-related RFV code that was categorized as “definitely  
14 painful”. The full list of codes considered as “definitely painful” or “probably painful” is detailed  
15 in eMethods S1 (Supplementary Material). Trauma involvement was defined by the variable  
16 “Injury” in the PRF. Visits in which a “definitely painful” or “probably painful” code was  
17 present and the variable “Injury” was present were considered to be pain-related ED visits with  
18 trauma.

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20 We also categorized RFV codes by body systems including musculoskeletal, abdominal,  
21 ear/nose/throat, laceration, headache, general pain, chest, genital-urinary/dysuria, eye, bite, oral,  
22 and burn related complaints. The full list of codes and categorization is detailed in eMethods S2  
23 (Supplementary Material).

## 24 **Data analysis**

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3 Analysis was completed using the *svy* suite of tools in Stata version 15, which considers  
4 the sampling design of the NHAMCS survey to accurately calculate nationally weighted  
5 estimates and their variability (StataCorp LLC, 2017). The total number of pediatric visits, both  
6 pain- and non-pain-related, was estimated. Descriptive statistics were calculated for age, sex,  
7 ethnicity, race, geographic region, arrival by emergency medical services (EMS), primary payer  
8 source, immediacy of visit, trauma involvement, and pain scale rating. Children were grouped by  
9 age into three developmental stages: age < 6, age 6 to 11, and age 12 to 18 years. Proportions of  
10 trauma involvement among pain-related visits and categorization by body system involved  
11 among pain-related visits were also calculated. Weighted proportions were calculated with 95%  
12 confidence intervals (CI). Characteristics between pain- and non-pain-related visits were  
13 compared using t-tests to compare proportions for each baseline characteristic.  
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### 31 **Patient and public involvement**

32 Patients and/or public were not involved in this study.  
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## 38 **RESULTS**

39 We analyzed all 4,112 pediatric ED visits in the 2017 NHAMCS dataset, which  
40 represents an estimated 35 million visits during the study period. Across all pediatric ED visits  
41 (pain- and non-pain-related visits), 44.5% of the children were younger than 6 years of age,  
42 24.1% aged 6 to 11 years, and 31.5% aged 12 to 18 years. The cohort was 48.5% female. White  
43 children made up 67.7% of the study population, followed by black children at 28.2%. Hispanic  
44 or Latino ethnicity comprised 25.5% of the cohort. Arrival by ambulance occurred in 5.0% (95%  
45 CI, 4.0% to 6.1%) of all pediatric ED visits.  
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3 The prevalence of pain-related ED visits was 55.6% (95% CI, 53.3% to 57.8%),  
4 representing a population estimate of 19.7 million ED visits for pediatric pain. Among all pain-  
5 related ED visits, 68.8% (95% CI, 65.9% to 71.6%) had a painful chief complaint. When we  
6 plotted the proportion of ED visits with painful chief complaint by age, there was a steady  
7 increase till the age of 7 and it then plateaued at relatively high proportions, ranging from a  
8 minimum of 49.8% (age 14) to a maximum of 64.6% (age 11). (Figure 1)  
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17 Baseline characteristics between pain-related ED visits and non-pain-related ED visits  
18 were generally similar, except for race (non-pain-related visits had a higher proportion of white  
19 children than pain-related visits at 70.9% vs. 63.8%,  $p = 0.001$ ), insurance (pain-related visits  
20 had a higher proportion of children with private insurance than non-pain-related visits at 26.0%  
21 vs. 18.3%,  $p < 0.001$ ), and triage (children triaged as non-urgent were more likely to have a non-  
22 pain-related visit at 10.1% vs. 4.5%,  $p < 0.001$ ). Black children represented similar proportions  
23 of pain- and non-pain-related visits, but pain-related visits had higher proportions of children  
24 with races other than black and white than non-pain-related visits (5.9% vs. 2.6%,  $p = 0.001$ ).  
25 There were no significant differences by ethnicity for pain- and non-pain-related visits. As for  
26 pain scale reporting among pain-related visits, less than 50% had pain score available (14.8%  
27 with a score 0 to 4, and 29.3% with a score 5 to 10). (Table 1).  
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42 Trauma involvement was reported in 46.5% (95% CI, 42.0% to 51.0%), or an estimated  
43 9.2 million of the pain-related visits. There were an estimated 1.3 million, or 2.5% of visits with  
44 unknown trauma involvement. In pain-related visits with trauma, the percentage of  
45 musculoskeletal system involvement was 69.5% (95% CI, 63.7% to 74.8%), followed by skin  
46 laceration at 14.7% (95% CI, 11.4% to 18.8%). In pain-related ED visits without trauma, the  
47 most common body system involved was abdominal at 32.0% (95% CI, 25.5% to 39.3%),  
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3 followed by ear/nose/throat at 31.0% (95% CI, 23.1% to 40.2%), and headache at 8.8% (95% CI,  
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5 6.6% to 11.8%). (Table 2)

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8 Among the estimated 13.6 million pain-related ED visits with a painful chief complaint,  
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10 the body systems most frequently involved were musculoskeletal at 39.9% (95% CI 34.6% to  
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12 45.6%), followed by abdominal at 16.0% (95% CI 11.9% to 21.1%) and ear/nose/throat at 14.8%  
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14 (95% CI 12.1% to 18.0%) (Table 3)

## 15 16 17 18 19 **DISCUSSION**

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21 In this cross-sectional study, we found that 55.6% of all US ED pediatric visits were  
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23 related to pain. This equates to 19.7 million yearly visits to EDs across the US for pediatric pain.  
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25 The prevalence of pain-related visits in children peaked as early as 7 years old and it then  
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27 plateaued at relatively high proportions. Baseline characteristics stratified by the painful nature  
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29 of the visit were generally similar. However, non-white children and those with private insurance  
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31 were more likely to have pain-related visits. Trauma was involved in just under half of pain-  
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33 related ED visits in the pediatric population. Lastly, recording of pain scores remains poor  
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35 among painful visits.  
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40 Few NHAMCS studies have assessed the prevalence of pain-related ED visits in the  
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42 pediatric population. In a study looking at pediatric ED visits from the NHAMCS 1997-2000  
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44 survey dataset, Drendel et al reported that 51.7% of all pediatric ED visits had a painful reason  
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46 for visit, with an approximated estimate of 10.3 million visits for pain during the 4-year study  
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48 period.[5] The prevalence of painful ED visits has remained relatively stable (now 55.6%), but  
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50 the total number of painful pediatric ED visits has grown substantially, now reaching an  
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52 estimated 19.7 million during a 1-year period. Also, these data indicate that acute pain remains  
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3 highly prevalent among the several reasons for which children present to the ED. This pattern is  
4 similar to the adult literature, where pain-related ED visits remained consistently high between  
5 42% to 45% of ED visits. [2,10]  
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10 Our study shows that the prevalence of pain-related ED visits significantly increases from  
11 infancy till age 7, reaching a relatively high proportion that then remains similar throughout  
12 childhood and adolescence. This is the first study to show that the proportion of pain-related ED  
13 visits is similar for children from 7 to 12 years as to the typical adolescent, 13 to 18 years. This  
14 data emphasizes the need for primary injury prevention in young children.  
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22 As expected, trauma remains a major source of pain-related ED visits during childhood.  
23 Just under half of all pediatric pain-related ED visits involved trauma, once again emphasizing  
24 the importance of more trauma prevention initiatives. These findings are similar to older studies  
25 using the NHAMCS dataset,[5] indicating little change in the proportion of pediatric pain-related  
26 ED visits due to trauma in the last 20 years.  
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33 When comparing baseline characteristics between pain- and non-pain-related pediatric  
34 ED visits, there were significant differences in race. Pain-related visits had significantly higher  
35 proportions of children who were of races other than black or white than non-pain-related visits.  
36 Other studies have shown that minoritized groups are at particularly high risk of receiving  
37 inadequate pain treatment.[10–12] White children, for example, are more likely to receive opioid  
38 prescriptions than non-white children.[13] Given these known disparities in pain management,  
39 the findings of our study should emphasize the importance of assessing and treating pain in  
40 minoritized children seen in the ED.  
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51 The pain scale was blank or unknown in more than half of pediatric pain-related ED  
52 visits. This is similar to the percentage of pain scores documented in the study by Drendel et al  
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3 looking at 1997-2000 data from NHAMCS,[5] highlighting that pain score recording is poorly  
4 performed in children and has not improved over the last two decades. Further examination will  
5 be necessary to evaluate whether this missing data refers to poor reporting or to the difficulty of  
6 using structured pain scales in children. The poor reporting of pain scores also occurs in adult  
7 populations.[14] For this reason, one may argue that the difficulty of using pain scales in  
8 children does not play a major role on the absence of these data in the NHAMCS surveys.  
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## 19 **LIMITATIONS**

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21 Our study had several limitations. First, NHAMCS is a cross-sectional survey, and  
22 tracking use among individual patients is not possible. Second, NHAMCS may include errors in  
23 documentation and missing data. Although NCHS standardizes data collection and processing,  
24 some inconsistencies may remain across different participating EDs. Third, this data may be only  
25 representative of US pediatric ED visits. Strengths of the NHAMCS survey are its rigorous  
26 methodology, nationally representative nature, large size, and wide array of variables.[8] It  
27 provides epidemiological data and trends over time and allows assessment of these trends in a  
28 nationally representative population, regardless of patient age, gender, comorbid conditions,  
29 insurance, or other characteristics.  
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## 44 **CONCLUSIONS**

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46 This study provides the most current prevalence of pediatric pain-related visits to EDs  
47 across the United States at 55.6%. The prevalence of pain-related visits peaks before the  
48 adolescence and it persists relatively high. Younger children should receive as much attention to  
49 injury and pain prevention as older children. Trauma prevention, racial disparities, and poor pain  
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score reporting should remain major topics of research in the care of pediatric acute pain in the ED.

For peer review only

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## LEGENDS

**Figure 1.** Proportion of all pain-related ED visits with painful chief complaint.

**Table 1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

**Table 2.** Body system involvement for all pain-related ED visits stratified by the presence of trauma.

**Table 3.** Body system involvement for pain-related ED visits with a painful chief complaint.

**Table 1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

	<b>Pain-related ED visit</b> 55.57%* (53.27%, 57.85%)	<b>Non-pain-related ED visit</b> 44.42%* (42.15%, 46.72%)	<b>P Value</b>
<b>Age</b>			
< 6 years	27.14% (23.13%, 31.55%)	66.16% (61.47%, 70.55%)	<0.001
6-11 years	31.58% (29.16%, 34.10%)	14.67% (12.71%, 16.88%)	<0.001
12-18 years	41.29% (36.14%, 46.63%)	19.17% (15.87%, 22.96%)	<0.001
<b>Sex</b>			
Female	48.88% (45.36%, 52.42%)	47.95% (45.19%, 50.72%)	0.732
Male	51.12% (47.58%, 54.64%)	52.05% (49.28%, 54.81%)	0.732
<b>Ethnicity</b>			
Hispanic or Latino	25.10% (18.09%, 33.71%)	25.93% (19.95%, 32.96%)	0.714
Not Hispanic or Latino	74.90% (66.29%, 81.91%)	74.07% (67.04%, 80.05%)	0.714
<b>Race</b>			
White	63.79% (57.54%, 69.61%)	70.86% (64.15%, 76.77%)	0.001
Black	30.27% (24.60%, 36.61%)	26.57% (20.89%, 33.15%)	0.07
Other	5.94% (4.32%, 8.11%)	2.56% (1.72%, 3.82%)	0.001
<b>Region</b>			
Northeast	12.92% (7.84%, 20.57%)	13.69% (8.00%, 22.46%)	0.592
Midwest	24.77% (17.79%, 33.39%)	24.63% (16.16%, 35.66%)	0.949
South	47.02% (35.34%, 59.04%)	43.15% (31.00%, 56.18%)	0.068
West	15.28% (9.21%, 24.30%)	18.53% (10.46%, 30.69%)	0.123
<b>Arrived in EMS</b>			
Yes	4.37% (3.27%, 5.83%)	5.67% (4.14%, 7.72%)	0.238
No	91.13% (84.59%, 95.06%)	89.76% (83.06%, 94.00%)	0.229
Unknown	3.90% (1.01%, 13.90%)	4.15% (1.10%, 14.47%)	0.412
Blank	0.59% (0.31%, 1.13%)	0.42% (0.19%, 0.93%)	0.546
<b>Triage (Immediacy)</b>			
Immediate	1.14% (0.29%, 4.36%)	0.75% (0.27%, 2.06%)	0.415
Emergent	6.00% (3.73%, 9.53%)	8.77% (5.19%, 14.44%)	0.02
Urgent	28.73% (22.63%, 35.72%)	23.87% (19.65%, 28.66%)	0.075
Semi-urgent	35.07% (28.70%, 42.02%)	31.73% (27.04%, 36.82%)	0.084
Non-urgent	4.52% (2.19%, 9.11%)	10.12% (6.66%, 15.08%)	<0.001
Unknown	24.53% (16.38%, 35.04%)	24.77% (17.01%, 34.59%)	0.891
<b>Primary Payer</b>			
Private insurance	26.05% (21.68%, 30.95%)	18.29% (14.21%, 23.22%)	<0.001
Medicare	0.35% (0.17%, 0.72%)	0.38% (0.16%, 0.88%)	0.865
Medicaid or CHIP	60.91% (55.13%, 66.39%)	65.80% (56.93%, 73.69%)	0.03
Self pay	4.49% (3.11%, 6.42%)	4.45% (2.92%, 6.72%)	0.961

Worker's compensation	0.03% (0.01%, 0.14%)	0.01% (0.00%, 0.06%)	0.382
No charge/charity	0.05% (0.01%, 0.40%)	0.12% (0.03%, 0.54%)	0.553
Other	1.36% (0.75%, 2.47%)	1.38% (0.72%, 2.65%)	0.963
Unknown	5.40% (2.31%, 12.12%)	7.73% (2.69%, 20.25%)	0.216
Blank	1.36% (0.47%, 3.92%)	1.85% (0.63%, 5.31%)	0.182
<b>Pain Scale</b>			
Blank/Unknown	55.91% (46.67%, 64.76%)	87.46% (83.17%, 90.78%)	<0.001
0-4 score	14.81% (11.08%, 19.52%)	6.44% (4.43%, 9.27%)	<0.001
5-10 score	29.28% (23.37%, 35.98%)	6.10% (4.15%, 8.86%)	<0.001

\*Results are presented as weighted proportions with its 95% confidence intervals.

**Table 2.** Body system involvement for all pain-related ED visits stratified by the presence of trauma.

<b>Body system</b>	<b>Pain-related ED visits with trauma*</b>	<b>Pain-related ED visits without trauma*</b>
Musculoskeletal	69.5% (63.7%, 74.8%)	7.1% (4.5%, 11.1%)
Skin Laceration	14.7% (11.4%, 18.8%)	0.0% (0.0%, 0.0%)
General Pain	3.7% (2.4%, 5.5%)	6.2% (4.0%, 9.5%)
Headache	3.2% (2.0%, 5.2%)	8.8% (6.6%, 11.8%)
Eye	1.6% (0.8%, 3.2%)	0.8% (0.3%, 2.3%)
Bite	2.3% (1.4%, 3.8%)	0.0% (0.0%, 0.0%)
Burn	1.9% (0.9%, 4.1%)	0.0% (0.0%, 0.0%)
Abdominal	0.6% (0.3%, 1.4%)	32.0% (25.5%, 39.3%)
Ear/Nose/Throat	0.7% (0.3%, 1.7%)	31.0% (23.1%, 40.2%)
Genital-urinary/Dysuria	0.2% (0.1%, 0.9%)	5.7% (4.2%, 7.7%)
Chest	0.9% (0.3%, 2.4%)	6.9% (4.8%, 10.0%)
Oral	0.6% (0.2%, 2.1%)	1.3% (0.5%, 2.3%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

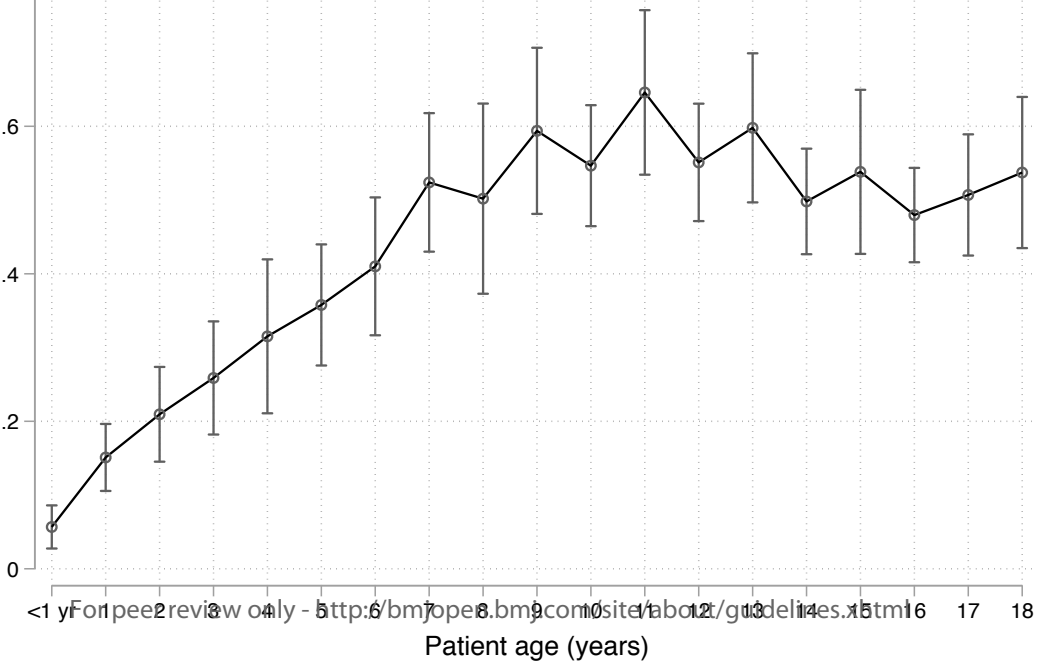
**Table 3.** Body system involvement for pain-related ED visits with a painful chief complaint.

<b>Body system</b>	<b>Proportion* (95% CI)</b>
Musculoskeletal	39.9% (34.6%, 45.6%)
Abdominal	16.0% (11.9%, 21.1%)
Ear/Nose/Throat	14.8% (12.1%, 18.0%)
Skin Laceration	7.6% (5.6%, 10.2%)
Headache	5.8% (4.5%, 7.3%)
General Pain	4.7% (3.3%, 6.9%)
Chest	3.8% (2.6%, 5.6%)
Genital-urinary/Dysuria	2.8% (2.1%, 3.8%)
Eye	1.3% (0.8%, 2.1%)
Bite	1.2% (0.7%, 2.0%)
Burn	1.0% (0.4%, 2.2%)
Oral	0.9% (0.4%, 1.9%)

\*Results are presented as weighted proportions with its 95% confidence intervals.



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Patient age (years)

## Data Supplement S1

Pain-related ED visits included any visit with a Reason for Visit code that was “definitively painful” or “probably painful”.

Pain-related ED visits with painful chief complaint included any visit with a Reason for Visit code that was “definitively painful”.

### *Definitively painful Reason for Visit codes (SYMPTOMS)*

- **1050.0** Chest pain and related symptoms
  - 1050.1 Chest pain, soreness (excludes: heart pain, 1265.0)
  - 1050.2 Chest discomfort, pressure, tightness, heaviness (includes C – pressure)
  - 1050.3 Burning sensation in the chest
- **1055.0** Pain, specified site not referable to a specific body system (includes: Buttock pain, Gluteal pain, Perineal pain; excludes: abdominal pain [1545.1-1545.3], chest pain [1050.1], phantom leg/limb [2307.0])
  - 1055.1 Rib pain
  - 1055.2 Side pain, flank pain
  - 1055.3 Groin pain (includes: Pubic pain)
  - 1055.4 Facial pain (includes: Jaw pain, Pain over eye)
- **1060.0** Pain and related symptoms, NEC
  - 1060.1 Pain, unspecified (includes: Ache all over [generalized], Incisions [postopcode 4205.0 also])
  - 1060.2 Cramps, spasms, site unspecified (excludes: Menstrual cramps [1745.2])
  - 1060.3 Stiffness, site unspecified
- **1355.0** Earache, or ear infection
  - 1355.1 Earache, pain
  - 1355.2 Ear infection
- **1545.0** Stomach and abdominal pain, cramps and spasms (includes: gastric pain; excludes: groin pain [1055.3])
  - 1545.1 Abdominal pain, cramps, spasms, NOS (includes: Abdominal discomfort, NO, Gas pains, intestinal colic)
  - 1545.2 Lower abdominal pain, cramps, spasms (includes: Right lower quadrant [RLQ] pain, Left lower quadrant [LLQ] pain, inguinal pain)
  - 1545.3 Upper abdominal pain, cramps, spasms (includes: Epigastric pain, Left upper quadrant (LUQ) pain, Pain in umbilical region, Right upper quadrant (RUQ) pain).
- **1210.0** Headache, pain in head (includes: Post-traumatic [also code 5575.0]; excludes: migraine [2365.0], sinus headache [1410.1], symptoms of head, NEC [1207.0])
- **1265.0** Heart pain (includes: Anginal pain, heart distress, pain over heart; excludes: angina pectoris [2515.0], chest pain [1050.1])
- **1320.1** Eye pain (includes: irritation)
- **1320.3** Eye burning, stinging
- **1410.1** Sinus pain and pressure (includes: Sinus headache)
- **1455.1** Soreness (Includes: Throat hurts)
- **1455.2** Pain (burning, throat on fire)

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- **1485.1** Lung pain
  - **1500.1** Toothache
  - **1500.2** Gum pain
  - **1510.1** Pain, burning, soreness (1510.0 is symptoms referable to mouth)
  - **1515.1** Pain (1515.0 is symptoms referable to tongue)
  - **1605.1** Pain (includes: burning, irritation) (1605.0 is symptoms referable to anus-rectum)
  - **1610.1** Pain (1610.0 is symptoms of liver, gallbladder, and biliary tract)
  - **1650.0** Painful urination (includes: Burning, discomfort)
  - **1665.1** Pain (1665.0 is symptoms of bladder)
  - **1670.1** Pain (1670.0 is symptoms of the kidneys)
  - **1700.1** Pain, aching, soreness, tenderness, painful erection (1700.0 is symptoms of penis)
  - **1715.1** Pain, aching, tenderness (1715.0 is symptoms of the scrotum and testes)
  - **1745.2** Painful menstruation (dysmenorrhea) (includes: Menstrual cramps, pain in legs and back during menstruation) (1745.0 is menstrual symptoms, other and unspecified)
  - **1765.1** Pain (1765.0 is other vaginal symptoms)
  - **1775.1** Pain (1775.0 is pelvic symptoms)
  - **1790.1** Pain during pregnancy
  - **1800.0** Pain or soreness of breast (includes: Tenderness)
  - **1870.1** Pain (1870.0 is skin irritations, NEC)
  - **1900.1** Neck symptoms (includes: pain, ache, soreness, discomfort)
  - **1905.1** Back symptoms (includes: pain, ache, soreness, discomfort)
  - **1910.1** Low back symptoms (includes: pain, ache, soreness, discomfort)
  - **1915.1** Hip symptoms (includes: pain, ache, soreness, discomfort)
  - **1920.1** Leg symptoms (includes: pain, ache, soreness, discomfort)
  - **1925.1** Knee symptoms (includes: pain, ache, soreness, discomfort)
  - **1930.1** Ankle symptoms (includes: pain, ache, soreness, discomfort)
  - **1935.1** Foot and toe symptoms (includes: pain, ache, soreness, discomfort)
  - **1940.1** Shoulder symptoms (includes: pain, ache, soreness, discomfort)
  - **1945.1** Arm symptoms (includes: pain, ache, soreness, discomfort)
  - **1950.1** Elbow symptoms (includes: pain, ache, soreness, discomfort)
  - **1955.1** Wrist symptoms (includes: pain, ache, soreness, discomfort)
  - **1960.1** Hand and finger symptoms (includes: pain, ache, soreness, discomfort)
  - **1965.1** Symptoms of unspecified muscles (includes: pain, ache, soreness, discomfort)
  - **1970.1** Symptoms of unspecified joints (includes: pain, ache, soreness, discomfort)
  - **1975.1** Bowlegged, knock-kneed (1975.0 is Musculoskeletal deformities)
  - **1980.1** Other musculoskeletal symptoms (includes: bone pain, stump pain)

*Definitively painful Reason for Visit codes (CONDITIONS)*

- **2010.0** Streptococcal infection (includes: Streptococcal tonsillitis, Scarlet fever)
- **2365.0** Migraine headache
- **2655.0** Appendicitis, all types
- **4521.0** Major surgery
- **5005.0** Fractures and dislocations, Head and face (includes: facial bones, jaw, nose, skull)
- **5010.0** Fracture and dislocation, Spinal column (includes: back, neck, vertebrae)

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- 4 • **5015.0** Fractures and dislocations, Trunk area except spinal column (includes: clavicle, collarbone, pelvic scapula, rib)
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- 6 • **5020.0** Fractures and dislocations, Leg (includes: femur, fibula, hip, knee, tibia)
- 7 • **5025.0** Fractures and dislocations, Ankle
- 8 • **5030.0** Fractures and dislocations, Foot and toes
- 9 • **5035.0** Fractures and dislocations, Arm (includes: elbow, humerus, radius, shoulder, ulna)
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- 11 • **5040.0** Fractures and dislocations, Wrist
- 12 • **5045.0** Fractures and dislocations, Hand and fingers
- 13 • **5050.0** Fractures and dislocations, Fracture, other and unspecified
- 14 • **5105.0** Sprains and strains, Cervical spine, neck (includes: whiplash)
- 15 • **5110.0** Sprains and strains, Back
- 16 • **5115.0** Sprains and strains, Knee
- 17 • **5120.0** Sprains and strains, Ankle
- 18 • **5125.0** Sprains and strains, Wrist
- 19 • **5130.0** Sprains and strains, other and unspecified
- 20 • **5205.0** Lacerations and cuts, Head and neck area (excludes: face [5210.0])
- 21 • **5210.0** Lacerations and cuts, Facial area (includes: eye, ear, forehead, lip, nose)
- 22 • **5215.0** Lacerations and cuts, Trunk area (includes: perineum)
- 23 • **5220.0** Lacerations and cuts, Lower extremity (includes: ankle, foot)
- 24 • **5225.0** Lacerations and cuts, Upper extremity (includes: arm, fingers, hand, wrist)
- 25 • **5230.0** Lacerations and cuts, site unspecified
- 26 • **5305.0** Puncture wounds, Head, neck, and facial area
- 27 • **5310.0** Puncture wounds, Trunk area
- 28 • **5315.0** Puncture wounds, Lower extremity
- 29 • **5320.0** Puncture wounds, Upper extremity
- 30 • **5325.0** Puncture wounds, site unspecified (includes: Needlestick, NOS)
- 31 • **5405.0** Contusions, abrasions, and bruises, Head, neck, and face (excludes: Eye [5410.0])
- 32 • **5410.0** Contusions, abrasions, and bruises, Eye (includes: black eye, contusion, corneal abrasion)
- 33 • **5415.0** Contusions, abrasions, and bruises, Trunk area (includes: injury to scrotum)
- 34 • **5420.0** Contusions, abrasions, and bruises, Lower extremity
- 35 • **5425.0** Contusions, abrasions, and bruises, Upper extremity
- 36 • **5430.0** Contusions, abrasions, and bruises, site unspecified
- 37 • **5505.0** Injury, other, and unspecified type, Head, neck, and face (includes: post concussive syndrome, tooth fracture, tooth knocked out, traumatic brain injury; excludes: Loose tooth [no injury] 1500.0)
- 38 • **5510.0** Injury, other, and unspecified type, Eye
- 39 • **5515.0** Injury, other, and unspecified type, Back (includes: Tail bone)
- 40 • **5520.0** Injury, other, and unspecified type, Chest and abdomen (includes: Internal injuries)
- 41 • **5525.0** Injury, other, and unspecified type, Hip
- 42 • **5535.0** Injury, other, and unspecified type, Knee
- 43 • **5530.0** Injury, other, and unspecified type, Leg
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- **5540.0** Injury, other, and unspecified type, Ankle
  - **5545.0** Injury, other, and unspecified type, Foot and toe(s)
  - **5550.0** Injury, other, and unspecified type, Shoulder
  - **5555.0** Injury, other, and unspecified type, Arm
  - **5560.0** Injury, other, and unspecified type, Elbow
  - **5565.0** Injury, other, and unspecified type, Wrist
  - **5570.0** Injury, other, and unspecified type, Hand and finger(s)
  - **5575.0** Injury, multiple or unspecified (includes: post traumatic NOS headache)
  - **5705.0** Burns, all degrees, Head, neck, and face (includes: eyes)
  - **5710.0** Burns, all degrees, Trunk area
  - **5715.0** Burns, all degrees, Extremities (includes: lower, upper)
  - **5720.0** Burns, all degrees, Burn site unspecified
  - **5760.0** Bites, animal, snake, human

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3 *Probably painful Reason for Visit codes (SYMPTOMS)*

- 4 • **1220.3** Disturbances of sensation, Abnormal sensation (paresthesia) (includes: burning
- 5 legs, burning, tingling sensation, needles and pins, prickly feeling, stinging)
- 6 • **1430.0** Breathing problems (includes: Hurts to breath)
- 7 • **1791.0** Postpartum problems (includes: bleeding, pain; excludes: postpartum
- 8 examination, routine)
- 9 • **2675.5** Temporomandibular joint (TMJ) pain, temporomandibular joint (TMJ) syndrome
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13 *Probably painful Reason for Visit codes (CONDITIONS)*

- 14 • **1840.0** Infections of skin, NOS (includes: draining wounds, infected blister, infected
- 15 wound; excludes: athlete's foot [2025.0], wound drainage [as treatment])
  - 16 ○ **1840.1** Infection of skin of head or neck area
  - 17 ○ **1840.2** Infection of skin of arm, hand, or finger
  - 18 ○ **1840.3** Infection of skin of leg, foot, or toe
- 19 • **1240.0** Other symptoms referable to the nervous system (includes: brain lesion,
- 20 confusion, cognitive decline, damaged nerves, neuralgia, neurovegetative, pinched nerve,
- 21 postictal; excludes: nerve block 4560.0)
- 22 • **1825.0** Symptoms of sexual dysfunction (includes: dyspareunia, painful intercourse;
- 23 excludes: psychological disorders)
- 24 • **2250.0** Anemia (includes: anemia, NOS, iron deficiency anemia, pernicious anemia,
- 25 sickle cell anemia)
- 26 • **2450.0** Otitis media
- 27 • **2515.0** Ischemic heart disease (includes: angina pectoris, arteriosclerotic cardiovascular
- 28 disease, arteriosclerotic heart disease, coronary, coronary heart disease, heart attack,
- 29 ischemic cardiomyopathy, myocardial infarction)
- 30 • **2600.0** Upper respiratory infections except tonsillitis (includes: croup, laryngitis,
- 31 pharyngitis, rhinitis, sinusitis; excludes: allergic rhinitis [2636.0], cold [1445.0], nose
- 32 infection NOS [1405.3], sinus infection NOS [1410.2], throat infection NOS [1455.3])
- 33 • **2605.0** Tonsillitis
- 34 • **2650.0** Diseases of the esophagus, stomach, and duodenum (includes: Barrett's
- 35 esophagus, duodenal ulcer, esophageal ulcer, esophagitis, gastritis, GERD, peptic ulcer,
- 36 reflux, stomach ulcer; excludes: gastroenteritis [2005.0], stomach flu [1540.0])
- 37 • **2665.0** Diseases of the intestine and peritoneum (includes: abscess rectal, adhesions
- 38 [abdominal or NOS; if states post-op, code 42050 also], Crohn's disease, diverticulitis,
- 39 diverticulosis, fissure – rectal and anal, fistula – rectal and anal, ileitis, irritable bowel
- 40 syndrome, proctitis, small bowel obstruction, spastic colitis, ulcerative colitis; excludes:
- 41 intestinal virus [1540.0])
- 42 • **2675.1** Dental abscess
- 43 • **2675.2** Dental cavities
- 44 • **2705.0** Urinary tract disease except cystitis (includes: bladder stones, glomerulonephritis,
- 45 glomerulonephrosis, kidney cyst, kidney stones, neurogenic bladder, pyelonephritis, renal
- 46 failure, ureteral calculus, urethritis, urolithiasis; excludes: bladder infection [1665.2],
- 47 kidney infection NOS [1670.2], passed stones [1680.0], urinary tract infection [1675.0])
- 48 • **2900.0** Arthritis (includes: osteoarthritis, rheumatism NOS, rheumatoid arthritis, septic)
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- 4 • **2905.0** Nonarticular rheumatism (includes: bursitis, ganglion cyst, lumbago, myositis, polymyalgia theumatica, radiculitis/radiculopathy, synovitis, tendinitis, tenosynovitis; excludes: rheumatism NOS [2900.0])
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- 7 • **4520.0** Minor surgery
- 8 • **4540.0** Cast, splint – application, removal
- 9 • **5920.0** Adverse effects of environment (includes: air pollution, frostbite, hypothermia, noise pollution, sun damage, sun poisoning, too hot, water pollution)
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- 11 • **5930.0** Complications of surgical or medical procedures and treatments (includes: artificial openings [ostomies, stoma], catheter, foreign body [accidentally left during surgery eg. Sponge, instrument], medical complication NOS, non-healing surgical wound, post-op fever, post-op hemorrhage [bleeding], post-op infection or inflammation, post-op [septicemia], shunt, tubes, wound dehiscence; excludes: postpartum conditions [1791.0 and 1810.2], complication of transplant organs [4565.1-4565.2])
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- 18 • **5805.0** Motor vehicle accident, type of injury unspecified (includes: auto accident, car accident, motorcycle accident)
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- 21 • **5810.0** Accident NOS (includes: fall, type or location of injury unspecified)
- 22 • **5815.0** Violence NOS (includes: abuse, beat up, in a fight, stabbing; excludes: violence against oneself [5818.0, 5820.0])
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- 24 • **5818.0** Intentional self-mutilation (includes: self-abuse, tried to hurt self; excludes: suicide attempt [5820.0])
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- 26 • **5820.0** Suicide attempt (includes: found in car with motor running, hanging oneself, slashed wrists, stabbed oneself).
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## Data Supplement S2

### Codes by body system:

#### Musculoskeletal

- 1900 Neck symptoms
- 1905 Back symptoms
- 1910 Low back symptoms
- 1915 Hip symptoms
- 1920 Leg symptoms
- 1925 Knee symptoms
- 1930 Ankle symptoms
- 1940 Shoulder symptoms
- 1945 Arm symptoms
- 1950 Elbow symptoms
- 1955 Wrist symptoms
- 1960 Hand and finger symptoms (includes ring stuck on finger)
- 5005 Fractures and dislocations, Head and face
- 5020 Fractures and dislocations, Leg
- 5035 Fractures and dislocations, Arm
- 5045 Fractures and dislocations, Hand and Fingers
- 5050 Fractures and dislocations, other and unspecified
- 5105 Sprains and strains, Cervical spine, neck
- 5115 Sprains and strains, Knee
- 5120 Sprains and strains, Ankle
- 5405 Contusions, abrasions, and bruises, Head, neck, and face
- 5415 Contusions, abrasions, and bruises, Trunk area
- 5420 Contusions, abrasions, and bruises, Lower extremity
- 5425 Contusions, abrasions, and bruises, Upper extremity
- 5505 Injury, other and unspecified type, Head, neck, and face
- 5515 Injury, other and unspecified type, Back
- 5520 Injury, other and unspecified type, Chest and abdomen (includes internal injuries)
- 5530 Injury, other and unspecified type, Leg
- 5535 Injury, other and unspecified type, Knee
- 5540 Injury, other and unspecified type, Ankle
- 5545 Injury, other and unspecified type, Foot and toe(s)
- 5550 Injury, other and unspecified type, Shoulder
- 5555 Injury, other and unspecified type, Arm
- 5560 Injury, other and unspecified type, Elbow
- 5565 Injury, other and unspecified type, Wrist
- 5570 Injury, multiple or unspecified (includes post-traumatic NOS headache)

#### ENT

- 1355 Earache, or ear infection
- 1410 Sinus problems
- 1455 Symptoms referable to throat, raw throat



- 2010 Streptococcal infection

### Abdominal

- 1545 Stomach and abdominal pain, cramps and spasms

### Laceration

- 5205 Lacerations and cuts, Head and neck area
- 5210 Lacerations and cuts, Facial area
- 5215 Lacerations and cuts, Trunk area
- 5220 Lacerations and cuts, Lower extremity
- 5225 Lacerations and cuts, Upper extremity
- 5230 Laceration and cuts, site unspecified
- 5305 Puncture wounds, Head, neck and facial area
- 5315 Puncture wounds, Trunk area
- 5315 Puncture wounds, Lower extremity
- 5320 Puncture wounds, Upper extremity
- 5325 Puncture wound, site unspecified

### Headache

- 1210 Headache, pain in head
- 2365 Migraine headache

### General Pain

- 1800 Pain or soreness of breast
- 1055 Pain specified site not referable to a specific body system
- 1060 Pain and related symptoms, NEC
- 5430 Contusions, abrasions, and bruises, site unspecified
- 5575 Injury, multiple or unspecified
- 5130 Sprain or strain, other and unspecified
- 1970 Symptoms of unspecified joints
- 1965 Wrist symptoms

### Chest

- 1050 Chest pain and related symptoms (not referable to a specific body system)

### Eye

- 1320 Abnormal sensations of the eye
- 5510 Injury, other and unspecified type, Eye

### Bite

- 5760 Bites, Animal, snake, human

### Genitourinary

- 1650 Painful urination
- 1605 Symptoms referable to anus-rectum

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- 1700 Symptoms of penis
  - 1715 Symptoms of scrotum and testes
  - 1745 Menstrual symptoms, other and unspecified
  - 1765 Other vaginal symptoms
  - 1775 Pelvic symptoms
  - 1790 Problems of pregnancy

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### Burn

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- 5705 Burns, all degrees, Head, neck, and face
  - 5715 Burns, all degrees, Extremities
  - 5720 Burn, site unspecified

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### Oral

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- 1500 Symptoms of teeth and gums
  - 1510 Symptoms referable to mouth

Peer review only

**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

Section/Topic	Item #	Recommendation	Reported on page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7, 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7, 8
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8, 9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	-
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
<b>Results</b>			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 10
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	10
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10, 11
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11, 12, 13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Epidemiology of pediatric pain-related visits to emergency departments in the United States: a cross-sectional study

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3 **Epidemiology of pediatric pain-related visits to emergency departments in the United**  
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5 **States: a cross-sectional study**  
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10 **Authors**

11 Jana L. Anderson<sup>1</sup> MD, Lucas Oliveira J. e Silva<sup>1</sup> MD, Shealeigh A. Funni<sup>2</sup>, Fernanda Bellolio<sup>1,2</sup>  
12  
13 MD MS, Molly M. Jeffery<sup>1,2</sup> PhD.  
14  
15

16  
17  
18  
19 **Author Affiliations**

20  
21 <sup>1</sup>Department of Emergency Medicine, Mayo Clinic, Rochester, Minnesota, USA;

22  
23 <sup>2</sup>Department of Health Sciences Research, Mayo Clinic, Rochester, Minnesota, USA.  
24  
25

26  
27  
28 **Corresponding Author**

29  
30 Jana L. Anderson, MD

31  
32 Department of Emergency Medicine

33  
34 Mayo Clinic

35  
36 Phone: 507-255-5388, Email: Anderson.Jana@mayo.edu  
37  
38

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## ABSTRACT

**Objective:** To describe the epidemiology of pediatric pain-related visits to emergency departments (EDs) across the United States (US).

**Design:** Cross-sectional study.

**Setting:** A representative sample of US ED visits using data from the National Hospital Ambulatory Medical Care Survey (NHAMCS).

**Participants:** Pediatric (age  $\leq 18$  years) ED visits in the 2017 NHAMCS dataset.

**Data analysis:** Each visit was coded as pain- or non-pain-related using the “reason for visit” variable. Weighted proportions were calculated with 95% confidence intervals (CI). Logistic regression was used to compare odds of pain-related visits.

**Outcome measures:** Prevalence of pain-related visits among pediatric ED visits.

**Results:** There were an estimated 35 million pediatric ED visits in the US in 2017, 55.6% (CI 53.3% to 57.8%) were pain related, which equates to 19.7 million annual visits. The prevalence of pain-related visits reached more than 50% of visits at age 6 to 7 and plateaued at relatively high proportions. Children of races other than white or Black had lower odds of having a pain-related visit (odds ratio [OR] 0.48, CI 0.29 to 0.81) than white children, as did children who were Black, though the difference was not statistically significant (OR 0.88, CI 0.73 to 1.06). Relative to children covered by private insurance, children with Medicaid or CHIP coverage had lower odds of a pain-related visit (OR 0.75, CI 0.60 to 0.93). Injuries represented 46.5% (CI 42.0% to 51.0%) of pain-related visits. Pain scores were reported in less than 50% of pain-related visits.

**Conclusion:** Pain is the reason for visit in 55.6% of pediatric ED visits across the US. The prevalence of pain-related visits peak before adolescence and it continues relatively high until



1  
2  
3 the age 18. Injury, racial disparities in pain, and poor pain score reporting should remain major  
4  
5 topics of study in the pediatric population.  
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7 Keywords: Prevalence, Acute Pain, Pediatrics, Emergency Departments.  
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## ARTICLE SUMMARY

### Strengths and limitations of this study

- This study used data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), which uses a multistage probability design to achieve a representative sample of Emergency Department visits in the United States.
- We have used up to five “reason for visit” variables to define the painful nature of visits and to identify pain-related visits.
- Tracking use among individual patients is not possible in the NHAMCS dataset.
- The National Center for Health Statistics standardizes data collection and processing, however some inconsistencies may remain across different participating Emergency Departments.

## INTRODUCTION

Acute pain is known to be one of the most frequent reasons for visiting the Emergency Department (ED).[1] Given that pain is a driving factor for the majority of visits, it is important to understand the epidemiology of the disease. There is little up-to-date information on pediatric ED visits for acute pain, as the majority of acute pain ED epidemiology studies have excluded children, were limited to one institution, or are now outdated.[2–5]

One of the first pediatric pain ED epidemiology studies was performed in Canada in 1996.[3] This study utilized pain scale responses rather than chief complaint to define a pain-related visit. The definition based on pain scale, which is inherently subjective, is fraught with unreliability and difficulty with validity in younger children with immature verbal response. Also, some limitations of this study were its short time period of enrollment and the limited setting including only two hospitals and excluding the critical area of the ED. In 2000, the first ED pain study with consecutive enrollment was published.[4] This study was performed at a single large urban center and utilized chief complaint to identify a pain visit. Children were not the focus of this study, but children less than 5 years of age did comprise 14% of the study population. The first pediatric national level epidemiology study on acute pain in United States (US) EDs was performed using data from 1997 to 2000.[5] This study utilized the National Hospital Ambulatory Medical Care Survey (NHAMCS) database and it used the “reason for visit” variable to define a pain-related visit. As the last US-based national study on the prevalence of pain-related visits, this data is outdated by two decades. It is unclear if pain remains a major driver of ED visits in the pediatric population.

Our goal in this study was to examine the current prevalence of pain-related visits among children presenting to EDs in the US. This information will help to build foundational

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3 knowledge about the dimension of this clinically important condition and to focus future  
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5 preventative, home and ED therapy to hopefully decrease the incidence of pain. In addition, this  
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7 study will provide a background for trends in pediatric pain prevalence looking towards the  
8  
9 utilization and optimization of analgesics.  
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## 14 **METHODS**

### 15 **Study design, setting, and participants**

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19 This was a cross-sectional study of all children (age  $\leq 18$  years) in the 2017 National  
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21 Hospital Ambulatory Medical Care Survey (NHAMCS), which was released in November of  
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23 2019, the latest available at the start of this study. This de-identified data is publicly available  
24  
25 from the National Center for Health Statistics (NCHS) and provides a representative sample of  
26  
27 ED visits throughout the US.[6] We followed the STrengthening the Reporting of OBServational  
28  
29 studies in Epidemiology (STROBE) guidelines for reporting observational studies.[7]  
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### 35 **Ethics approval**

36  
37 NHAMCS is approved by the Ethics Review Board of the National Center for Health  
38  
39 Statistics (NCHS), a division of the Center for Disease Control and Prevention (CDC).[6]  
40  
41 Because this study used pre-existing, de-identified data, the Institutional Review Board deemed  
42  
43 this study exempt.  
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### 49 **Data source**

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51 The NHAMCS ED data set has been collected yearly since 1992 to describe US ED visits  
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53 and utilization.[8] NHAMCS utilizes extensive surveys in randomly selected sampling units, that  
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3 are then weighted to make national visit-level estimates. The sampling of Emergency Service  
4 Areas (ESAs) allows for inclusion of both academic and non-academic institutions.[8] In the  
5  
6 2017 NHAMCS dataset, a total of 479 hospitals were selected of which 374 were in scope and  
7  
8 had eligible EDs. Of these, 234 responded, yielding an unweighted ED response rate of 62.6%.  
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10 This corresponded to a total of 331 ESAs that were identified from the EDs. Of these, 240  
11  
12 responded fully or adequately by providing forms for at least one-half of their expected visits  
13  
14 based on the total number of visits during the reporting period. In all, 16,709 patient record  
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16 forms (PRFs) were submitted electronically. The resulting unweighted ESA sample response rate  
17  
18 was 72.5%, and the overall unweighted two-stage sampling response rate was 45.4% (48.4%  
19  
20 weighted). The surveys, called PRFs, are obtained by trained individuals from the U.S. Census  
21  
22 Bureau. Each ESA is surveyed over a randomly selected 4-week period that rotates each survey  
23  
24 year. Subsequently, these surveys are then weighted using population statistics to estimate visits  
25  
26 on a national level.  
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### 35 **Variables and measurements**

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37 Data was collected through a PRF which can be viewed on the NCHS website.[9] The  
38  
39 PRF lists up to five “reasons for visit” (RFV), including the first-listed RFV (i.e., chief  
40  
41 complaint) and up to four additional symptoms, problems, or issues. We used these five RFV  
42  
43 variables to initially categorize visits as pain- or non-pain-related.  
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47 Codes related to pain were identified by two methods: 1) “pain” keywords and 2) by  
48  
49 physician consensus. First, all RFV codes that contained symptom keywords such as “pain”,  
50  
51 “burn”, “stinging”, “soreness”, “ache” or “algia” were classified as “definitely painful”. Second,  
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53 to classify conditions that did not contain the previously mentioned keywords, two independent  
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3 physicians, one board-certified in emergency and one board-certified in pediatric emergency  
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5 medicine, reviewed all of the codes for conditions and classified them as “definitely painful”,  
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7 “probably painful”, or non-painful. Any disagreements were settled with discussion and  
8  
9 consensus. The full list of codes considered as “definitely painful” or “probably painful” is  
10  
11 detailed in Data Supplement S1 (Supplementary Material).  
12  
13

14  
15 Pain-related ED visits were defined as any visit with at least one pain-related RFV code  
16  
17 (not necessarily the first-listed RFV code), including those either categorized as “definitely  
18  
19 painful” or “probably painful”. Pain-related ED visits with a painful chief complaint was defined  
20  
21 as any visit in which the first-listed RFV code was a “definitely painful” condition. This included  
22  
23 only those “definitely painful” conditions or symptoms present at the first-listed RFV, which is  
24  
25 the chief complaint of the visit. Pain-related ED visits with injury was defined by the variable  
26  
27 “Injury” in the PRF. NHAMCS classifies injury visits as those involving injury, trauma,  
28  
29 overdose, poisoning, or adverse effects of medical treatments. The original dataset does not  
30  
31 allow to separate these three categories but rather classifies them under the same umbrella of the  
32  
33 “Injury” variable. Visits in which a “definitely painful” or “probably painful” code was present  
34  
35 and the variable “Injury” was present were considered to be pain-related ED visits with injury.  
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40 For pain-related ED visits with a painful chief complaint, we categorized the first-listed  
41  
42 RFV code (i.e., chief complaint) by body systems including musculoskeletal, abdominal,  
43  
44 ear/nose/throat, laceration, headache, general pain, chest, genital-urinary/dysuria, eye, bite, oral,  
45  
46 and burn related complaints. The full list of codes and categorization is detailed in Data  
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48 Supplement S2 (Supplementary Material).  
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## 51 52 53 54 **Data analysis** 55 56 57 58 59 60

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3 Analysis was completed using the *svy* suite of tools in Stata version 15, which considers  
4 the sampling design of the NHAMCS survey to accurately calculate nationally weighted  
5 estimates and their variability (StataCorp LLC, 2017). The total number of pediatric visits, both  
6 pain- and non-pain-related, was estimated. Descriptive statistics were calculated for age, sex,  
7 ethnicity, race, geographic region, arrival by emergency medical services (EMS), primary payer  
8 source, immediacy of visit, injury involvement, and pain scale rating. For the variables age, sex,  
9 ethnicity, and race we used imputed values provided by NHAMCS to reduce the effect of  
10 missingness on our results. Children were grouped by age into three developmental stages: age <  
11 6, age 6 to 11, and age 12 to 18 years. Proportions of trauma involvement among pain-related  
12 visits and categorization by body system involved among pain-related visits were also calculated.  
13 Weighted proportions were calculated with 95% confidence intervals (CI). Characteristics  
14 between pain- and non-pain-related visits were compared using t-tests to compare proportions for  
15 each baseline characteristic.  
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33 Odds ratios (OR) and 95% CI were produced from a multivariable analysis using logistic  
34 regression to identify factors associated with pain-related visits. The same variables previously  
35 described were included as covariates in the model  
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### 43 **Patient and public involvement**

44 Patients and/or public were not involved in this study.  
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## 49 **RESULTS**

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51 We analyzed all 4,112 pediatric ED visits in the 2017 NHAMCS dataset, which  
52 represents an estimated 35 million visits during the study period. Across all pediatric ED visits  
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3 (pain- and non-pain-related visits), 44.5% of the children were younger than 6 years of age,  
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5 24.1% aged 6 to 11 years, and 31.5% aged 12 to 18 years. The cohort was 48.5% female. White  
6  
7 children made up 67.7% of the study population, followed by Black children at 28.2%. Hispanic  
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9 or Latino ethnicity comprised 25.5% of the cohort. Arrival by ambulance occurred in 5.0% (95%  
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11 CI, 4.0% to 6.1%) of all pediatric ED visits. (Data Supplement S3)  
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14  
15 The prevalence of pain-related ED visits was 55.6% (95% CI, 53.3% to 57.8%),  
16  
17 representing a population estimate of 19.7 million ED visits for pediatric pain. Among all pain-  
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19 related ED visits, 68.8% (95% CI, 65.9% to 71.6%) had a painful chief complaint. When we  
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21 plotted the proportion of pain-related ED visits by age, there was a steady increase till the age of  
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23 7 and it then plateaued at relatively high proportions, ranging from a minimum of 66.7% (age 16)  
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25 to a maximum of 79.0% (age 12). The pattern remained the same when different definitions of  
26  
27 pain-related visits were used. (Figure 1)  
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31 Baseline characteristics between pain-related ED visits and non-pain-related ED visits  
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33 were generally similar, except for race (non-pain-related visits had a higher proportion of white  
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35 children than pain-related visits at 70.9% vs. 63.8%,  $p = 0.001$ ), insurance (pain-related visits  
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37 had a higher proportion of children with private insurance than non-pain-related visits at 26.0%  
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39 vs. 18.3%,  $p < 0.001$ ), and triage (children triaged as non-urgent were more likely to have a non-  
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41 pain-related visit at 10.1% vs. 4.5%,  $p < 0.001$ ). Black children represented similar proportions  
42  
43 of pain- and non-pain-related visits, but pain-related visits had higher proportions of children  
44  
45 with races other than Black and white than non-pain-related visits (5.9% vs. 2.6%,  $p = 0.001$ ).  
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47 There were no significant differences by ethnicity for pain- and non-pain-related visits. There  
48  
49 were no significant differences by sex. As for pain scale reporting among pain-related visits, less  
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51 than 50% had pain score available (14.8% with a score 0 to 4, and 29.3% with a score 5 to 10).  
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3 (Table 1). The same descriptive analysis of baseline characteristics was also performed by  
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5 comparing visits with “definitely painful” codes to non-painful visits. (Data Supplement S4)  
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8 In the multivariable analysis, older age groups (6 to 11 and 12 to 18 years) were  
9  
10 significantly more likely to have a pain-related ED visit than the group aged < 6 years (Table 2)  
11  
12 Race was also found to be an important factor associated with pain-related visits. After adjusting  
13  
14 for age and other baseline characteristics, children with races other than Black and white were  
15  
16 less likely than white children to have a pain-related ED visit (adjusted OR 0.48, 95% CI 0.29 to  
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18 0.81,  $p = 0.006$ ). Children with Medicaid were less likely to have a pain-related ED visit than  
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20 children with private insurance (adjusted OR 0.76, 95% CI 0.60 to 0.93,  $p = 0.008$ ). (Table 2)  
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23

24 Injury was reported in 46.5% (95% CI, 42.0% to 51.0%), or an estimated 9.2 million of  
25  
26 the pain-related visits. There were an estimated 1.3 million, or 2.5% of visits with unknown  
27  
28 injury involvement.  
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31 Among the estimated 13.6 million pain-related ED visits with a painful chief complaint,  
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33 the body systems most frequently involved were musculoskeletal at 39.9% (95% CI 34.6% to  
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35 45.6%), followed by abdominal at 16.0% (95% CI 11.9% to 21.1%) and ear/nose/throat at 14.8%  
36  
37 (95% CI 12.1% to 18.0%). In pain-related ED visits without injury, the most common body  
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39 system involved was abdominal at 32.0% (95% CI, 25.5% to 39.3%), followed by  
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41 ear/nose/throat at 31.0% (95% CI, 23.1% to 40.2%), and headache at 8.8% (95% CI, 6.6% to  
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43 11.8%). (Data Supplement S5)  
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## 49 **DISCUSSION**

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51 In this cross-sectional study, we found that 55.6% of all US ED pediatric visits were  
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53 related to pain. This equates to 19.7 million yearly visits to EDs across the US for pediatric pain.  
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3 The prevalence of pain-related visits in children peaked as early as 7 years old and it then  
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5 plateaued at relatively high proportions. Race and payer type yielded important differences in the  
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7 likelihood of a pain-related ED visit. Children of races other than Black and white had  
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9 significantly more painful than non-painful visits, while white children had significantly more  
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11 non-painful than painful visits. However, when compared to white race, children of races other  
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13 than Black and white were less likely to have a pain-related visit in the multivariable analysis.  
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15 Also, children with Medicaid were less likely to have a pain-related visit than children with  
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17 private insurance. An injury was involved in just under half of pain-related ED visits in the  
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19 pediatric population. Lastly, recording of pain scores remains poor among painful visits.  
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24 Few NHAMCS studies have assessed the prevalence of pain-related ED visits in the  
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26 pediatric population. In a study looking at pediatric ED visits from the NHAMCS 1997-2000  
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28 survey dataset, Drendel et al reported that 51.7% of all pediatric ED visits had a painful reason  
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30 for visit, with an approximated estimate of 10.3 million visits for pain during the 4-year study  
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32 period.[5] The prevalence of painful ED visits has remained relatively stable (now 55.6%), but  
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34 the total number of painful pediatric ED visits has grown substantially, now reaching an  
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36 estimated 19.7 million during a 1-year period. Also, these data indicate that acute pain remains  
37  
38 highly prevalent among the several reasons for which children present to the ED. This pattern is  
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40 similar to the adult literature, where pain-related ED visits remained consistently high between  
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42 42% to 45% of ED visits. [2,10]  
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47 Our study shows that the prevalence of pain-related ED visits significantly increases from  
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49 infancy till age 7, reaching a relatively high proportion that then remains similar throughout  
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51 childhood and adolescence. This is the first study to show that the proportion of pain-related ED  
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53 visits is similar for children from 7 to 12 years as to the typical adolescent, 13 to 18 years. This  
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3 data emphasizes the need for primary injury prevention in young children. The type and  
4 effectiveness of prevention interventions, however, will depend on factors such as child's age,  
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6 level of development, and household environment.[11]  
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10 As expected, injuries (which includes trauma in the NHAMCS definition) remains a  
11 major source of pain-related ED visits during childhood. Just under half of all pediatric pain-  
12 related ED visits involved an injury, once again emphasizing the importance of more prevention  
13 initiatives. These findings are similar to older studies using the NHAMCS dataset,[5] indicating  
14 little change in the proportion of pediatric pain-related ED visits due to injuries in the last 20  
15 years.  
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24 When comparing baseline characteristics between pain- and non-pain-related pediatric  
25 ED visits, there were significant differences in race. Pain-related visits had significantly higher  
26 proportions of children who were of races other than Black or white than non-pain-related visits.  
27 This category is comprised of American Indian or Alaskan native, Asian, Native Hawaiian or  
28 Other Pacific Islander. This group is small and comprises only 4% of the total study population,  
29 but is still important given their large difference in pain to non-pain visits. Studies on adults have  
30 shown that American Indian and Alaskan native populations do have a higher rate of pain  
31 symptoms and pain conditions compared to the general US population.[12] Also, Native  
32 American adolescents were noted to have the highest rate of all the race/ethnicity groups for any  
33 substance abuse and opioid abuse.[13] Despite having more painful than non-painful visits, this  
34 group was less likely to have a pain-related ED visit than the group of white children in the  
35 multivariable analysis. Nevertheless, studies have shown that minoritized groups are at  
36 particularly high risk of receiving inadequate pain treatment.[10,14,15] White children, for  
37 example, are more likely to receive opioid prescriptions than non-white children.[16] Given  
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3 these known disparities in pain management, the findings of our study should emphasize the  
4 importance of assessing and treating pain in minoritized children seen in the ED.  
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8 The pain scale was blank or unknown in more than half of pediatric pain-related ED  
9 visits. This is similar to the percentage of pain scores documented in the study by Drendel et al  
10 looking at 1997-2000 data from NHAMCS,[5] highlighting that pain score recording is poorly  
11 performed in children and has not improved over the last two decades. Further examination will  
12 be necessary to evaluate whether this missing data refers to poor reporting or to the difficulty of  
13 using structured pain scales in children, especially in younger groups with immature verbal  
14 response. The poor reporting of pain scores also occurs in adult populations.[17] For this reason,  
15 one may argue that the difficulty of using pain scales in children does not play a major role on  
16 the absence of these data in the NHAMCS surveys.  
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### 31 **LIMITATIONS**

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33 Our study had several limitations. First, the proportion of pain-related visits in the  
34 youngest children (age < 6 years) may be underestimated. This group is prone to  
35 misclassification due to their immature verbal response. Certain presentations such as fever or  
36 irritability, for example, may have been equivocally categorized as non-pain related even though  
37 these may represent pain-related visits. Second, our classification system for visits does not rely  
38 on the reported pain score. There are two main reasons behind this decision: (1) as previously  
39 noted, many children may be unable to respond to the standard pain score question, making it  
40 less useful for a large portion of our population; (2) the pain score field in NHAMCS has a large  
41 proportion of missing data. For these reasons, we used clinical knowledge to classify reasons for  
42 visits according to how painful they are likely to be. Because children classified as having  
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3 painful visits are nearly 5 times as likely to report a pain score of 6 or higher and 3.5 times as  
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5 likely to have a recorded pain score, we believe that the pain classification we created is  
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7 appropriate for use. Third, NHAMCS is a cross-sectional survey, and tracking use among  
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9 individual patients is not possible. Fourth, NHAMCS may include errors in documentation and  
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11 missing data. Although NCHS standardizes data collection and processing, some inconsistencies  
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13 may remain across different participating EDs. Lastly, this data may be only representative of US  
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15 pediatric ED visits.[8]  
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## 21 **CONCLUSIONS**

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24 This study provides the most current prevalence of pediatric pain-related visits to EDs  
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26 across the United States at 55.6%. The prevalence of pain-related visits peaks before the  
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28 adolescence and it persists relatively high. Younger children should receive as much attention to  
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30 injury and pain prevention as older children. Injuries, racial disparities, and poor pain score  
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32 reporting should remain major topics of research in the care of pediatric acute pain in the ED.  
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## 38 **CONTRIBUTIONS STATEMENT**

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40 Conceptualization: JLA, FB and MMJ. Formal analysis: SAF, MMJ. Investigation: JLA, LOJS,  
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42 FB, MMJ. Methodology: LOJS, FB, MMJ. Project administration: JLA. Supervision: MMJ.  
43  
44 Validation: FB MMJ. Writing-original draft: JLA. Writing-review and editing: JLA, LOJS, SAF,  
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46 FB, MMJ. Guarantor: JLA, MMJ. All authors provided critical revision and contribution for  
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48 important intellectual content.  
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3 **COMPETING INTERESTS**  
4

5 None.  
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8  
9 **FUNDING**  
10

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20 **PATIENT CONSENT FOR PUBLICATION**  
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22 Not applicable / Not required.  
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25 **DATA SHARING STATEMENT**  
26

27 The NHAMCS data are publicly available at  
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29 [https://www.cdc.gov/nchs/ahcd/datasets\\_documentation\\_related.htm](https://www.cdc.gov/nchs/ahcd/datasets_documentation_related.htm).  
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## LEGENDS

**Figure 1.** Percentage of pain-related visits by age using different definitions.

**Table 1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

**Table 2.** Multivariable logistic regression analysis of the association between baseline characteristics and the outcome of a pain-related visit.

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**Table 1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

	<b>Pain-related ED visit</b> 55.57%* (53.27%, 57.85%)	<b>Non-pain-related ED visit</b> 44.42%* (42.15%, 46.72%)	<b>P Value</b>
<b>Age</b>			
< 6 years	27.14% (23.13%, 31.55%)	66.16% (61.47%, 70.55%)	<0.001
6-11 years	31.58% (29.16%, 34.10%)	14.67% (12.71%, 16.88%)	<0.001
12-18 years	41.29% (36.14%, 46.63%)	19.17% (15.87%, 22.96%)	<0.001
<b>Sex</b>			
Female	48.88% (45.36%, 52.42%)	47.95% (45.19%, 50.72%)	0.732
Male	51.12% (47.58%, 54.64%)	52.05% (49.28%, 54.81%)	0.732
<b>Ethnicity</b>			
Hispanic or Latino	25.10% (18.09%, 33.71%)	25.93% (19.95%, 32.96%)	0.714
Not Hispanic or Latino	74.90% (66.29%, 81.91%)	74.07% (67.04%, 80.05%)	0.714
<b>Race</b>			
White	63.79% (57.54%, 69.61%)	70.86% (64.15%, 76.77%)	0.001
Black	30.27% (24.60%, 36.61%)	26.57% (20.89%, 33.15%)	0.07
Other	5.94% (4.32%, 8.11%)	2.56% (1.72%, 3.82%)	0.001
<b>Region</b>			
Northeast	12.92% (7.84%, 20.57%)	13.69% (8.00%, 22.46%)	0.592
Midwest	24.77% (17.79%, 33.39%)	24.63% (16.16%, 35.66%)	0.949
South	47.02% (35.34%, 59.04%)	43.15% (31.00%, 56.18%)	0.068
West	15.28% (9.21%, 24.30%)	18.53% (10.46%, 30.69%)	0.123
<b>Arrived in EMS</b>			
Yes	4.37% (3.27%, 5.83%)	5.67% (4.14%, 7.72%)	0.238
No	91.13% (84.59%, 95.06%)	89.76% (83.06%, 94.00%)	0.229
Unknown	3.90% (1.01%, 13.90%)	4.15% (1.10%, 14.47%)	0.412
Blank	0.59% (0.31%, 1.13%)	0.42% (0.19%, 0.93%)	0.546
<b>Triage (Immediacy)</b>			
Immediate	1.14% (0.29%, 4.36%) <sup>†</sup>	0.75% (0.27%, 2.06%) <sup>†</sup>	0.415
Emergent	6.00% (3.73%, 9.53%)	8.77% (5.19%, 14.44%)	0.02
Urgent	28.73% (22.63%, 35.72%)	23.87% (19.65%, 28.66%)	0.075
Semi-urgent	35.07% (28.70%, 42.02%)	31.73% (27.04%, 36.82%)	0.084
Non-urgent	4.52% (2.19%, 9.11%)	10.12% (6.66%, 15.08%)	<0.001
Unknown	24.53% (16.38%, 35.04%)	24.77% (17.01%, 34.59%)	0.891
<b>Primary Payer</b>			
Private insurance	26.05% (21.68%, 30.95%)	18.29% (14.21%, 23.22%)	<0.001
Medicare	0.35% (0.17%, 0.72%) <sup>†</sup>	0.38% (0.16%, 0.88%) <sup>†</sup>	0.865
Medicaid or CHIP	60.91% (55.13%, 66.39%)	65.80% (56.93%, 73.69%)	0.03
Self pay	4.49% (3.11%, 6.42%)	4.45% (2.92%, 6.72%)	0.961

Worker's compensation	0.03% (0.01%, 0.14%) <sup>†</sup>	0.01% (0.00%, 0.06%) <sup>†</sup>	0.382
No charge/charity	0.05% (0.01%, 0.40%) <sup>†</sup>	0.12% (0.03%, 0.54%) <sup>†</sup>	0.553
Other	1.36% (0.75%, 2.47%)	1.38% (0.72%, 2.65%)	0.963
Unknown	5.40% (2.31%, 12.12%)	7.73% (2.69%, 20.25%)	0.216
Blank	1.36% (0.47%, 3.92%)	1.85% (0.63%, 5.31%)	0.182
<b>Pain Scale</b>			
Blank/Unknown	55.91% (46.67%, 64.76%)	87.46% (83.17%, 90.78%)	<0.001
0-4 score	14.81% (11.08%, 19.52%)	6.44% (4.43%, 9.27%)	<0.001
5-10 score	29.28% (23.37%, 35.98%)	6.10% (4.15%, 8.86%)	<0.001

\*Results are presented as weighted proportions with its 95% confidence intervals.

<sup>†</sup>This represented cell sizes smaller than 30, which are considered not reliable for meaningful analysis by the NHAMCS guidelines.

**Table 2.** Multivariable logistic regression analysis of the association between baseline characteristics and the outcome of a pain-related visit.

<b>Table 2.</b>	<b>Adjusted odds ratio (OR), 95% confidence interval (CI)</b>	<b>P Value</b>
<b>Age</b>		
< 6 years	Reference	
6-11 years	5.21 (4.14 to 6.55)	<.001
12-18 years	5.25 (4.23 to 6.52)	<.001
<b>Sex</b>		
Female	Reference	
Male	1.1 (0.89 to 1.39)	0.344
<b>Ethnicity</b>		
Hispanic or Latino	Reference	
Not Hispanic or Latino	1.05 (0.87 to 1.25)	0.629
<b>Race</b>		
White	Reference	
Black	0.88 (0.73 to 1.06)	0.186
Other	0.48 (0.29 to 0.81)	0.006
<b>Region</b>		
Northeast	Reference	
Midwest	0.98 (0.73 to 1.32)	0.907
South	0.95 (0.71 to 1.27)	0.716
West	0.88 (0.67 to 1.16)	0.352
<b>Arrived in EMS</b>		
Yes	Reference	
No	1.48 (0.91 to 2.43)	0.116
Blank/Unknown	1.58 (0.90 to 2.75)	0.108
<b>Triage (Immediacy)</b>		
No triage for visit, but ESA	1.06 (0.40 to 2.83)	0.876
Immediate	0.91 (0.20, 4.21)	0.870
Emergent	1.99 (1.14 to 3.48)	0.002
Urgent	Reference	
Semi-urgent	0.95 (0.71 to 1.27)	0.649
Non-urgent	2.20 (1.15 to 4.18)	0.002
Blank/Unknown	1.03 (0.73 to 1.44)	0.844
<b>Primary Payer</b>		
Private insurance	Reference	
Medicare	1.10 (0.29 to 4.21)	0.883
Medicaid or CHIP	0.75 (0.60 to 0.93)	0.008

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Self pay	0.76 (0.50 to 1.16)	0.200
Worker's compensation	2.04 (0.30 to 13.95)	0.462
No charge/charity	0.45 (0.08 to 2.56)	0.363
Other	0.74 (0.29 to 1.87)	0.515
Blank/Unknown	0.55 (0.38 to 0.79)	0.002

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Percentage of Pediatric ED Visits

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Age (Years)

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● Any Pain

● Definitely Painful

● Painful Chief Complaint

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## Data Supplement S1

Pain-related ED visits included any visit with a Reason for Visit code that was “definitively painful” or “probably painful”.

Pain-related ED visits with painful chief complaint included any visit in which the first Reason for Visit code (first line of RFV) was categorized as “definitely painful”.

### *Definitely painful Reason for Visit codes (SYMPTOMS)*

- **1050.0** Chest pain and related symptoms
  - 1050.1 Chest pain, soreness (excludes: heart pain, 1265.0)
  - 1050.2 Chest discomfort, pressure, tightness, heaviness (includes C – pressure)
  - 1050.3 Burning sensation in the chest
- **1055.0** Pain, specified site not referable to a specific body system (includes: Buttock pain, Gluteal pain, Perineal pain; excludes: abdominal pain [1545.1-1545.3], chest pain [1050.1], phantom leg/limb [2307.0])
  - 1055.1 Rib pain
  - 1055.2 Side pain, flank pain
  - 1055.3 Groin pain (includes: Pubic pain)
  - 1055.4 Facial pain (includes: Jaw pain, Pain over eye)
- **1060.0** Pain and related symptoms, NEC
  - 1060.1 Pain, unspecified (includes: Ache all over [generalized], Incisions [postopcode 4205.0 also])
  - 1060.2 Cramps, spasms, site unspecified (excludes: Menstrual cramps [1745.2])
  - 1060.3 Stiffness, site unspecified
- **1355.0** Earache, or ear infection
  - 1355.1 Earache, pain
  - 1355.2 Ear infection
- **1545.0** Stomach and abdominal pain, cramps and spasms (includes: gastric pain; excludes: groin pain [1055.3])
  - 1545.1 Abdominal pain, cramps, spasms, NOS (includes: Abdominal discomfort, NO, Gas pains, intestinal colic)
  - 1545.2 Lower abdominal pain, cramps, spasms (includes: Right lower quadrant [RLQ] pain, Left lower quadrant [LLQ] pain, inguinal pain)
  - 1545.3 Upper abdominal pain, cramps, spasms (includes: Epigastric pain, Left upper quadrant (LUQ) pain, Pain in umbilical region, Right upper quadrant (RUQ) pain).
- **1210.0** Headache, pain in head (includes: Post-traumatic [also code 5575.0]; excludes: migraine [2365.0], sinus headache [1410.1], symptoms of head, NEC [1207.0])
- **1265.0** Heart pain (includes: Anginal pain, heart distress, pain over heart; excludes: angina pectoris [2515.0], chest pain [1050.1])
- **1320.1** Eye pain (includes: irritation)
- **1320.3** Eye burning, stinging
- **1410.1** Sinus pain and pressure (includes: Sinus headache)
- **1455.1** Soreness (Includes: Throat hurts)
- **1455.2** Pain (burning, throat on fire)



- **1485.1** Lung pain
- **1500.1** Toothache
- **1500.2** Gum pain
- **1510.1** Pain, burning, soreness (1510.0 is symptoms referable to mouth)
- **1515.1** Pain (1515.0 is symptoms referable to tongue)
- **1605.1** Pain (includes: burning, irritation) (1605.0 is symptoms referable to anus-rectum)
- **1610.1** Pain (1610.0 is symptoms of liver, gallbladder, and biliary tract)
- **1650.0** Painful urination (includes: Burning, discomfort)
- **1665.1** Pain (1665.0 is symptoms of bladder)
- **1670.1** Pain (1670.0 is symptoms of the kidneys)
- **1700.1** Pain, aching, soreness, tenderness, painful erection (1700.0 is symptoms of penis)
- **1715.1** Pain, aching, tenderness (1715.0 is symptoms of the scrotum and testes)
- **1745.2** Painful menstruation (dysmenorrhea) (includes: Menstrual cramps, pain in legs and back during menstruation) (1745.0 is menstrual symptoms, other and unspecified)
- **1765.1** Pain (1765.0 is other vaginal symptoms)
- **1775.1** Pain (1775.0 is pelvic symptoms)
- **1790.1** Pain during pregnancy
- **1800.0** Pain or soreness of breast (includes: Tenderness)
- **1870.1** Pain (1870.0 is skin irritations, NEC)
- **1900.1** Neck symptoms (includes: pain, ache, soreness, discomfort)
- **1905.1** Back symptoms (includes: pain, ache, soreness, discomfort)
- **1910.1** Low back symptoms (includes: pain, ache, soreness, discomfort)
- **1915.1** Hip symptoms (includes: pain, ache, soreness, discomfort)
- **1920.1** Leg symptoms (includes: pain, ache, soreness, discomfort)
- **1925.1** Knee symptoms (includes: pain, ache, soreness, discomfort)
- **1930.1** Ankle symptoms (includes: pain, ache, soreness, discomfort)
- **1935.1** Foot and toe symptoms (includes: pain, ache, soreness, discomfort)
- **1940.1** Shoulder symptoms (includes: pain, ache, soreness, discomfort)
- **1945.1** Arm symptoms (includes: pain, ache, soreness, discomfort)
- **1950.1** Elbow symptoms (includes: pain, ache, soreness, discomfort)
- **1955.1** Wrist symptoms (includes: pain, ache, soreness, discomfort)
- **1960.1** Hand and finger symptoms (includes: pain, ache, soreness, discomfort)
- **1965.1** Symptoms of unspecified muscles (includes: pain, ache, soreness, discomfort)
- **1970.1** Symptoms of unspecified joints (includes: pain, ache, soreness, discomfort)
- **1975.1** Bowlegged, knock-kneed (1975.0 is Musculoskeletal deformities)
- **1980.1** Other musculoskeletal symptoms (includes: bone pain, stump pain)

*Definitely painful Reason for Visit codes (CONDITIONS)*

- **2010.0** Streptococcal infection (includes: Streptococcal tonsillitis, Scarlet fever)
- **2365.0** Migraine headache
- **2655.0** Appendicitis, all types
- **4521.0** Major surgery
- **5005.0** Fractures and dislocations, Head and face (includes: facial bones, jaw, nose, skull)
- **5010.0** Fracture and dislocation, Spinal column (includes: back, neck, vertebrae)

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- 4 • **5015.0** Fractures and dislocations, Trunk area except spinal column (includes: clavicle, collarbone, pelvic scapula, rib)
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- 6 • **5020.0** Fractures and dislocations, Leg (includes: femur, fibula, hip, knee, tibia)
- 7 • **5025.0** Fractures and dislocations, Ankle
- 8 • **5030.0** Fractures and dislocations, Foot and toes
- 9 • **5035.0** Fractures and dislocations, Arm (includes: elbow, humerus, radius, shoulder, ulna)
- 10
- 11 • **5040.0** Fractures and dislocations, Wrist
- 12 • **5045.0** Fractures and dislocations, Hand and fingers
- 13 • **5050.0** Fractures and dislocations, Fracture, other and unspecified
- 14 • **5105.0** Sprains and strains, Cervical spine, neck (includes: whiplash)
- 15 • **5110.0** Sprains and strains, Back
- 16 • **5115.0** Sprains and strains, Knee
- 17 • **5120.0** Sprains and strains, Ankle
- 18 • **5125.0** Sprains and strains, Wrist
- 19 • **5130.0** Sprains and strains, other and unspecified
- 20 • **5205.0** Lacerations and cuts, Head and neck area (excludes: face [5210.0])
- 21 • **5210.0** Lacerations and cuts, Facial area (includes: eye, ear, forehead, lip, nose)
- 22 • **5215.0** Lacerations and cuts, Trunk area (includes: perineum)
- 23 • **5220.0** Lacerations and cuts, Lower extremity (includes: ankle, foot)
- 24 • **5225.0** Lacerations and cuts, Upper extremity (includes: arm, fingers, hand, wrist)
- 25 • **5230.0** Lacerations and cuts, site unspecified
- 26 • **5305.0** Puncture wounds, Head, neck, and facial area
- 27 • **5310.0** Puncture wounds, Trunk area
- 28 • **5315.0** Puncture wounds, Lower extremity
- 29 • **5320.0** Puncture wounds, Upper extremity
- 30 • **5325.0** Puncture wounds, site unspecified (includes: Needlestick, NOS)
- 31 • **5405.0** Contusions, abrasions, and bruises, Head, neck, and face (excludes: Eye [5410.0])
- 32 • **5410.0** Contusions, abrasions, and bruises, Eye (includes: black eye, contusion, corneal abrasion)
- 33 • **5415.0** Contusions, abrasions, and bruises, Trunk area (includes: injury to scrotum)
- 34 • **5420.0** Contusions, abrasions, and bruises, Lower extremity
- 35 • **5425.0** Contusions, abrasions, and bruises, Upper extremity
- 36 • **5430.0** Contusions, abrasions, and bruises, site unspecified
- 37 • **5505.0** Injury, other, and unspecified type, Head, neck, and face (includes: post concussive syndrome, tooth fracture, tooth knocked out, traumatic brain injury; excludes: Loose tooth [no injury] 1500.0)
- 38 • **5510.0** Injury, other, and unspecified type, Eye
- 39 • **5515.0** Injury, other, and unspecified type, Back (includes: Tail bone)
- 40 • **5520.0** Injury, other, and unspecified type, Chest and abdomen (includes: Internal injuries)
- 41 • **5525.0** Injury, other, and unspecified type, Hip
- 42 • **5535.0** Injury, other, and unspecified type, Knee
- 43 • **5530.0** Injury, other, and unspecified type, Leg
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- **5540.0** Injury, other, and unspecified type, Ankle
  - **5545.0** Injury, other, and unspecified type, Foot and toe(s)
  - **5550.0** Injury, other, and unspecified type, Shoulder
  - **5555.0** Injury, other, and unspecified type, Arm
  - **5560.0** Injury, other, and unspecified type, Elbow
  - **5565.0** Injury, other, and unspecified type, Wrist
  - **5570.0** Injury, other, and unspecified type, Hand and finger(s)
  - **5575.0** Injury, multiple or unspecified (includes: post traumatic NOS headache)
  - **5705.0** Burns, all degrees, Head, neck, and face (includes: eyes)
  - **5710.0** Burns, all degrees, Trunk area
  - **5715.0** Burns, all degrees, Extremities (includes: lower, upper)
  - **5720.0** Burns, all degrees, Burn site unspecified
  - **5760.0** Bites, animal, snake, human

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3 *Probably painful Reason for Visit codes (SYMPTOMS)*

- 4 • **1220.3** Disturbances of sensation, Abnormal sensation (paresthesia) (includes: burning  
5 legs, burning, tingling sensation, needles and pins, prickly feeling, stinging)
- 6 • **1430.0** Breathing problems (includes: Hurts to breath)
- 7 • **1791.0** Postpartum problems (includes: bleeding, pain; excludes: postpartum  
8 examination, routine)
- 9 • **2675.5** Temporomandibular joint (TMJ) pain, temporomandibular joint (TMJ) syndrome

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13 *Probably painful Reason for Visit codes (CONDITIONS)*

- 14 • **1840.0** Infections of skin, NOS (includes: draining wounds, infected blister, infected  
15 wound; excludes: athlete's foot [2025.0], wound drainage [as treatment])
    - 16 ○ **1840.1** Infection of skin of head or neck area
    - 17 ○ **1840.2** Infection of skin of arm, hand, or finger
    - 18 ○ **1840.3** Infection of skin of leg, foot, or toe
  - 19 • **1240.0** Other symptoms referable to the nervous system (includes: brain lesion,  
20 confusion, cognitive decline, damaged nerves, neuralgia, neurovegetative, pinched nerve,  
21 postictal; excludes: nerve block 4560.0)
  - 22 • **1825.0** Symptoms of sexual dysfunction (includes: dyspareunia, painful intercourse;  
23 excludes: psychological disorders)
  - 24 • **2250.0** Anemia (includes: anemia, NOS, iron deficiency anemia, pernicious anemia,  
25 sickle cell anemia)
  - 26 • **2450.0** Otitis media
  - 27 • **2515.0** Ischemic heart disease (includes: angina pectoris, arteriosclerotic cardiovascular  
28 disease, arteriosclerotic heart disease, coronary, coronary heart disease, heart attack,  
29 ischemic cardiomyopathy, myocardial infarction)
  - 30 • **2600.0** Upper respiratory infections except tonsillitis (includes: croup, laryngitis,  
31 pharyngitis, rhinitis, sinusitis; excludes: allergic rhinitis [2636.0], cold [1445.0], nose  
32 infection NOS [1405.3], sinus infection NOS [1410.2], throat infection NOS [1455.3])
  - 33 • **2605.0** Tonsillitis
  - 34 • **2650.0** Diseases of the esophagus, stomach, and duodenum (includes: Barrett's  
35 esophagus, duodenal ulcer, esophageal ulcer, esophagitis, gastritis, GERD, peptic ulcer,  
36 reflux, stomach ulcer; excludes: gastroenteritis [2005.0], stomach flu [1540.0])
  - 37 • **2665.0** Diseases of the intestine and peritoneum (includes: abscess rectal, adhesions  
38 [abdominal or NOS; if states post-op, code 42050 also], Crohn's disease, diverticulitis,  
39 diverticulosis, fissure – rectal and anal, fistula – rectal and anal, ileitis, irritable bowel  
40 syndrome, proctitis, small bowel obstruction, spastic colitis, ulcerative colitis; excludes:  
41 intestinal virus [1540.0])
  - 42 • **2675.1** Dental abscess
  - 43 • **2675.2** Dental cavities
  - 44 • **2705.0** Urinary tract disease except cystitis (includes: bladder stones, glomerulonephritis,  
45 glomerulonephrosis, kidney cyst, kidney stones, neurogenic bladder, pyelonephritis, renal  
46 failure, ureteral calculus, urethritis, urolithiasis; excludes: bladder infection [1665.2],  
47 kidney infection NOS [1670.2], passed stones [1680.0], urinary tract infection [1675.0])
  - 48 • **2900.0** Arthritis (includes: osteoarthritis, rheumatism NOS, rheumatoid arthritis, septic)
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- 4 • **2905.0** Nonarticular rheumatism (includes: bursitis, ganglion cyst, lumbago, myositis, polymyalgia rheumatica, radiculitis/radiculopathy, synovitis, tendinitis, tenosynovitis; excludes: rheumatism NOS [2900.0])
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- 7 • **4520.0** Minor surgery
- 8 • **4540.0** Cast, splint – application, removal
- 9
- 10 • **5920.0** Adverse effects of environment (includes: air pollution, frostbite, hypothermia, noise pollution, sun damage, sun poisoning, too hot, water pollution)
- 11
- 12 • **5930.0** Complications of surgical or medical procedures and treatments (includes: artificial openings [ostomies, stoma], catheter, foreign body [accidentally left during surgery eg. Sponge, instrument], medical complication NOS, non-healing surgical wound, post-op fever, post-op hemorrhage [bleeding], post-op infection or inflammation, post-op [septicemia], shunt, tubes, wound dehiscence; excludes: postpartum conditions [1791.0 and 1810.2], complication of transplant organs [4565.1-4565.2])
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- 18 • **5805.0** Motor vehicle accident, type of injury unspecified (includes: auto accident, car accident, motorcycle accident)
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- 21 • **5810.0** Accident NOS (includes: fall, type or location of injury unspecified)
- 22
- 23 • **5815.0** Violence NOS (includes: abuse, beat up, in a fight, stabbing; excludes: violence against oneself [5818.0, 5820.0])
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- 25 • **5818.0** Intentional self-mutilation (includes: self-abuse, tried to hurt self; excludes: suicide attempt [5820.0])
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- 27 • **5820.0** Suicide attempt (includes: found in car with motor running, hanging oneself, slashed wrists, stabbed oneself).
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## Data Supplement S2

### Codes by body system:

#### Musculoskeletal

- 1900 Neck symptoms
- 1905 Back symptoms
- 1910 Low back symptoms
- 1915 Hip symptoms
- 1920 Leg symptoms
- 1925 Knee symptoms
- 1930 Ankle symptoms
- 1940 Shoulder symptoms
- 1945 Arm symptoms
- 1950 Elbow symptoms
- 1955 Wrist symptoms
- 1960 Hand and finger symptoms (includes ring stuck on finger)
- 5005 Fractures and dislocations, Head and face
- 5020 Fractures and dislocations, Leg
- 5035 Fractures and dislocations, Arm
- 5045 Fractures and dislocations, Hand and Fingers
- 5050 Fractures and dislocations, other and unspecified
- 5105 Sprains and strains, Cervical spine, neck
- 5115 Sprains and strains, Knee
- 5120 Sprains and strains, Ankle
- 5405 Contusions, abrasions, and bruises, Head, neck, and face
- 5415 Contusions, abrasions, and bruises, Trunk area
- 5420 Contusions, abrasions, and bruises, Lower extremity
- 5425 Contusions, abrasions, and bruises, Upper extremity
- 5505 Injury, other and unspecified type, Head, neck, and face
- 5515 Injury, other and unspecified type, Back
- 5520 Injury, other and unspecified type, Chest and abdomen (includes internal injuries)
- 5530 Injury, other and unspecified type, Leg
- 5535 Injury, other and unspecified type, Knee
- 5540 Injury, other and unspecified type, Ankle
- 5545 Injury, other and unspecified type, Foot and toe(s)
- 5550 Injury, other and unspecified type, Shoulder
- 5555 Injury, other and unspecified type, Arm
- 5560 Injury, other and unspecified type, Elbow
- 5565 Injury, other and unspecified type, Wrist
- 5570 Injury, multiple or unspecified (includes post-traumatic NOS headache)

#### ENT

- 1355 Earache, or ear infection
- 1410 Sinus problems
- 1455 Symptoms referable to throat, raw throat

- 2010 Streptococcal infection

### Abdominal

- 1545 Stomach and abdominal pain, cramps and spasms

### Laceration

- 5205 Lacerations and cuts, Head and neck area
- 5210 Lacerations and cuts, Facial area
- 5215 Lacerations and cuts, Trunk area
- 5220 Lacerations and cuts, Lower extremity
- 5225 Lacerations and cuts, Upper extremity
- 5230 Laceration and cuts, site unspecified
- 5305 Puncture wounds, Head, neck and facial area
- 5315 Puncture wounds, Trunk area
- 5315 Puncture wounds, Lower extremity
- 5320 Puncture wounds, Upper extremity
- 5325 Puncture wound, site unspecified

### Headache

- 1210 Headache, pain in head
- 2365 Migraine headache

### General Pain

- 1800 Pain or soreness of breast
- 1055 Pain specified site not referable to a specific body system
- 1060 Pain and related symptoms, NEC
- 5430 Contusions, abrasions, and bruises, site unspecified
- 5575 Injury, multiple or unspecified
- 5130 Sprain or strain, other and unspecified
- 1970 Symptoms of unspecified joints
- 1965 Wrist symptoms

### Chest

- 1050 Chest pain and related symptoms (not referable to a specific body system)

### Eye

- 1320 Abnormal sensations of the eye
- 5510 Injury, other and unspecified type, Eye

### Bite

- 5760 Bites, Animal, snake, human

### Genitourinary

- 1650 Painful urination
- 1605 Symptoms referable to anus-rectum



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- 1700 Symptoms of penis
  - 1715 Symptoms of scrotum and testes
  - 1745 Menstrual symptoms, other and unspecified
  - 1765 Other vaginal symptoms
  - 1775 Pelvic symptoms
  - 1790 Problems of pregnancy

#### Burn

- 5705 Burns, all degrees, Head, neck, and face
- 5715 Burns, all degrees, Extremities
- 5720 Burn, site unspecified

#### Oral

- 1500 Symptoms of teeth and gums
- 1510 Symptoms referable to mouth

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## Data Supplement S3

**Table S3.1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

<b>All ED Visits</b>	
<b>Age</b>	
< 6 years	44.47% (40.20%, 48.83%)
6-11 years	24.07% (22.83%, 25.35%)
12-18 years	31.46% (27.25%, 26.00%)
<b>Sex</b>	
Female	48.47% (46.70%, 50.25%)
Male	51.53% (49.75%, 53.30%)
<b>Ethnicity</b>	
Hispanic or Latino	25.47% (19.16%, 33.00%)
Not Hispanic or Latino	74.53% (67.00%, 80.84%)
<b>Race</b>	
White	67.72% (61.60%, 73.29%)
Black	28.21% (22.82%, 34.32%)
Other	4.06% (3.10%, 5.32%)
<b>Region</b>	
Northeast	13.27% (8.00%, 21.21%)
Midwest	24.71% (17.22%, 34.12%)
South	45.30% (33.52%, 57.63%)
West	16.72% (9.84%, 26.97%)
<b>Metropolitan Statistical Area (MSA)</b>	
MSA	86.96% (75.42%, 93.55%)
Non-MSA	13.04% (6.45%, 24.58%)
<b>Arrived in EMS</b>	
Yes	4.95% (4.00%, 6.11%)
No	90.52% (84.10%, 94.52%)
Unknown	4.01% (1.05%, 14.13%)
Blank	0.52% (0.34%, 0.79%)
<b>Triage (Immediacy)</b>	
Immediate	0.97% (0.29%, 3.22%)
Emergent	7.23% (4.43%, 11.58%)
Urgent	26.57% (21.79%, 31.97%)
Semi-urgent	33.59% (28.20%, 39.44%)
Non-urgent	7.01% (4.15%, 11.60%)
Unknown	16.30% (10.35%, 24.72%)
<b>Primary Payer</b>	
Private insurance	22.60% (18.55%, 27.24%)
Medicare	0.36% (0.19%, 0.69%)

Medicaid or CHIP	63.08% (56.22%, 69.46%)
Self-pay	4.47% (3.14%, 6.31%)
Worker's compensation	0.02% (0.01%, 0.07%)
No charge/charity	0.08% (0.02%, 0.28%)
Other	1.37% (0.81%, 2.31%)
Unknown	6.44% (2.48%, 15.70%)
Blank	1.58% (0.55%, 4.49%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

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## Data Supplement S4

**Table S4.1.** Sensitivity analysis - baseline characteristics comparison between definitely painful visits and non-painful visits.

	<b>Definitely Painful Reason for Visit</b> 54.27% (51.79% to 56.50%)	<b>Non-Pain Related Visits</b> 45.85% (43.50% to 48.21%)
<b>Age</b>		
< 6 years	25.93% (22.08%, 30.20%)	66.16% (61.47%, 70.55%)
6-11 years	32.33% (29.68%, 35.10%)	14.67% (12.71%, 16.88%)
12-18 years	41.73% (36.47%, 47.19%)	19.17% (15.87%, 22.96%)
<b>Sex</b>		
Female	49.21% (45.30%, 53.14%)	47.95% (45.19%, 50.72%)
Male	50.79% (46.86%, 54.70%)	52.05% (49.28%, 54.81%)
<b>Ethnicity</b>		
Hispanic or Latino	25.46% (18.06%, 34.61%)	25.93% (19.95%, 32.96%)
Not Hispanic or Latino	74.54% (65.39%, 81.94%)	74.07% (67.04%, 80.05%)
<b>Race</b>		
White	71.09% (64.41%, 76.96%)	70.86% (64.15%, 76.77%)
Black	26.50% (20.82%, 33.09%)	26.57% (20.89%, 33.15%)
Other	2.41% (1.67%, 3.45%)	2.56% (1.72%, 3.82%)
<b>Region</b>		
Northeast	12.66% (7.67%, 20.17%)	13.69% (8.00%, 22.46%)
Midwest	24.89% (17.78%, 33.68%)	24.63% (16.16%, 35.66%)
South	47.05% (35.24%, 59.21%)	43.15% (31.00%, 56.18%)
West	15.40% (9.19%, 24.66%)	18.53% (10.46%, 30.69%)
<b>Arrived in EMS</b>		
Yes	3.95% (2.84%, 5.46%)	5.67% (4.14%, 7.72%)
No	91.69% (85.19%, 95.49%)	89.76% (83.06%, 94.00%)
Blank/Unknown	4.36% (1.34%, 13.26%)	4.57% (1.34%, 14.48%)
<b>Triage (Immediacy)</b>		
No triage for visit but ESA	0.83% (0.34%, 2.03%)	1.04% (0.42%, 2.54%)
Immediate	1.04% (0.28%, 3.85%)	0.75% (0.27%, 2.06%)
Emergent	5.49% (3.36%, 8.84%)	8.77% (5.19%, 14.44%)
Urgent	28.78% (22.51%, 35.99%)	23.87% (19.65%, 28.66%)
Semi-urgent	35.32% (28.88%, 42.33%)	31.73% (27.04%, 36.82%)
Non-urgent	4.63% (2.27%, 9.21%)	10.12% (6.66%, 15.08%)
Blank/Unknown	20.09% (13.04%, 29.66%)	19.66% (13.37%, 27.96%)
<b>Primary Payer</b>		
Private insurance	25.90% (21.61%, 30.71%)	18.29% (14.21%, 23.22%)
Medicare	0.37% (0.18%, 0.77%) <sup>†</sup>	0.38% (0.16%, 0.88%) <sup>†</sup>
Medicaid or CHIP	61.24% (55.39%, 66.79%)	65.80% (56.93%, 73.69%)

Self pay	4.57% (3.17%, 6.56%)	4.45% (2.92%, 6.72%)
Worker's compensation	0.03% (0.01%, 0.14%) <sup>†</sup>	0.01% (0.00%, 0.06%) <sup>†</sup>
No charge/charity	0.06% (0.01%, 0.43%) <sup>†</sup>	0.12% (0.03%, 0.54%) <sup>†</sup>
Other	1.12% (0.60%, 2.07%)	1.38% (0.72%, 2.65%)
Blank/Unknown	6.71% (3.22%, 13.42%)	9.58% (4.03%, 21.11%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

<sup>†</sup>This represented cell sizes smaller than 30, which are considered not reliable for meaningful analysis by the NHAMCS guidelines.

For peer review only

## Data Supplement S5

**Table S5.1.** Body system involvement for all pain-related ED visits stratified by the presence of injury/trauma.

Body system	Pain-related ED visits with injury/trauma*	Pain-related ED visits without injury/trauma*
Musculoskeletal	69.5% (63.7%, 74.8%)	7.1% (4.5%, 11.1%)
Skin Laceration	14.7% (11.4%, 18.8%)	0.0% (0.0%, 0.0%)
General Pain	3.7% (2.4%, 5.5%)	6.2% (4.0%, 9.5%)
Headache	3.2% (2.0%, 5.2%)	8.8% (6.6%, 11.8%)
Eye	1.6% (0.8%, 3.2%)	0.8% (0.3%, 2.3%)
Bite	2.3% (1.4%, 3.8%)	0.0% (0.0%, 0.0%)
Burn	1.9% (0.9%, 4.1%)	0.0% (0.0%, 0.0%)
Abdominal	0.6% (0.3%, 1.4%)	32.0% (25.5%, 39.3%)
Ear/Nose/Throat	0.7% (0.3%, 1.7%)	31.0% (23.1%, 40.2%)
Genital-urinary/Dysuria	0.2% (0.1%, 0.9%)	5.7% (4.2%, 7.7%)
Chest	0.9% (0.3%, 2.4%)	6.9% (4.8%, 10.0%)
Oral	0.6% (0.2%, 2.1%)	1.3% (0.5%, 2.3%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

**Table S5.2.** Body system involvement for pain-related ED visits with a painful chief complaint.

Body system	Proportion* (95% CI)
Musculoskeletal	39.9% (34.6%, 45.6%)
Abdominal	16.0% (11.9%, 21.1%)
Ear/Nose/Throat	14.8% (12.1%, 18.0%)
Skin Laceration	7.6% (5.6%, 10.2%)
Headache	5.8% (4.5%, 7.3%)
General Pain	4.7% (3.3%, 6.9%)
Chest	3.8% (2.6%, 5.6%)
Genital-urinary/Dysuria	2.8% (2.1%, 3.8%)
Eye	1.3% (0.8%, 2.1%)
Bite	1.2% (0.7%, 2.0%)
Burn	1.0% (0.4%, 2.2%)
Oral	0.9% (0.4%, 1.9%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

Section/Topic	Item #	Recommendation	Reported on page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7, 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7, 8
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8, 9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	-
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
<b>Results</b>			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 10
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	10
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10, 11
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11, 12, 13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Epidemiology of pediatric pain-related visits to emergency departments in the United States: a cross-sectional study

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3 **Epidemiology of pediatric pain-related visits to emergency departments in the United**  
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5 **States: a cross-sectional study**  
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10 **Authors**

11 Jana L. Anderson<sup>1</sup> MD, Lucas Oliveira J. e Silva<sup>1</sup> MD, Shealeigh A. Funni<sup>2</sup>, Fernanda Bellolio<sup>1,2</sup>  
12  
13 MD MS, Molly M. Jeffery<sup>1,2</sup> PhD.  
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19 **Author Affiliations**

20  
21 <sup>1</sup>Department of Emergency Medicine, Mayo Clinic, Rochester, Minnesota, USA;

22  
23 <sup>2</sup>Department of Health Sciences Research, Mayo Clinic, Rochester, Minnesota, USA.  
24  
25  
26  
27

28 **Corresponding Author**

29  
30 Jana L. Anderson, MD

31  
32 Department of Emergency Medicine

33  
34 Mayo Clinic

35  
36 Phone: 507-255-5388, Email: Anderson.Jana@mayo.edu  
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## ABSTRACT

**Objective:** To describe the epidemiology of pediatric pain-related visits to emergency departments (EDs) across the United States (US).

**Design:** Cross-sectional study.

**Setting:** A representative sample of US ED visits using data from the National Hospital Ambulatory Medical Care Survey (NHAMCS).

**Participants:** Pediatric (age  $\leq 18$  years) ED visits in the 2017 NHAMCS dataset.

**Data analysis:** Each visit was coded as pain- or non-pain-related using the “reason for visit” variable. Weighted proportions were calculated with 95% confidence intervals (CI). Logistic regression was used to compare odds of pain-related visits.

**Outcome measures:** Prevalence of pain-related visits among pediatric ED visits.

**Results:** There were an estimated 35 million pediatric ED visits in the US in 2017, 55.6% (CI 53.3% to 57.8%) were pain related, which equates to 19.7 million annual visits. The prevalence of pain-related visits reached more than 50% of visits at age 6 to 7 and plateaued at relatively high proportions. Children of races other than white or Black had lower odds of having a pain-related visit (odds ratio [OR] 0.48, CI 0.29 to 0.81) than white children, as did children who were Black, though the difference was not statistically significant (OR 0.88, CI 0.73 to 1.06). Relative to children covered by private insurance, children with Medicaid or CHIP coverage had lower odds of a pain-related visit (OR 0.75, CI 0.60 to 0.93). Injuries represented 46.5% (CI 42.0% to 51.0%) of pain-related visits. Pain scores were reported in less than 50% of pain-related visits.

**Conclusion:** Pain is the reason for visit in 55.6% of pediatric ED visits across the US. The prevalence of pain-related visits peak before adolescence and it continues relatively high until

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3 the age 18. Injury, racial disparities in pain, and poor pain score reporting should remain major  
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5 topics of study in the pediatric population.  
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7 Keywords: Prevalence, Acute Pain, Pediatrics, Emergency Departments.  
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## ARTICLE SUMMARY

### Strengths and limitations of this study

- This study used data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), which uses a multistage probability design to achieve a representative sample of Emergency Department visits in the United States.
- We have used up to five “reason for visit” variables to define the painful nature of visits and to identify pain-related visits.
- Tracking use among individual patients is not possible in the NHAMCS dataset.
- The National Center for Health Statistics standardizes data collection and processing, however some inconsistencies may remain across different participating Emergency Departments.

## INTRODUCTION

Acute pain is known to be one of the most frequent reasons for visiting the Emergency Department (ED).[1] Given that pain is a driving factor for the majority of visits, it is important to understand the epidemiology of the disease. There is little up-to-date information on pediatric ED visits for acute pain, as the majority of acute pain ED epidemiology studies have excluded children, were limited to one institution, or are now outdated.[2–5]

One of the first pediatric pain ED epidemiology studies was performed in Canada in 1996.[3] This study utilized pain scale responses rather than chief complaint to define a pain-related visit. The definition based on pain scale, which is inherently subjective, is fraught with unreliability and difficulty with validity in younger children with immature verbal response. Also, some limitations of this study were its short time period of enrollment and the limited setting including only two hospitals and excluding the critical area of the ED. In 2000, the first ED pain study with consecutive enrollment was published.[4] This study was performed at a single large urban center and utilized chief complaint to identify a pain visit. Children were not the focus of this study, but children less than 5 years of age did comprise 14% of the study population. The first pediatric national level epidemiology study on acute pain in United States (US) EDs was performed using data from 1997 to 2000.[5] This study utilized the National Hospital Ambulatory Medical Care Survey (NHAMCS) database and it used the “reason for visit” variable to define a pain-related visit. As the last US-based national study on the prevalence of pain-related visits, this data is outdated by two decades. It is unclear if pain remains a major driver of ED visits in the pediatric population.

Our goal in this study was to examine the current prevalence of pain-related visits among children presenting to EDs in the US. This information will help to build foundational

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3 knowledge about the dimension of this clinically important condition and to focus future  
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5 preventative, home and ED therapy to hopefully decrease the incidence of pain. In addition, this  
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7 study will provide a background for trends in pediatric pain prevalence looking towards the  
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9 utilization and optimization of analgesics.  
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## 14 **METHODS**

### 15 **Study design, setting, and participants**

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19 This was a cross-sectional study of all children (age  $\leq$  18 years) in the 2017 National  
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21 Hospital Ambulatory Medical Care Survey (NHAMCS), which was released in November of  
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23 2019, the latest available at the start of this study. This de-identified data is publicly available  
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25 from the National Center for Health Statistics (NCHS) and provides a representative sample of  
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27 ED visits throughout the US.[6] We followed the STrengthening the Reporting of OBServational  
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29 studies in Epidemiology (STROBE) guidelines for reporting observational studies.[7]  
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### 35 **Ethics approval**

36  
37 NHAMCS is approved by the Ethics Review Board of the National Center for Health  
38  
39 Statistics (NCHS), a division of the Center for Disease Control and Prevention (CDC).[6]  
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41 Because this study used pre-existing, de-identified data, the Institutional Review Board deemed  
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43 this study exempt.  
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### 49 **Data source**

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51 The NHAMCS ED data set has been collected yearly since 1992 to describe US ED visits  
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53 and utilization.[8] NHAMCS utilizes extensive surveys in randomly selected sampling units, that  
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3 are then weighted to make national visit-level estimates. The sampling of Emergency Service  
4 Areas (ESAs) allows for inclusion of both academic and non-academic institutions.[8] In the  
5  
6 2017 NHAMCS dataset, a total of 479 hospitals were selected of which 374 were in scope and  
7  
8 had eligible EDs. Of these, 234 responded, yielding an unweighted ED response rate of 62.6%.  
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10 This corresponded to a total of 331 ESAs that were identified from the EDs. Of these, 240  
11  
12 responded fully or adequately by providing forms for at least one-half of their expected visits  
13  
14 based on the total number of visits during the reporting period. In all, 16,709 patient record  
15  
16 forms (PRFs) were submitted electronically. The resulting unweighted ESA sample response rate  
17  
18 was 72.5%, and the overall unweighted two-stage sampling response rate was 45.4% (48.4%  
19  
20 weighted). The surveys, called PRFs, are obtained by trained individuals from the U.S. Census  
21  
22 Bureau. Each ESA is surveyed over a randomly selected 4-week period that rotates each survey  
23  
24 year. Subsequently, these surveys are then weighted using population statistics to estimate visits  
25  
26 on a national level.  
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### 35 **Variables and measurements**

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37 Data was collected through a PRF which can be viewed on the NCHS website.[9] The  
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39 PRF lists up to five “reasons for visit” (RFV), including the first-listed RFV (i.e., chief  
40  
41 complaint) and up to four additional symptoms, problems, or issues. We used these five RFV  
42  
43 variables to initially categorize visits as pain- or non-pain-related.  
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47 Codes related to pain were identified by two methods: 1) “pain” keywords and 2) by  
48  
49 physician consensus. First, all RFV codes that contained symptom keywords such as “pain”,  
50  
51 “burn”, “stinging”, “soreness”, “ache” or “algia” were classified as “definitely painful”. Second,  
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53 to classify conditions that did not contain the previously mentioned keywords, two independent  
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3 physicians, one board-certified in emergency and one board-certified in pediatric emergency  
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5 medicine, reviewed all of the codes for conditions and classified them as “definitely painful”,  
6  
7 “probably painful”, or non-painful. Any disagreements were settled with discussion and  
8  
9 consensus. The full list of codes considered as “definitely painful” or “probably painful” is  
10  
11 detailed in Data Supplement S1 (Supplementary Material).  
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14  
15 Pain-related ED visits were defined as any visit with at least one pain-related RFV code  
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17 (not necessarily the first-listed RFV code), including those either categorized as “definitely  
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19 painful” or “probably painful”. Pain-related ED visits with a painful chief complaint was defined  
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21 as any visit in which the first-listed RFV code was a “definitely painful” condition. This included  
22  
23 only those “definitely painful” conditions or symptoms present at the first-listed RFV, which is  
24  
25 the chief complaint of the visit. Pain-related ED visits with injury was defined by the variable  
26  
27 “Injury” in the PRF. NHAMCS classifies injury visits as those involving injury, trauma,  
28  
29 overdose, poisoning, or adverse effects of medical treatments. The original dataset does not  
30  
31 allow to separate these three categories but rather classifies them under the same umbrella of the  
32  
33 “Injury” variable. Visits in which a “definitely painful” or “probably painful” code was present  
34  
35 and the variable “Injury” was present were considered to be pain-related ED visits with injury.  
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40 For pain-related ED visits with a painful chief complaint, we categorized the first-listed  
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42 RFV code (i.e., chief complaint) by body systems including musculoskeletal, abdominal,  
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44 ear/nose/throat, laceration, headache, general pain, chest, genital-urinary/dysuria, eye, bite, oral,  
45  
46 and burn related complaints. The full list of codes and categorization is detailed in Data  
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48 Supplement S2 (Supplementary Material).  
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## 51 52 53 54 **Data analysis** 55 56 57 58 59 60

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3 Analysis, including the logistic regression model, was completed using the *svy* suite of  
4 tools in Stata version 15, which considers the sampling design of the NHAMCS survey to  
5 accurately calculate nationally weighted estimates and their variability (StataCorp LLC, 2017).  
6  
7 The total number of pediatric visits, both pain- and non-pain-related, was estimated. Descriptive  
8 statistics were calculated for age, sex, ethnicity, race, geographic region, arrival by emergency  
9 medical services (EMS), primary payer source, immediacy of visit, injury involvement, and pain  
10 scale rating. For the variables age, sex, ethnicity, and race we used imputed values provided by  
11 NHAMCS to reduce the effect of missingness on our results. Children were grouped by age into  
12 three developmental stages: age < 6, age 6 to 11, and age 12 to 18 years. Proportions of trauma  
13 involvement among pain-related visits and categorization by body system involved among pain-  
14 related visits were also calculated. Weighted proportions were calculated with 95% confidence  
15 intervals (CI). Characteristics between pain- and non-pain-related visits were compared using t-  
16 tests to compare proportions for each baseline characteristic.  
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33 Odds ratios (OR) and 95% CI were produced from a multivariable analysis using logistic  
34 regression to identify factors associated with pain-related visits. The same variables previously  
35 described were included as covariates in the model. We selected variables to include in the  
36 model based on theoretical relevance.  
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#### 44 **Patient and public involvement**

45 Patients and/or public were not involved in this study.  
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## 51 **RESULTS**

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3 We analyzed all 4,112 pediatric ED visits in the 2017 NHAMCS dataset, which  
4 represents an estimated 35 million visits during the study period. Across all pediatric ED visits  
5 (pain- and non-pain-related visits), 44.5% of the children were younger than 6 years of age,  
6 24.1% aged 6 to 11 years, and 31.5% aged 12 to 18 years. The cohort was 48.5% female. White  
7 children made up 67.7% of the study population, followed by Black children at 28.2%. Hispanic  
8 or Latino ethnicity comprised 25.5% of the cohort. Arrival by ambulance occurred in 5.0% (95%  
9 CI, 4.0% to 6.1%) of all pediatric ED visits. (Data Supplement S3)

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11  
12 The prevalence of pain-related ED visits was 55.6% (95% CI, 53.3% to 57.8%),  
13 representing a population estimate of 19.7 million ED visits for pediatric pain. Among all pain-  
14 related ED visits, 68.8% (95% CI, 65.9% to 71.6%) had a painful chief complaint. When we  
15 plotted the proportion of pain-related ED visits by age, there was a steady increase till the age of  
16 7 and it then plateaued at relatively high proportions, ranging from a minimum of 66.7% (age 16)  
17 to a maximum of 79.0% (age 12). The pattern remained the same when different definitions of  
18 pain-related visits were used. (Figure 1)

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21 Baseline characteristics between pain-related ED visits and non-pain-related ED visits  
22 were generally similar, except for race (non-pain-related visits had a higher proportion of white  
23 children than pain-related visits at 70.9% vs. 63.8%,  $p = 0.001$ ), insurance (pain-related visits  
24 had a higher proportion of children with private insurance than non-pain-related visits at 26.0%  
25 vs. 18.3%,  $p < 0.001$ ), and triage (children triaged as non-urgent were more likely to have a non-  
26 pain-related visit at 10.1% vs. 4.5%,  $p < 0.001$ ). Black children represented similar proportions  
27 of pain- and non-pain-related visits, but pain-related visits had higher proportions of children  
28 with races other than Black and white than non-pain-related visits (5.9% vs. 2.6%,  $p = 0.001$ ).  
29 There were no significant differences by ethnicity for pain- and non-pain-related visits. There  
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3 were no significant differences by sex. As for pain scale reporting among pain-related visits, less  
4 than 50% had pain score available (14.8% with a score 0 to 4, and 29.3% with a score 5 to 10).  
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6 (Table 1). The same descriptive analysis of baseline characteristics was also performed by  
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8 comparing visits with “definitely painful” codes to non-painful visits. (Data Supplement S4)  
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12 In the multivariable analysis, older age groups (6 to 11 and 12 to 18 years) were  
13 significantly more likely to have a pain-related ED visit than the group aged < 6 years (Table 2)  
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15 Race was also found to be an important factor associated with pain-related visits. After adjusting  
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17 for age and other baseline characteristics, children with races other than Black and white were  
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19 less likely than white children to have a pain-related ED visit (adjusted OR 0.48, 95% CI 0.29 to  
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21 0.81,  $p = 0.006$ ). Children with Medicaid were less likely to have a pain-related ED visit than  
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23 children with private insurance (adjusted OR 0.76, 95% CI 0.60 to 0.93,  $p = 0.008$ ). (Table 2)  
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28 Injury was reported in 46.5% (95% CI, 42.0% to 51.0%), or an estimated 9.2 million of  
29 the pain-related visits. There were an estimated 1.3 million, or 2.5% of visits with unknown  
30  
31 injury involvement.  
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35 Among the estimated 13.6 million pain-related ED visits with a painful chief complaint,  
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37 the body systems most frequently involved were musculoskeletal at 39.9% (95% CI 34.6% to  
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39 45.6%), followed by abdominal at 16.0% (95% CI 11.9% to 21.1%) and ear/nose/throat at 14.8%  
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41 (95% CI 12.1% to 18.0%). In pain-related ED visits without injury, the most common body  
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43 system involved was abdominal at 32.0% (95% CI, 25.5% to 39.3%), followed by  
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45 ear/nose/throat at 31.0% (95% CI, 23.1% to 40.2%), and headache at 8.8% (95% CI, 6.6% to  
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47 11.8%). (Data Supplement S5)  
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## 54 **DISCUSSION**

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3 In this cross-sectional study, we found that 55.6% of all US ED pediatric visits were  
4 related to pain. This equates to 19.7 million yearly visits to EDs across the US for pediatric pain.  
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6 The prevalence of pain-related visits in children peaked as early as 7 years old and it then  
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8 plateaued at relatively high proportions. Race and payer type yielded important differences in the  
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10 likelihood of a pain-related ED visit. Children of races other than Black and white had  
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12 significantly more painful than non-painful visits, while white children had significantly more  
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14 non-painful than painful visits. However, when compared to white race, children of races other  
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16 than Black and white were less likely to have a pain-related visit in the multivariable analysis.  
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18 Also, children with Medicaid were less likely to have a pain-related visit than children with  
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20 private insurance. An injury was involved in just under half of pain-related ED visits in the  
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22 pediatric population. Lastly, recording of pain scores remains poor among painful visits.  
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28 Few NHAMCS studies have assessed the prevalence of pain-related ED visits in the  
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30 pediatric population. In a study looking at pediatric ED visits from the NHAMCS 1997-2000  
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32 survey dataset, Drendel et al reported that 51.7% of all pediatric ED visits had a painful reason  
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34 for visit, with an approximated estimate of 10.3 million visits for pain during the 4-year study  
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36 period.[5] The prevalence of painful ED visits has remained relatively stable (now 55.6%), but  
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38 the total number of painful pediatric ED visits has grown substantially, now reaching an  
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40 estimated 19.7 million during a 1-year period. Also, these data indicate that acute pain remains  
41  
42 highly prevalent among the several reasons for which children present to the ED. This pattern is  
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44 similar to the adult literature, where pain-related ED visits remained consistently high between  
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46 42% to 45% of ED visits. [2,10]  
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51 Our study shows that the prevalence of pain-related ED visits significantly increases from  
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53 infancy till age 7, reaching a relatively high proportion that then remains similar throughout  
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3 childhood and adolescence. This is the first study to show that the proportion of pain-related ED  
4 visits is similar for children from 7 to 12 years as to the typical adolescent, 13 to 18 years. This  
5 data emphasizes the need for primary injury prevention in young children. The type and  
6 effectiveness of prevention interventions, however, will depend on factors such as child's age,  
7 level of development, and household environment.[11]  
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15 As expected, injuries (which includes trauma in the NHAMCS definition) remains a  
16 major source of pain-related ED visits during childhood. Just under half of all pediatric pain-  
17 related ED visits involved an injury, once again emphasizing the importance of more prevention  
18 initiatives. These findings are similar to older studies using the NHAMCS dataset,[5] indicating  
19 little change in the proportion of pediatric pain-related ED visits due to injuries in the last 20  
20 years.  
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29 When comparing baseline characteristics between pain- and non-pain-related pediatric  
30 ED visits, there were significant differences in race. Pain-related visits had significantly higher  
31 proportions of children who were of races other than Black or white than non-pain-related visits.  
32 This category is comprised of American Indian or Alaskan native, Asian, Native Hawaiian or  
33 Other Pacific Islander. This group is small and comprises only 4% of the total study population,  
34 but is still important given their large difference in pain to non-pain visits. Studies on adults have  
35 shown that American Indian and Alaskan native populations do have a higher rate of pain  
36 symptoms and pain conditions compared to the general US population.[12] Also, Native  
37 American adolescents were noted to have the highest rate of all the race/ethnicity groups for any  
38 substance abuse and opioid abuse.[13] Despite having more painful than non-painful visits, this  
39 group was less likely to have a pain-related ED visit than the group of white children in the  
40 multivariable analysis. Nevertheless, studies have shown that minoritized groups are at  
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3 particularly high risk of receiving inadequate pain treatment.[10,14,15] White children, for  
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5 example, are more likely to receive opioid prescriptions than non-white children.[16] Given  
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7 these known disparities in pain management, the findings of our study should emphasize the  
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9 importance of assessing and treating pain in minoritized children seen in the ED.  
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12 The pain scale was blank or unknown in more than half of pediatric pain-related ED  
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14 visits. This is similar to the percentage of pain scores documented in the study by Drendel et al  
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16 looking at 1997-2000 data from NHAMCS,[5] highlighting that pain score recording is poorly  
17  
18 performed in children and has not improved over the last two decades. Further examination will  
19  
20 be necessary to evaluate whether this missing data refers to poor reporting or to the difficulty of  
21  
22 using structured pain scales in children, especially in younger groups with immature verbal  
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24 response. The poor reporting of pain scores also occurs in adult populations.[17] For this reason,  
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26 one may argue that the difficulty of using pain scales in children does not play a major role on  
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28 the absence of these data in the NHAMCS surveys.  
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## 35 **LIMITATIONS**

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37 Our study had several limitations. First, the proportion of pain-related visits in the  
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39 youngest children (age < 6 years) may be underestimated. This group is prone to  
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41 misclassification due to their immature verbal response. Certain presentations such as fever or  
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43 irritability, for example, may have been equivocally categorized as non-pain related even though  
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45 these may represent pain-related visits. Second, our classification system for visits does not rely  
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47 on the reported pain score. There are two main reasons behind this decision: (1) as previously  
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49 noted, many children may be unable to respond to the standard pain score question, making it  
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51 less useful for a large portion of our population; (2) the pain score field in NHAMCS has a large  
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3 proportion of missing data. For these reasons, we used clinical knowledge to classify reasons for  
4 visits according to how painful they are likely to be. Because children classified as having  
5 painful visits are nearly 5 times as likely to report a pain score of 6 or higher and 3.5 times as  
6 likely to have a recorded pain score, we believe that the pain classification we created is  
7 appropriate for use. Third, NHAMCS is a cross-sectional survey, and tracking use among  
8 individual patients is not possible. Fourth, NHAMCS may include errors in documentation and  
9 missing data. Although NCHS standardizes data collection and processing, some inconsistencies  
10 may remain across different participating EDs. Lastly, this data may be only representative of US  
11 pediatric ED visits.[8]  
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## 26 **CONCLUSIONS**

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28 This study provides the most current prevalence of pediatric pain-related visits to EDs  
29 across the United States at 55.6%. The prevalence of pain-related visits peaks before the  
30 adolescence and it persists relatively high. Younger children should receive as much attention to  
31 injury and pain prevention as older children. Injuries, racial disparities, and poor pain score  
32 reporting should remain major topics of research in the care of pediatric acute pain in the ED.  
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## 42 **CONTRIBUTIONS STATEMENT**

43  
44 Conceptualization: JLA, FB and MMJ. Formal analysis: SAF, MMJ. Investigation: JLA, LOJS,  
45 FB, MMJ. Methodology: LOJS, FB, MMJ. Project administration: JLA. Supervision: MMJ.  
46  
47 Validation: FB MMJ. Writing-original draft: JLA. Writing-review and editing: JLA, LOJS, SAF,  
48 FB, MMJ. Guarantor: JLA, MMJ. All authors provided critical revision and contribution for  
49 important intellectual content.  
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**COMPETING INTERESTS**

None.

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**PATIENT CONSENT FOR PUBLICATION**

Not applicable / Not required.

**DATA SHARING STATEMENT**

The NHAMCS data are publicly available at  
[https://www.cdc.gov/nchs/ahcd/datasets\\_documentation\\_related.htm](https://www.cdc.gov/nchs/ahcd/datasets_documentation_related.htm).

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## LEGENDS

**Figure 1.** Percentage of pain-related visits by age using different definitions.

**Table 1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

**Table 2.** Multivariable logistic regression analysis of the association between baseline characteristics and the outcome of a pain-related visit.

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**Table 1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

	<b>Pain-related ED visit</b> 55.57%* (53.27%, 57.85%)	<b>Non-pain-related ED visit</b> 44.42%* (42.15%, 46.72%)	<b>P Value</b>
<b>Age</b>			
< 6 years	27.14% (23.13%, 31.55%)	66.16% (61.47%, 70.55%)	<0.001
6-11 years	31.58% (29.16%, 34.10%)	14.67% (12.71%, 16.88%)	<0.001
12-18 years	41.29% (36.14%, 46.63%)	19.17% (15.87%, 22.96%)	<0.001
<b>Sex</b>			
Female	48.88% (45.36%, 52.42%)	47.95% (45.19%, 50.72%)	0.732
Male	51.12% (47.58%, 54.64%)	52.05% (49.28%, 54.81%)	0.732
<b>Ethnicity</b>			
Hispanic or Latino	25.10% (18.09%, 33.71%)	25.93% (19.95%, 32.96%)	0.714
Not Hispanic or Latino	74.90% (66.29%, 81.91%)	74.07% (67.04%, 80.05%)	0.714
<b>Race</b>			
White	63.79% (57.54%, 69.61%)	70.86% (64.15%, 76.77%)	0.001
Black	30.27% (24.60%, 36.61%)	26.57% (20.89%, 33.15%)	0.07
Other	5.94% (4.32%, 8.11%)	2.56% (1.72%, 3.82%)	0.001
<b>Region</b>			
Northeast	12.92% (7.84%, 20.57%)	13.69% (8.00%, 22.46%)	0.592
Midwest	24.77% (17.79%, 33.39%)	24.63% (16.16%, 35.66%)	0.949
South	47.02% (35.34%, 59.04%)	43.15% (31.00%, 56.18%)	0.068
West	15.28% (9.21%, 24.30%)	18.53% (10.46%, 30.69%)	0.123
<b>Arrived in EMS</b>			
Yes	4.37% (3.27%, 5.83%)	5.67% (4.14%, 7.72%)	0.238
No	91.13% (84.59%, 95.06%)	89.76% (83.06%, 94.00%)	0.229
Unknown	3.90% (1.01%, 13.90%)	4.15% (1.10%, 14.47%)	0.412
Blank	0.59% (0.31%, 1.13%)	0.42% (0.19%, 0.93%)	0.546
<b>Triage (Immediacy)</b>			
Immediate	1.14% (0.29%, 4.36%) <sup>†</sup>	0.75% (0.27%, 2.06%) <sup>†</sup>	0.415
Emergent	6.00% (3.73%, 9.53%)	8.77% (5.19%, 14.44%)	0.02
Urgent	28.73% (22.63%, 35.72%)	23.87% (19.65%, 28.66%)	0.075
Semi-urgent	35.07% (28.70%, 42.02%)	31.73% (27.04%, 36.82%)	0.084
Non-urgent	4.52% (2.19%, 9.11%)	10.12% (6.66%, 15.08%)	<0.001
Unknown	24.53% (16.38%, 35.04%)	24.77% (17.01%, 34.59%)	0.891
<b>Primary Payer</b>			
Private insurance	26.05% (21.68%, 30.95%)	18.29% (14.21%, 23.22%)	<0.001
Medicare	0.35% (0.17%, 0.72%) <sup>†</sup>	0.38% (0.16%, 0.88%) <sup>†</sup>	0.865
Medicaid or CHIP	60.91% (55.13%, 66.39%)	65.80% (56.93%, 73.69%)	0.03
Self pay	4.49% (3.11%, 6.42%)	4.45% (2.92%, 6.72%)	0.961

Worker's compensation	0.03% (0.01%, 0.14%) <sup>†</sup>	0.01% (0.00%, 0.06%) <sup>†</sup>	0.382
No charge/charity	0.05% (0.01%, 0.40%) <sup>†</sup>	0.12% (0.03%, 0.54%) <sup>†</sup>	0.553
Other	1.36% (0.75%, 2.47%)	1.38% (0.72%, 2.65%)	0.963
Unknown	5.40% (2.31%, 12.12%)	7.73% (2.69%, 20.25%)	0.216
Blank	1.36% (0.47%, 3.92%)	1.85% (0.63%, 5.31%)	0.182
<b>Pain Scale</b>			
Blank/Unknown	55.91% (46.67%, 64.76%)	87.46% (83.17%, 90.78%)	<0.001
0-4 score	14.81% (11.08%, 19.52%)	6.44% (4.43%, 9.27%)	<0.001
5-10 score	29.28% (23.37%, 35.98%)	6.10% (4.15%, 8.86%)	<0.001

\*Results are presented as weighted proportions with its 95% confidence intervals.

<sup>†</sup>This represented cell sizes smaller than 30, which are considered not reliable for meaningful analysis by the NHAMCS guidelines.

**Table 2.** Multivariable logistic regression analysis of the association between baseline characteristics and the outcome of a pain-related visit.

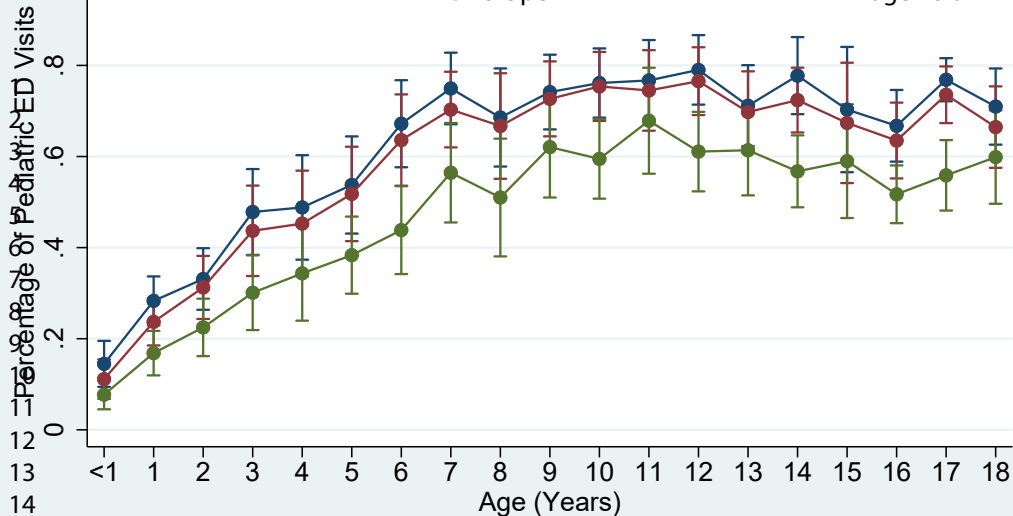
<b>Table 2.</b>	<b>Adjusted odds ratio (OR), 95% confidence interval (CI)</b>	<b>P Value</b>
<b>Age</b>		
< 6 years	Reference	
6-11 years	5.21 (4.14 to 6.55)	<.001
12-18 years	5.25 (4.23 to 6.52)	<.001
<b>Sex</b>		
Female	Reference	
Male	1.1 (0.89 to 1.39)	0.344
<b>Ethnicity</b>		
Hispanic or Latino	Reference	
Not Hispanic or Latino	1.05 (0.87 to 1.25)	0.629
<b>Race</b>		
White	Reference	
Black	0.88 (0.73 to 1.06)	0.186
Other	0.48 (0.29 to 0.81)	0.006
<b>Region</b>		
Northeast	Reference	
Midwest	0.98 (0.73 to 1.32)	0.907
South	0.95 (0.71 to 1.27)	0.716
West	0.88 (0.67 to 1.16)	0.352
<b>Arrived in EMS</b>		
Yes	Reference	
No	1.48 (0.91 to 2.43)	0.116
Blank/Unknown	1.58 (0.90 to 2.75)	0.108
<b>Triage (Immediacy)</b>		
No triage for visit, but ESA	1.06 (0.40 to 2.83)	0.876
Immediate	0.91 (0.20, 4.21)	0.870
Emergent	1.99 (1.14 to 3.48)	0.002
Urgent	Reference	
Semi-urgent	0.95 (0.71 to 1.27)	0.649
Non-urgent	2.20 (1.15 to 4.18)	0.002
Blank/Unknown	1.03 (0.73 to 1.44)	0.844
<b>Primary Payer</b>		
Private insurance	Reference	
Medicare	1.10 (0.29 to 4.21)	0.883
Medicaid or CHIP	0.75 (0.60 to 0.93)	0.008



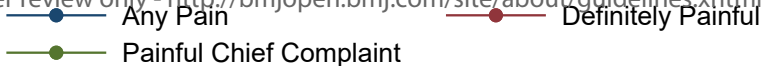
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Self pay	0.76 (0.50 to 1.16)	0.200
Worker's compensation	2.04 (0.30 to 13.95)	0.462
No charge/charity	0.45 (0.08 to 2.56)	0.363
Other	0.74 (0.29 to 1.87)	0.515
Blank/Unknown	0.55 (0.38 to 0.79)	0.002

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## Data Supplement S1

Pain-related ED visits included any visit with a Reason for Visit code that was “definitively painful” or “probably painful”.

Pain-related ED visits with painful chief complaint included any visit in which the first Reason for Visit code (first line of RFV) was categorized as “definitely painful”.

### *Definitely painful Reason for Visit codes (SYMPTOMS)*

- **1050.0** Chest pain and related symptoms
  - 1050.1 Chest pain, soreness (excludes: heart pain, 1265.0)
  - 1050.2 Chest discomfort, pressure, tightness, heaviness (includes C – pressure)
  - 1050.3 Burning sensation in the chest
- **1055.0** Pain, specified site not referable to a specific body system (includes: Buttock pain, Gluteal pain, Perineal pain; excludes: abdominal pain [1545.1-1545.3], chest pain [1050.1], phantom leg/limb [2307.0])
  - 1055.1 Rib pain
  - 1055.2 Side pain, flank pain
  - 1055.3 Groin pain (includes: Pubic pain)
  - 1055.4 Facial pain (includes: Jaw pain, Pain over eye)
- **1060.0** Pain and related symptoms, NEC
  - 1060.1 Pain, unspecified (includes: Ache all over [generalized], Incisions [postopcode 4205.0 also])
  - 1060.2 Cramps, spasms, site unspecified (excludes: Menstrual cramps [1745.2])
  - 1060.3 Stiffness, site unspecified
- **1355.0** Earache, or ear infection
  - 1355.1 Earache, pain
  - 1355.2 Ear infection
- **1545.0** Stomach and abdominal pain, cramps and spasms (includes: gastric pain; excludes: groin pain [1055.3])
  - 1545.1 Abdominal pain, cramps, spasms, NOS (includes: Abdominal discomfort, NO, Gas pains, intestinal colic)
  - 1545.2 Lower abdominal pain, cramps, spasms (includes: Right lower quadrant [RLQ] pain, Left lower quadrant [LLQ] pain, inguinal pain)
  - 1545.3 Upper abdominal pain, cramps, spasms (includes: Epigastric pain, Left upper quadrant (LUQ) pain, Pain in umbilical region, Right upper quadrant (RUQ) pain).
- **1210.0** Headache, pain in head (includes: Post-traumatic [also code 5575.0]; excludes: migraine [2365.0], sinus headache [1410.1], symptoms of head, NEC [1207.0])
- **1265.0** Heart pain (includes: Anginal pain, heart distress, pain over heart; excludes: angina pectoris [2515.0], chest pain [1050.1])
- **1320.1** Eye pain (includes: irritation)
- **1320.3** Eye burning, stinging
- **1410.1** Sinus pain and pressure (includes: Sinus headache)
- **1455.1** Soreness (Includes: Throat hurts)
- **1455.2** Pain (burning, throat on fire)

- **1485.1** Lung pain
- **1500.1** Toothache
- **1500.2** Gum pain
- **1510.1** Pain, burning, soreness (1510.0 is symptoms referable to mouth)
- **1515.1** Pain (1515.0 is symptoms referable to tongue)
- **1605.1** Pain (includes: burning, irritation) (1605.0 is symptoms referable to anus-rectum)
- **1610.1** Pain (1610.0 is symptoms of liver, gallbladder, and biliary tract)
- **1650.0** Painful urination (includes: Burning, discomfort)
- **1665.1** Pain (1665.0 is symptoms of bladder)
- **1670.1** Pain (1670.0 is symptoms of the kidneys)
- **1700.1** Pain, aching, soreness, tenderness, painful erection (1700.0 is symptoms of penis)
- **1715.1** Pain, aching, tenderness (1715.0 is symptoms of the scrotum and testes)
- **1745.2** Painful menstruation (dysmenorrhea) (includes: Menstrual cramps, pain in legs and back during menstruation) (1745.0 is menstrual symptoms, other and unspecified)
- **1765.1** Pain (1765.0 is other vaginal symptoms)
- **1775.1** Pain (1775.0 is pelvic symptoms)
- **1790.1** Pain during pregnancy
- **1800.0** Pain or soreness of breast (includes: Tenderness)
- **1870.1** Pain (1870.0 is skin irritations, NEC)
- **1900.1** Neck symptoms (includes: pain, ache, soreness, discomfort)
- **1905.1** Back symptoms (includes: pain, ache, soreness, discomfort)
- **1910.1** Low back symptoms (includes: pain, ache, soreness, discomfort)
- **1915.1** Hip symptoms (includes: pain, ache, soreness, discomfort)
- **1920.1** Leg symptoms (includes: pain, ache, soreness, discomfort)
- **1925.1** Knee symptoms (includes: pain, ache, soreness, discomfort)
- **1930.1** Ankle symptoms (includes: pain, ache, soreness, discomfort)
- **1935.1** Foot and toe symptoms (includes: pain, ache, soreness, discomfort)
- **1940.1** Shoulder symptoms (includes: pain, ache, soreness, discomfort)
- **1945.1** Arm symptoms (includes: pain, ache, soreness, discomfort)
- **1950.1** Elbow symptoms (includes: pain, ache, soreness, discomfort)
- **1955.1** Wrist symptoms (includes: pain, ache, soreness, discomfort)
- **1960.1** Hand and finger symptoms (includes: pain, ache, soreness, discomfort)
- **1965.1** Symptoms of unspecified muscles (includes: pain, ache, soreness, discomfort)
- **1970.1** Symptoms of unspecified joints (includes: pain, ache, soreness, discomfort)
- **1975.1** Bowlegged, knock-kneed (1975.0 is Musculoskeletal deformities)
- **1980.1** Other musculoskeletal symptoms (includes: bone pain, stump pain)

*Definitely painful Reason for Visit codes (CONDITIONS)*

- **2010.0** Streptococcal infection (includes: Streptococcal tonsillitis, Scarlet fever)
- **2365.0** Migraine headache
- **2655.0** Appendicitis, all types
- **4521.0** Major surgery
- **5005.0** Fractures and dislocations, Head and face (includes: facial bones, jaw, nose, skull)
- **5010.0** Fracture and dislocation, Spinal column (includes: back, neck, vertebrae)

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- 4 • **5015.0** Fractures and dislocations, Trunk area except spinal column (includes: clavicle, collarbone, pelvic scapula, rib)
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- 6 • **5020.0** Fractures and dislocations, Leg (includes: femur, fibula, hip, knee, tibia)
- 7 • **5025.0** Fractures and dislocations, Ankle
- 8 • **5030.0** Fractures and dislocations, Foot and toes
- 9 • **5035.0** Fractures and dislocations, Arm (includes: elbow, humerus, radius, shoulder, ulna)
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- 11 • **5040.0** Fractures and dislocations, Wrist
- 12 • **5045.0** Fractures and dislocations, Hand and fingers
- 13 • **5050.0** Fractures and dislocations, Fracture, other and unspecified
- 14 • **5105.0** Sprains and strains, Cervical spine, neck (includes: whiplash)
- 15 • **5110.0** Sprains and strains, Back
- 16 • **5115.0** Sprains and strains, Knee
- 17 • **5120.0** Sprains and strains, Ankle
- 18 • **5125.0** Sprains and strains, Wrist
- 19 • **5130.0** Sprains and strains, other and unspecified
- 20 • **5205.0** Lacerations and cuts, Head and neck area (excludes: face [5210.0])
- 21 • **5210.0** Lacerations and cuts, Facial area (includes: eye, ear, forehead, lip, nose)
- 22 • **5215.0** Lacerations and cuts, Trunk area (includes: perineum)
- 23 • **5220.0** Lacerations and cuts, Lower extremity (includes: ankle, foot)
- 24 • **5225.0** Lacerations and cuts, Upper extremity (includes: arm, fingers, hand, wrist)
- 25 • **5230.0** Lacerations and cuts, site unspecified
- 26 • **5305.0** Puncture wounds, Head, neck, and facial area
- 27 • **5310.0** Puncture wounds, Trunk area
- 28 • **5315.0** Puncture wounds, Lower extremity
- 29 • **5320.0** Puncture wounds, Upper extremity
- 30 • **5325.0** Puncture wounds, site unspecified (includes: Needlestick, NOS)
- 31 • **5405.0** Contusions, abrasions, and bruises, Head, neck, and face (excludes: Eye [5410.0])
- 32 • **5410.0** Contusions, abrasions, and bruises, Eye (includes: black eye, contusion, corneal abrasion)
- 33 • **5415.0** Contusions, abrasions, and bruises, Trunk area (includes: injury to scrotum)
- 34 • **5420.0** Contusions, abrasions, and bruises, Lower extremity
- 35 • **5425.0** Contusions, abrasions, and bruises, Upper extremity
- 36 • **5430.0** Contusions, abrasions, and bruises, site unspecified
- 37 • **5505.0** Injury, other, and unspecified type, Head, neck, and face (includes: post concussive syndrome, tooth fracture, tooth knocked out, traumatic brain injury; excludes: Loose tooth [no injury] 1500.0)
- 38 • **5510.0** Injury, other, and unspecified type, Eye
- 39 • **5515.0** Injury, other, and unspecified type, Back (includes: Tail bone)
- 40 • **5520.0** Injury, other, and unspecified type, Chest and abdomen (includes: Internal injuries)
- 41 • **5525.0** Injury, other, and unspecified type, Hip
- 42 • **5535.0** Injury, other, and unspecified type, Knee
- 43 • **5530.0** Injury, other, and unspecified type, Leg
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- **5540.0** Injury, other, and unspecified type, Ankle
- **5545.0** Injury, other, and unspecified type, Foot and toe(s)
- **5550.0** Injury, other, and unspecified type, Shoulder
- **5555.0** Injury, other, and unspecified type, Arm
- **5560.0** Injury, other, and unspecified type, Elbow
- **5565.0** Injury, other, and unspecified type, Wrist
- **5570.0** Injury, other, and unspecified type, Hand and finger(s)
- **5575.0** Injury, multiple or unspecified (includes: post traumatic NOS headache)
- **5705.0** Burns, all degrees, Head, neck, and face (includes: eyes)
- **5710.0** Burns, all degrees, Trunk area
- **5715.0** Burns, all degrees, Extremities (includes: lower, upper)
- **5720.0** Burns, all degrees, Burn site unspecified
- **5760.0** Bites, animal, snake, human

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3 *Probably painful Reason for Visit codes (SYMPTOMS)*

- 4 • **1220.3** Disturbances of sensation, Abnormal sensation (paresthesia) (includes: burning
- 5 legs, burning, tingling sensation, needles and pins, prickly feeling, stinging)
- 6 • **1430.0** Breathing problems (includes: Hurts to breath)
- 7 • **1791.0** Postpartum problems (includes: bleeding, pain; excludes: postpartum
- 8 examination, routine)
- 9 • **2675.5** Temporomandibular joint (TMJ) pain, temporomandibular joint (TMJ) syndrome
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13 *Probably painful Reason for Visit codes (CONDITIONS)*

- 14 • **1840.0** Infections of skin, NOS (includes: draining wounds, infected blister, infected
- 15 wound; excludes: athlete's foot [2025.0], wound drainage [as treatment])
  - 16 ○ **1840.1** Infection of skin of head or neck area
  - 17 ○ **1840.2** Infection of skin of arm, hand, or finger
  - 18 ○ **1840.3** Infection of skin of leg, foot, or toe
- 19 • **1240.0** Other symptoms referable to the nervous system (includes: brain lesion,
- 20 confusion, cognitive decline, damaged nerves, neuralgia, neurovegetative, pinched nerve,
- 21 postictal; excludes: nerve block 4560.0)
- 22 • **1825.0** Symptoms of sexual dysfunction (includes: dyspareunia, painful intercourse;
- 23 excludes: psychological disorders)
- 24 • **2250.0** Anemia (includes: anemia, NOS, iron deficiency anemia, pernicious anemia,
- 25 sickle cell anemia)
- 26 • **2450.0** Otitis media
- 27 • **2515.0** Ischemic heart disease (includes: angina pectoris, arteriosclerotic cardiovascular
- 28 disease, arteriosclerotic heart disease, coronary, coronary heart disease, heart attack,
- 29 ischemic cardiomyopathy, myocardial infarction)
- 30 • **2600.0** Upper respiratory infections except tonsillitis (includes: croup, laryngitis,
- 31 pharyngitis, rhinitis, sinusitis; excludes: allergic rhinitis [2636.0], cold [1445.0], nose
- 32 infection NOS [1405.3], sinus infection NOS [1410.2], throat infection NOS [1455.3])
- 33 • **2605.0** Tonsillitis
- 34 • **2650.0** Diseases of the esophagus, stomach, and duodenum (includes: Barrett's
- 35 esophagus, duodenal ulcer, esophageal ulcer, esophagitis, gastritis, GERD, peptic ulcer,
- 36 reflux, stomach ulcer; excludes: gastroenteritis [2005.0], stomach flu [1540.0])
- 37 • **2665.0** Diseases of the intestine and peritoneum (includes: abscess rectal, adhesions
- 38 [abdominal or NOS; if states post-op, code 42050 also], Crohn's disease, diverticulitis,
- 39 diverticulosis, fissure – rectal and anal, fistula – rectal and anal, ileitis, irritable bowel
- 40 syndrome, proctitis, small bowel obstruction, spastic colitis, ulcerative colitis; excludes:
- 41 intestinal virus [1540.0])
- 42 • **2675.1** Dental abscess
- 43 • **2675.2** Dental cavities
- 44 • **2705.0** Urinary tract disease except cystitis (includes: bladder stones, glomerulonephritis,
- 45 glomerulonephrosis, kidney cyst, kidney stones, neurogenic bladder, pyelonephritis, renal
- 46 failure, ureteral calculus, urethritis, urolithiasis; excludes: bladder infection [1665.2],
- 47 kidney infection NOS [1670.2], passed stones [1680.0], urinary tract infection [1675.0])
- 48 • **2900.0** Arthritis (includes: osteoarthritis, rheumatism NOS, rheumatoid arthritis, septic)
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- 4 • **2905.0** Nonarticular rheumatism (includes: bursitis, ganglion cyst, lumbago, myositis, polymyalgia rheumatica, radiculitis/radiculopathy, synovitis, tendinitis, tenosynovitis; excludes: rheumatism NOS [2900.0])
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- 7 • **4520.0** Minor surgery
- 8 • **4540.0** Cast, splint – application, removal
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- 10 • **5920.0** Adverse effects of environment (includes: air pollution, frostbite, hypothermia, noise pollution, sun damage, sun poisoning, too hot, water pollution)
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- 12 • **5930.0** Complications of surgical or medical procedures and treatments (includes: artificial openings [ostomies, stoma], catheter, foreign body [accidentally left during surgery eg. Sponge, instrument], medical complication NOS, non-healing surgical wound, post-op fever, post-op hemorrhage [bleeding], post-op infection or inflammation, post-op [septicemia], shunt, tubes, wound dehiscence; excludes: postpartum conditions [1791.0 and 1810.2], complication of transplant organs [4565.1-4565.2])
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- 18 • **5805.0** Motor vehicle accident, type of injury unspecified (includes: auto accident, car accident, motorcycle accident)
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- 21 • **5810.0** Accident NOS (includes: fall, type or location of injury unspecified)
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- 23 • **5815.0** Violence NOS (includes: abuse, beat up, in a fight, stabbing; excludes: violence against oneself [5818.0, 5820.0])
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- 25 • **5818.0** Intentional self-mutilation (includes: self-abuse, tried to hurt self; excludes: suicide attempt [5820.0])
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- 27 • **5820.0** Suicide attempt (includes: found in car with motor running, hanging oneself, slashed wrists, stabbed oneself).
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## Data Supplement S2

### Codes by body system:

#### Musculoskeletal

- 1900 Neck symptoms
- 1905 Back symptoms
- 1910 Low back symptoms
- 1915 Hip symptoms
- 1920 Leg symptoms
- 1925 Knee symptoms
- 1930 Ankle symptoms
- 1940 Shoulder symptoms
- 1945 Arm symptoms
- 1950 Elbow symptoms
- 1955 Wrist symptoms
- 1960 Hand and finger symptoms (includes ring stuck on finger)
- 5005 Fractures and dislocations, Head and face
- 5020 Fractures and dislocations, Leg
- 5035 Fractures and dislocations, Arm
- 5045 Fractures and dislocations, Hand and Fingers
- 5050 Fractures and dislocations, other and unspecified
- 5105 Sprains and strains, Cervical spine, neck
- 5115 Sprains and strains, Knee
- 5120 Sprains and strains, Ankle
- 5405 Contusions, abrasions, and bruises, Head, neck, and face
- 5415 Contusions, abrasions, and bruises, Trunk area
- 5420 Contusions, abrasions, and bruises, Lower extremity
- 5425 Contusions, abrasions, and bruises, Upper extremity
- 5505 Injury, other and unspecified type, Head, neck, and face
- 5515 Injury, other and unspecified type, Back
- 5520 Injury, other and unspecified type, Chest and abdomen (includes internal injuries)
- 5530 Injury, other and unspecified type, Leg
- 5535 Injury, other and unspecified type, Knee
- 5540 Injury, other and unspecified type, Ankle
- 5545 Injury, other and unspecified type, Foot and toe(s)
- 5550 Injury, other and unspecified type, Shoulder
- 5555 Injury, other and unspecified type, Arm
- 5560 Injury, other and unspecified type, Elbow
- 5565 Injury, other and unspecified type, Wrist
- 5570 Injury, multiple or unspecified (includes post-traumatic NOS headache)

#### ENT

- 1355 Earache, or ear infection
- 1410 Sinus problems
- 1455 Symptoms referable to throat, raw throat

- 2010 Streptococcal infection

### Abdominal

- 1545 Stomach and abdominal pain, cramps and spasms

### Laceration

- 5205 Lacerations and cuts, Head and neck area
- 5210 Lacerations and cuts, Facial area
- 5215 Lacerations and cuts, Trunk area
- 5220 Lacerations and cuts, Lower extremity
- 5225 Lacerations and cuts, Upper extremity
- 5230 Laceration and cuts, site unspecified
- 5305 Puncture wounds, Head, neck and facial area
- 5315 Puncture wounds, Trunk area
- 5315 Puncture wounds, Lower extremity
- 5320 Puncture wounds, Upper extremity
- 5325 Puncture wound, site unspecified

### Headache

- 1210 Headache, pain in head
- 2365 Migraine headache

### General Pain

- 1800 Pain or soreness of breast
- 1055 Pain specified site not referable to a specific body system
- 1060 Pain and related symptoms, NEC
- 5430 Contusions, abrasions, and bruises, site unspecified
- 5575 Injury, multiple or unspecified
- 5130 Sprain or strain, other and unspecified
- 1970 Symptoms of unspecified joints
- 1965 Wrist symptoms

### Chest

- 1050 Chest pain and related symptoms (not referable to a specific body system)

### Eye

- 1320 Abnormal sensations of the eye
- 5510 Injury, other and unspecified type, Eye

### Bite

- 5760 Bites, Animal, snake, human

### Genitourinary

- 1650 Painful urination
- 1605 Symptoms referable to anus-rectum

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- 1700 Symptoms of penis
- 1715 Symptoms of scrotum and testes
- 1745 Menstrual symptoms, other and unspecified
- 1765 Other vaginal symptoms
- 1775 Pelvic symptoms
- 1790 Problems of pregnancy

#### Burn

- 5705 Burns, all degrees, Head, neck, and face
- 5715 Burns, all degrees, Extremities
- 5720 Burn, site unspecified

#### Oral

- 1500 Symptoms of teeth and gums
- 1510 Symptoms referable to mouth

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## Data Supplement S3

**Table S3.1.** Baseline characteristics comparison between pain-related and non-pain-related pediatric ED visits.

<b>All ED Visits</b>	
<b>Age</b>	
< 6 years	44.47% (40.20%, 48.83%)
6-11 years	24.07% (22.83%, 25.35%)
12-18 years	31.46% (27.25%, 26.00%)
<b>Sex</b>	
Female	48.47% (46.70%, 50.25%)
Male	51.53% (49.75%, 53.30%)
<b>Ethnicity</b>	
Hispanic or Latino	25.47% (19.16%, 33.00%)
Not Hispanic or Latino	74.53% (67.00%, 80.84%)
<b>Race</b>	
White	67.72% (61.60%, 73.29%)
Black	28.21% (22.82%, 34.32%)
Other	4.06% (3.10%, 5.32%)
<b>Region</b>	
Northeast	13.27% (8.00%, 21.21%)
Midwest	24.71% (17.22%, 34.12%)
South	45.30% (33.52%, 57.63%)
West	16.72% (9.84%, 26.97%)
<b>Metropolitan Statistical Area (MSA)</b>	
MSA	86.96% (75.42%, 93.55%)
Non-MSA	13.04% (6.45%, 24.58%)
<b>Arrived in EMS</b>	
Yes	4.95% (4.00%, 6.11%)
No	90.52% (84.10%, 94.52%)
Unknown	4.01% (1.05%, 14.13%)
Blank	0.52% (0.34%, 0.79%)
<b>Triage (Immediacy)</b>	
Immediate	0.97% (0.29%, 3.22%)
Emergent	7.23% (4.43%, 11.58%)
Urgent	26.57% (21.79%, 31.97%)
Semi-urgent	33.59% (28.20%, 39.44%)
Non-urgent	7.01% (4.15%, 11.60%)
Unknown	16.30% (10.35%, 24.72%)
<b>Primary Payer</b>	
Private insurance	22.60% (18.55%, 27.24%)
Medicare	0.36% (0.19%, 0.69%)

Medicaid or CHIP	63.08% (56.22%, 69.46%)
Self-pay	4.47% (3.14%, 6.31%)
Worker's compensation	0.02% (0.01%, 0.07%)
No charge/charity	0.08% (0.02%, 0.28%)
Other	1.37% (0.81%, 2.31%)
Unknown	6.44% (2.48%, 15.70%)
Blank	1.58% (0.55%, 4.49%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

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## Data Supplement S4

**Table S4.1.** Sensitivity analysis - baseline characteristics comparison between definitely painful visits and non-painful visits.

	<b>Definitely Painful Reason for Visit</b> 54.27% (51.79% to 56.50%)	<b>Non-Pain Related Visits</b> 45.85% (43.50% to 48.21%)
<b>Age</b>		
< 6 years	25.93% (22.08%, 30.20%)	66.16% (61.47%, 70.55%)
6-11 years	32.33% (29.68%, 35.10%)	14.67% (12.71%, 16.88%)
12-18 years	41.73% (36.47%, 47.19%)	19.17% (15.87%, 22.96%)
<b>Sex</b>		
Female	49.21% (45.30%, 53.14%)	47.95% (45.19%, 50.72%)
Male	50.79% (46.86%, 54.70%)	52.05% (49.28%, 54.81%)
<b>Ethnicity</b>		
Hispanic or Latino	25.46% (18.06%, 34.61%)	25.93% (19.95%, 32.96%)
Not Hispanic or Latino	74.54% (65.39%, 81.94%)	74.07% (67.04%, 80.05%)
<b>Race</b>		
White	71.09% (64.41%, 76.96%)	70.86% (64.15%, 76.77%)
Black	26.50% (20.82%, 33.09%)	26.57% (20.89%, 33.15%)
Other	2.41% (1.67%, 3.45%)	2.56% (1.72%, 3.82%)
<b>Region</b>		
Northeast	12.66% (7.67%, 20.17%)	13.69% (8.00%, 22.46%)
Midwest	24.89% (17.78%, 33.68%)	24.63% (16.16%, 35.66%)
South	47.05% (35.24%, 59.21%)	43.15% (31.00%, 56.18%)
West	15.40% (9.19%, 24.66%)	18.53% (10.46%, 30.69%)
<b>Arrived in EMS</b>		
Yes	3.95% (2.84%, 5.46%)	5.67% (4.14%, 7.72%)
No	91.69% (85.19%, 95.49%)	89.76% (83.06%, 94.00%)
Blank/Unknown	4.36% (1.34%, 13.26%)	4.57% (1.34%, 14.48%)
<b>Triage (Immediacy)</b>		
No triage for visit but ESA	0.83% (0.34%, 2.03%)	1.04% (0.42%, 2.54%)
Immediate	1.04% (0.28%, 3.85%)	0.75% (0.27%, 2.06%)
Emergent	5.49% (3.36%, 8.84%)	8.77% (5.19%, 14.44%)
Urgent	28.78% (22.51%, 35.99%)	23.87% (19.65%, 28.66%)
Semi-urgent	35.32% (28.88%, 42.33%)	31.73% (27.04%, 36.82%)
Non-urgent	4.63% (2.27%, 9.21%)	10.12% (6.66%, 15.08%)
Blank/Unknown	20.09% (13.04%, 29.66%)	19.66% (13.37%, 27.96%)
<b>Primary Payer</b>		
Private insurance	25.90% (21.61%, 30.71%)	18.29% (14.21%, 23.22%)
Medicare	0.37% (0.18%, 0.77%) <sup>†</sup>	0.38% (0.16%, 0.88%) <sup>†</sup>
Medicaid or CHIP	61.24% (55.39%, 66.79%)	65.80% (56.93%, 73.69%)

Self pay	4.57% (3.17%, 6.56%)	4.45% (2.92%, 6.72%)
Worker's compensation	0.03% (0.01%, 0.14%) <sup>†</sup>	0.01% (0.00%, 0.06%) <sup>†</sup>
No charge/charity	0.06% (0.01%, 0.43%) <sup>†</sup>	0.12% (0.03%, 0.54%) <sup>†</sup>
Other	1.12% (0.60%, 2.07%)	1.38% (0.72%, 2.65%)
Blank/Unknown	6.71% (3.22%, 13.42%)	9.58% (4.03%, 21.11%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

<sup>†</sup>This represented cell sizes smaller than 30, which are considered not reliable for meaningful analysis by the NHAMCS guidelines.

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## Data Supplement S5

**Table S5.1.** Body system involvement for all pain-related ED visits stratified by the presence of injury/trauma.

Body system	Pain-related ED visits with injury/trauma*	Pain-related ED visits without injury/trauma*
Musculoskeletal	69.5% (63.7%, 74.8%)	7.1% (4.5%, 11.1%)
Skin Laceration	14.7% (11.4%, 18.8%)	0.0% (0.0%, 0.0%)
General Pain	3.7% (2.4%, 5.5%)	6.2% (4.0%, 9.5%)
Headache	3.2% (2.0%, 5.2%)	8.8% (6.6%, 11.8%)
Eye	1.6% (0.8%, 3.2%)	0.8% (0.3%, 2.3%)
Bite	2.3% (1.4%, 3.8%)	0.0% (0.0%, 0.0%)
Burn	1.9% (0.9%, 4.1%)	0.0% (0.0%, 0.0%)
Abdominal	0.6% (0.3%, 1.4%)	32.0% (25.5%, 39.3%)
Ear/Nose/Throat	0.7% (0.3%, 1.7%)	31.0% (23.1%, 40.2%)
Genital-urinary/Dysuria	0.2% (0.1%, 0.9%)	5.7% (4.2%, 7.7%)
Chest	0.9% (0.3%, 2.4%)	6.9% (4.8%, 10.0%)
Oral	0.6% (0.2%, 2.1%)	1.3% (0.5%, 2.3%)

\*Results are presented as weighted proportions with its 95% confidence intervals.

**Table S5.2.** Body system involvement for pain-related ED visits with a painful chief complaint.

Body system	Proportion* (95% CI)
Musculoskeletal	39.9% (34.6%, 45.6%)
Abdominal	16.0% (11.9%, 21.1%)
Ear/Nose/Throat	14.8% (12.1%, 18.0%)
Skin Laceration	7.6% (5.6%, 10.2%)
Headache	5.8% (4.5%, 7.3%)
General Pain	4.7% (3.3%, 6.9%)
Chest	3.8% (2.6%, 5.6%)
Genital-urinary/Dysuria	2.8% (2.1%, 3.8%)
Eye	1.3% (0.8%, 2.1%)
Bite	1.2% (0.7%, 2.0%)
Burn	1.0% (0.4%, 2.2%)
Oral	0.9% (0.4%, 1.9%)

\*Results are presented as weighted proportions with its 95% confidence intervals.



**STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies***

Section/Topic	Item #	Recommendation	Reported on page #
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7, 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7, 8
Bias	9	Describe any efforts to address potential sources of bias	-
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8, 9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	9
		(b) Describe any methods used to examine subgroups and interactions	-
		(c) Explain how missing data were addressed	-
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
<b>Results</b>			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 10
		(b) Indicate number of participants with missing data for each variable of interest	-
Outcome data	15*	Report numbers of outcome events or summary measures	10
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10, 11
		(b) Report category boundaries when continuous variables were categorized	-
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11, 12, 13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).