



BMJ Open Epidemiology of paediatric pain-related visits to emergency departments in the USA: a cross-sectional study

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ABSTRACT

Objective To describe the epidemiology of paediatric pain-related visits to emergency departments (EDs) across the USA.

Design Cross-sectional study.

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

Participants Paediatric (age ≤18 years) ED visits in the 2017 NHAMCS data set.

Data analysis Each visit was coded as pain-related or non-pain-related using the 'reason for visit' variable. Weighted proportions were calculated with 95% CIs. Logistic regression was used to compare odds of pain-related visits.

Outcome measures Prevalence of pain-related visits among paediatric ED visits.

Results There were an estimated 35 million paediatric ED visits in the USA 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 6–7 and plateaued at relatively high proportions. Children of races other than white or black had lower odds of having a pain-related visit (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 (Children's Health Insurance Program) 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 paediatric ED visits across the USA. The prevalence of pain-related visits peak before adolescence and it continues relatively high until the age 18. Injury, racial disparities in pain and poor pain score reporting should remain major topics of study in the paediatric population.

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

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 USA.
- 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 data set.
- The National Center for Health Statistics standardises data collection and processing; however, some inconsistencies may remain across different participating emergency departments.

on paediatric 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 paediatric pain ED epidemiology studies was performed in Canada in 1996.³ This study used 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 enrolment 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 enrolment was published.⁴ This study was performed at a single large urban centre and used 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 paediatric national level epidemiology study on acute pain in US EDs was performed using data from 1997 to 2000.⁵ This study used 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 are outdated by two decades. It is unclear if pain remains a major driver of ED visits in the paediatric population.

Our goal in this study was to examine the current prevalence of pain-related visits among children presenting to EDs in the USA. 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 study will provide a background for trends in paediatric pain prevalence looking towards the utilisation and optimisation of analgesics.

METHODS

Study design, setting and participants

This was a cross-sectional study of all children (age ≤ 18 years) in the 2017 NHAMCS, which was released in November of 2019, the latest available at the start of this study. This deidentified data are publicly available from the National Center for Health Statistics (NCHS) and provide a representative sample of ED visits throughout the USA.⁶ We followed the STrengthening the Reporting of OBservational studies in Epidemiology guidelines for reporting observational studies.⁷

Data source

The NHAMCS ED data set has been collected yearly since 1992 to describe US ED visits and utilisation.⁸ NHAMCS uses extensive surveys in randomly selected sampling units that are then weighted to make national visit-level estimates. The sampling of Emergency Service Areas (ESAs) allows for inclusion of both academic and non-academic institutions.⁸ In the 2017 NHAMCS data set, a total of 479 hospitals were selected of which 374 were in scope and had eligible EDs. Of these, 234 responded, yielding an unweighted ED response rate of 62.6%. This corresponded to a total of 331 ESAs that were identified from the EDs. Of these, 240 responded fully or adequately by providing forms for at least one-half of their expected visits based on the total number of visits during the reporting period. In all, 16 709 patient record forms (PRFs) were submitted electronically. The resulting unweighted ESA sample response rate was 72.5%, and the overall unweighted two-stage sampling response rate was 45.4% (48.4% weighted). The surveys, called PRFs, are obtained by trained individuals from the US Census Bureau. Each ESA is surveyed over a randomly selected 4-week period that rotates each survey year. Subsequently, these surveys are then weighted using population statistics to estimate visits on a national level.

Variables and measurements

Data were collected through a PRF that can be viewed on the NCHS website.⁹ The PRF lists up to five ‘reasons

for visit’ (RFV), including the first-listed RFV (ie, chief complaint) and up to four additional symptoms, problems or issues. We used these five RFV variables to initially categorise visits as pain-related or non-pain-related.

Codes related to pain were identified by two methods: (1) ‘pain’ keywords and (2) by physician consensus. First, all RFV codes that contained symptom keywords such as ‘pain’, ‘burn’, ‘stinging’, ‘soreness’, ‘ache’ or ‘algia’ were classified as ‘definitely painful’. Second, to classify conditions that did not contain the previously mentioned keywords, two independent physicians, one board-certified in emergency and one board-certified in paediatric emergency medicine, reviewed all of the codes for conditions and classified them as ‘definitely painful’, ‘probably painful’ or non-painful. Any disagreements were settled with discussion and consensus. The full list of codes considered as ‘definitely painful’ or ‘probably painful’ is detailed in online supplemental data S1.

Pain-related ED visits were defined as any visit with at least one pain-related RFV code (not necessarily the first-listed RFV code), including those either categorised as ‘definitely painful’ or ‘probably painful’. Pain-related ED visits with a painful chief complaint were defined as any visit in which the first-listed RFV code was a ‘definitely painful’ condition. This included only those ‘definitely painful’ conditions or symptoms present at the first-listed RFV, which is the chief complaint of the visit. Pain-related ED visits with injury were defined by the variable ‘injury’ in the PRF. NHAMCS classifies injury visits as those involving injury, trauma, overdose, poisoning or adverse effects of medical treatments. The original data set does not allow to separate these three categories but rather classifies them under the same umbrella of the ‘injury’ variable. Visits in which a ‘definitely painful’ or ‘probably painful’ code was present and the variable ‘injury’ was present were considered to be pain-related ED visits with injury.

For pain-related ED visits with a painful chief complaint, we categorised the first-listed RFV code (ie, chief complaint) by body systems including musculoskeletal, abdominal, ear/nose/throat, laceration, headache, general pain, chest, genital-urinary/dysuria, eye, bite, oral and burn-related complaints. The full list of codes and categorisation is detailed in online supplemental data S2.

Data analysis

Analysis, including the logistic regression model, was completed using the *svy* suite of tools in Stata V.15, which considers the sampling design of the NHAMCS survey to accurately calculate nationally weighted estimates and their variability (StataCorp LLC, 2017). The total number of paediatric visits, both pain-related and non-pain-related, was estimated. Descriptive statistics were calculated for age, sex, ethnicity, race, geographic region, arrival by emergency medical services, primary payer source, immediacy of visit, injury involvement and pain scale rating. For the variables age, sex, ethnicity and race,

we used imputed values provided by NHAMCS to reduce the effect of missingness on our results. Children were grouped by age into three developmental stages: age <6, age 6–11 and age 12–18 years. Proportions of trauma involvement among pain-related visits and categorisation by body system involved among pain-related visits were also calculated. Weighted proportions were calculated with 95% CIs. Characteristics between pain-related and non-pain-related visits were compared using t-tests to compare proportions for each baseline characteristic.

ORs and 95% CI were produced from a multivariable analysis using logistic regression to identify factors associated with pain-related visits. The same variables previously described were included as covariates in the model. We selected variables to include in the model based on theoretical relevance.

Patient and public involvement

Patients and/or public were not involved in this study.

RESULTS

We analysed all 4112 paediatric ED visits in the 2017 NHAMCS data set, which represents an estimated 35 million visits during the study period. Across all paediatric ED visits (pain-related and non-pain-related visits), 44.5% of the children were younger than 6 years of age, 24.1% aged 6–11 years and 31.5% aged 12–18 years. The cohort was 48.5% woman. White children made up 67.7% of the study population, followed by Black children at 28.2%. Hispanic or Latino ethnicity comprised 25.5% of the cohort. Arrival by ambulance occurred in 5.0% (95% CI 4.0% to 6.1%) of all paediatric ED visits (online supplemental data S3).

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

Baseline characteristics between pain-related ED visits and non-pain-related ED visits were generally similar, except for race (non-pain-related visits had a higher proportion of white children than pain-related visits at 70.9% vs 63.8%, $p=0.001$), insurance (pain-related visits had a higher proportion of children with private insurance than non-pain-related visits at 26.0% vs 18.3%, $p<0.001$) and triage (children triaged as non-urgent were more likely to have a non-pain-related visit at 10.1% vs 4.5%, $p<0.001$). Black children represented similar proportions of pain-related and non-pain-related visits, but pain-related visits had higher proportions of children with races other than Black and White than non-pain-related

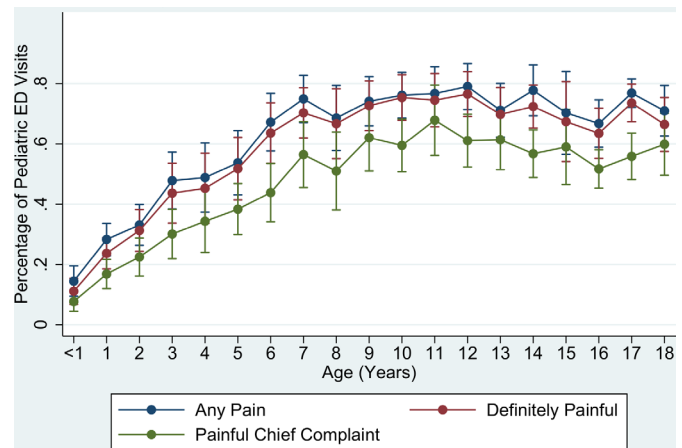


Figure 1 Percentage of pain-related visits by age using different definitions. ED, emergency department.

visits (5.9% vs 2.6%, $p=0.001$). There were no significant differences by ethnicity for pain-related and non-pain-related visits. There were no significant differences by sex. As for pain scale reporting among pain-related visits, less than 50% had pain score available (14.8% with a score 0 to 4 and 29.3% with a score 5 to 10) (table 1). The same descriptive analysis of baseline characteristics was also performed by comparing visits with ‘definitely painful’ codes to non-painful visits (online supplemental data S4).

In the multivariable analysis, older age groups (6–11 and 12–18 years) were significantly more likely to have a pain-related ED visit than the group aged <6 years (table 2). Race was also found to be an important factor associated with pain-related visits. After adjusting for age and other baseline characteristics, children with races other than Black and White were less likely than White children to have a pain-related ED visit (adjusted OR 0.48, 95% CI 0.29 to 0.81, $p=0.006$). Children with Medicaid were less likely to have a pain-related ED visit than children with private insurance (adjusted OR 0.76, 95% CI 0.60 to 0.93, $p=0.008$) (table 2).

Injury was reported in 46.5% (95% CI 42.0% to 51.0%) or an estimated 9.2 million of the pain-related visits. There were an estimated 1.3 million or 2.5% of visits with unknown injury involvement.

Among the estimated 13.6 million pain-related ED visits with a painful chief complaint, the body systems most frequently involved were musculoskeletal at 39.9% (95% CI 34.6% to 45.6%), followed by abdominal at 16.0% (95% CI 11.9% to 21.1%) and ear/nose/throat at 14.8% (95% CI 12.1% to 18.0%). In pain-related ED visits without injury, the most common body system involved was abdominal at 32.0% (95% CI 25.5% to 39.3%), followed by ear/nose/throat at 31.0% (95% CI 23.1% to 40.2%) and headache at 8.8% (95% CI 6.6% to 11.8%) (online supplemental data S5).

**Table 1** Baseline characteristic comparison between pain-related and non-pain-related paediatric ED visits

	Pain-related ED visit 55.57%* (53.27%, 57.85%)	Non-pain-related ED visit 44.42%* (42.15%, 46.72%)	P value
Age			
<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
Sex			
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
Ethnicity			
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
Race			
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
Region			
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
Arrived in EMS			
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
Triage (immediacy)			
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
Primary payer			
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
Pain Scale			
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

Continued

Table 1 Continued

	Pain-related ED visit 55.57%* (53.27%, 57.85%)	Non-pain-related ED visit 44.42%* (42.15%, 46.72%)	P value
5–10 score	29.28% (23.37%, 35.98%)	6.10% (4.15%, 8.86%)	<0.001

CHIP (Children's Health Insurance Program)

*Results are presented as weighted proportions with its 95% CIs.

†This represented cell sizes smaller than 30, which are considered not reliable for meaningful analysis by the NHAMCS guidelines. ED, emergency department; EMS, emergency medical service; NHAMCS, National Hospital Ambulatory Medical Care Survey.

DISCUSSION

In this cross-sectional study, we found that 55.6% of all US ED paediatric visits were related to pain. This equates to 19.7 million yearly visits to EDs across the US for paediatric pain. The prevalence of pain-related visits in children peaked as early as 7 years old and it then plateaued at relatively high proportions. Race and payer type yielded important differences in the likelihood of a pain-related ED visit. Children of races other than Black and White had significantly more painful than non-painful visits, while white children had significantly more non-painful than painful visits. However, when compared with white race, children of races other than Black and white were less likely to have a pain-related visit in the multivariable analysis. Also, children with Medicaid were less likely to have a pain-related visit than children with private insurance. An injury was involved in just under half of pain-related ED visits in the paediatric population. Finally, recording of pain scores remains poor among painful visits.

Few NHAMCS studies have assessed the prevalence of pain-related ED visits in the paediatric population. In a study looking at paediatric ED visits from the NHAMCS 1997–2000 survey data set, Drendel *et al* reported that 51.7% of all paediatric ED visits had a painful reason for visit, with an approximated estimate of 10.3 million visits for pain during the 4-year study period.⁵ The prevalence of painful ED visits has remained relatively stable (now 55.6%), but the total number of painful paediatric ED visits has grown substantially, now reaching an estimated 19.7 million during a 1-year period. Also, these data indicate that acute pain remains highly prevalent among the several reasons for which children present to the ED. This pattern is similar to the adult literature, where pain-related ED visits remained consistently high between 42% and 45% of ED visits.^{2 10}

Our study shows that the prevalence of pain-related ED visits significantly increases from infancy till age 7, reaching a relatively high proportion that then remains similar throughout childhood and adolescence. This is the first study to show that the proportion of pain-related ED visits is similar for children from 7 to 12 years as to the typical adolescent, 13 to 18 years. This data emphasise the need for primary injury prevention in young children. The type and effectiveness of prevention interventions,

however, will depend on factors such as child's age, level of development and household environment.¹¹

As expected, injuries (which includes trauma in the NHAMCS definition) remain a major source of pain-related ED visits during childhood. Just under half of all paediatric pain-related ED visits involved an injury, once again emphasising the importance of more prevention initiatives. These findings are similar to older studies using the NHAMCS data set,⁵ indicating little change in the proportion of paediatric pain-related ED visits due to injuries in the last 20 years.

When comparing baseline characteristics between pain-related and non-pain-related paediatric ED visits, there were significant differences in race. Pain-related visits had significantly higher proportions of children who were of races other than Black or White than non-pain-related visits. This category is comprised of American Indian or Alaskan native, Asian, Native Hawaiian or Other Pacific Islander. This group is small and comprises only 4% of the total study population but is still important given their large difference in pain to non-pain visits. Studies on adults have shown that American Indian and Alaskan native populations do have a higher rate of pain symptoms and pain conditions compared with the general US population.¹² Also, Native American adolescents were noted to have the highest rate of all the race/ethnicity groups for any substance abuse and opioid abuse.¹³ Despite having more painful than non-painful visits, this group was less likely to have a pain-related ED visit than the group of White children in the multivariable analysis. Nevertheless, studies have shown that minoritised groups are at particularly high risk of receiving inadequate pain treatment.^{10 14 15} White children, for example, are more likely to receive opioid prescriptions than non-white children.¹⁶ Given these known disparities in pain management, the findings of our study should emphasise the importance of assessing and treating pain in minoritised children seen in the ED.

The pain scale was blank or unknown in more than half of paediatric pain-related ED visits. This is similar to the percentage of pain scores documented in the study by Drendel *et al* looking at 1997–2000 data from NHAMCS,⁵ highlighting that pain score recording is poorly performed in children and has not improved over the

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

Age		
<6 years	Reference	
6–11 years	5.21 (4.14 to 6.55)	<0.001
12–18 years	5.25 (4.23 to 6.52)	<0.001
Sex		
Female	Reference	
Male	1.1 (0.89 to 1.39)	0.344
Ethnicity		
Hispanic or Latino	Reference	
Not Hispanic or Latino	1.05 (0.87 to 1.25)	0.629
Race		
White	Reference	
Black	0.88 (0.73 to 1.06)	0.186
Other	0.48 (0.29 to 0.81)	0.006
Region		
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
Arrived in EMS		
Yes	Reference	
No	1.48 (0.91 to 2.43)	0.116
Blank/unknown	1.58 (0.90 to 2.75)	0.108
Triage (immediacy)		
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
Primary payer		
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
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

CHIP (Children's Health Insurance Program)

EMS, emergency medical service; ESA, Emergency Service Area.

last two decades. Further examination will be necessary to evaluate whether this missing data refer to poor reporting or to the difficulty of using structured pain scales in children, especially in younger groups with immature verbal response. The poor reporting of pain scores also occurs

in adult populations.¹⁷ For this reason, one may argue that the difficulty of using pain scales in children does not play a major role on the absence of these data in the NHAMCS surveys.

LIMITATIONS

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

CONCLUSIONS

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

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Contributors Conceptualisation: JLA, FB and MMJ. Formal analysis: SAF and MMJ. Investigation: JLA, LOJS, FB, MMJ. Methodology: LOJS, FB, MMJ. Project administration: JLA. Supervision: MMJ. Validation: FB and MMJ. Writing—original draft: JLA. Writing—review and editing: JLA, LOJS, SAF, FB, MMJ. Guarantor: JLA, MMJ. All authors provided critical revision and contribution for important intellectual content.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval NHAMCS is approved by the Ethics Review Board of the National Center for Health Statistics (NCHS), a division of the Center for Disease Control and Prevention (CDC).⁶ Because this study used pre-existing, de-identified data, the Institutional Review Board deemed this study exempt.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. The NHAMCS data are publicly available at https://www.cdc.gov/nchs/ahcd/datasets_documentation_related.htm.

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Data Supplement S1

Pain-related ED visits included any visit with a Reason for Visit code that was “definitely 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)

- **5015.0** Fractures and dislocations, Trunk area except spinal column (includes: clavicle, collarbone, pelvic scapula, rib)
- **5020.0** Fractures and dislocations, Leg (includes: femur, fibula, hip, knee, tibia)
- **5025.0** Fractures and dislocations, Ankle
- **5030.0** Fractures and dislocations, Foot and toes
- **5035.0** Fractures and dislocations, Arm (includes: elbow, humerus, radius, shoulder, ulna)
- **5040.0** Fractures and dislocations, Wrist
- **5045.0** Fractures and dislocations, Hand and fingers
- **5050.0** Fractures and dislocations, Fracture, other and unspecified
- **5105.0** Sprains and strains, Cervical spine, neck (includes: whiplash)
- **5110.0** Sprains and strains, Back
- **5115.0** Sprains and strains, Knee
- **5120.0** Sprains and strains, Ankle
- **5125.0** Sprains and strains, Wrist
- **5130.0** Sprains and strains, other and unspecified
- **5205.0** Lacerations and cuts, Head and neck area (excludes: face [5210.0])
- **5210.0** Lacerations and cuts, Facial area (includes: eye, ear, forehead, lip, nose)
- **5215.0** Lacerations and cuts, Trunk area (includes: perineum)
- **5220.0** Lacerations and cuts, Lower extremity (includes: ankle, foot)
- **5225.0** Lacerations and cuts, Upper extremity (includes: arm, fingers, hand, wrist)
- **5230.0** Lacerations and cuts, site unspecified
- **5305.0** Puncture wounds, Head, neck, and facial area
- **5310.0** Puncture wounds, Trunk area
- **5315.0** Puncture wounds, Lower extremity
- **5320.0** Puncture wounds, Upper extremity
- **5325.0** Puncture wounds, site unspecified (includes: Needlestick, NOS)
- **5405.0** Contusions, abrasions, and bruises, Head, neck, and face (excludes: Eye [5410.0])
- **5410.0** Contusions, abrasions, and bruises, Eye (includes: black eye, contusion, corneal abrasion)
- **5415.0** Contusions, abrasions, and bruises, Trunk area (includes: injury to scrotum)
- **5420.0** Contusions, abrasions, and bruises, Lower extremity
- **5425.0** Contusions, abrasions, and bruises, Upper extremity
- **5430.0** Contusions, abrasions, and bruises, site unspecified
- **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)
- **5510.0** Injury, other, and unspecified type, Eye
- **5515.0** Injury, other, and unspecified type, Back (includes: Tail bone)
- **5520.0** Injury, other, and unspecified type, Chest and abdomen (includes: Internal injuries)
- **5525.0** Injury, other, and unspecified type, Hip
- **5535.0** Injury, other, and unspecified type, Knee
- **5530.0** Injury, other, and unspecified type, Leg

- **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

Probably painful Reason for Visit codes (SYMPTOMS)

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

Probably painful Reason for Visit codes (CONDITIONS)

- **1840.0** Infections of skin, NOS (includes: draining wounds, infected blister, infected wound; excludes: athlete's foot [2025.0], wound drainage [as treatment])
 - **1840.1** Infection of skin of head or neck area
 - **1840.2** Infection of skin of arm, hand, or finger
 - **1840.3** Infection of skin of leg, foot, or toe
- **1240.0** Other symptoms referable to the nervous system (includes: brain lesion, confusion, cognitive decline, damaged nerves, neuralgia, neurovegetative, pinched nerve, postictal; excludes: nerve block 4560.0)
- **1825.0** Symptoms of sexual dysfunction (includes: dyspareunia, painful intercourse; excludes: psychological disorders)
- **2250.0** Anemia (includes: anemia, NOS, iron deficiency anemia, pernicious anemia, sickle cell anemia)
- **2450.0** Otitis media
- **2515.0** Ischemic heart disease (includes: angina pectoris, arteriosclerotic cardiovascular disease, arteriosclerotic heart disease, coronary, coronary heart disease, heart attack, ischemic cardiomyopathy, myocardial infarction)
- **2600.0** Upper respiratory infections except tonsillitis (includes: croup, laryngitis, pharyngitis, rhinitis, sinusitis; excludes: allergic rhinitis [2636.0], cold [1445.0], nose infection NOS [1405.3], sinus infection NOS [1410.2], throat infection NOS [1455.3])
- **2605.0** Tonsillitis
- **2650.0** Diseases of the esophagus, stomach, and duodenum (includes: Barrett's esophagus, duodenal ulcer, esophageal ulcer, esophagitis, gastritis, GERD, peptic ulcer, reflux, stomach ulcer; excludes: gastroenteritis [2005.0], stomach flu [1540.0])
- **2665.0** Diseases of the intestine and peritoneum (includes: abscess rectal, adhesions [abdominal or NOS; if states post-op, code 42050 also], Crohn's disease, diverticulitis, diverticulosis, fissure – rectal and anal, fistula – rectal and anal, ileitis, irritable bowel syndrome, proctitis, small bowel obstruction, spastic colitis, ulcerative colitis; excludes: intestinal virus [1540.0])
- **2675.1** Dental abscess
- **2675.2** Dental cavities
- **2705.0** Urinary tract disease except cystitis (includes: bladder stones, glomerulonephritis, glomerulonephrosis, kidney cyst, kidney stones, neurogenic bladder, pyelonephritis, renal failure, ureteral calculus, urethritis, urolithiasis; excludes: bladder infection [1665.2], kidney infection NOS [1670.2], passed stones [1680.0], urinary tract infection [1675.0])
- **2900.0** Arthritis (includes: osteoarthritis, rheumatism NOS, rheumatoid arthritis, septic)

- **2905.0** Nonarticular rheumatism (includes: bursitis, ganglion cyst, lumbago, myositis, polymyalgia rheumatica, radiculitis/radiculopathy, synovitis, tendinitis, tenosynovitis; excludes: rheumatism NOS [2900.0])
- **4520.0** Minor surgery
- **4540.0** Cast, splint – application, removal
- **5920.0** Adverse effects of environment (includes: air pollution, frostbite, hypothermia, noise pollution, sun damage, sun poisoning, too hot, water pollution)
- **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])
- **5805.0** Motor vehicle accident, type of injury unspecified (includes: auto accident, car accident, motorcycle accident)
- **5810.0** Accident NOS (includes: fall, type or location of injury unspecified)
- **5815.0** Violence NOS (includes: abuse, beat up, in a fight, stabbing; excludes: violence against oneself [5818.0, 5820.0])
- **5818.0** Intentional self-mutilation (includes: self-abuse, tried to hurt self; excludes: suicide attempt [5820.0])
- **5820.0** Suicide attempt (includes: found in car with motor running, hanging oneself, slashed wrists, stabbed oneself).

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

- 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

Data Supplement S3

Table S3.1. Baseline characteristics comparison between pain-related and non-pain-related

pediatric ED visits.

	All ED Visits
Age	
< 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%)
Sex	
Female	48.47% (46.70%, 50.25%)
Male	51.53% (49.75%, 53.30%)
Ethnicity	
Hispanic or Latino	25.47% (19.16%, 33.00%)
Not Hispanic or Latino	74.53% (67.00%, 80.84%)
Race	
White	67.72% (61.60%, 73.29%)
Black	28.21% (22.82%, 34.32%)
Other	4.06% (3.10%, 5.32%)
Region	
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%)
Metropolitan Statistical Area (MSA)	
MSA	86.96% (75.42%, 93.55%)
Non-MSA	13.04% (6.45%, 24.58%)
Arrived in EMS	
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%)
Triage (Immediacy)	
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%)
Primary Payer	
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.

Data Supplement S4

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

	Definitely Painful Reason for Visit 54.27% (51.79% to 56.50%)	Non-Pain Related Visits 45.85% (43.50% to 48.21%)
Age		
< 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%)
Sex		
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%)
Ethnicity		
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%)
Race		
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%)
Region		
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%)
Arrived in EMS		
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%)
Triage (Immediacy)		
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%)
Primary Payer		
Private insurance	25.90% (21.61%, 30.71%)	18.29% (14.21%, 23.22%)
Medicare	0.37% (0.18%, 0.77%) [†]	0.38% (0.16%, 0.88%) [†]
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%) [†]	0.01% (0.00%, 0.06%) [†]
No charge/charity	0.06% (0.01%, 0.43%) [†]	0.12% (0.03%, 0.54%) [†]
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.

[†]This represented cell sizes smaller than 30, which are considered not reliable for meaningful analysis by the NHAMCS guidelines.

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.