




# 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).<sup>1</sup> 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.<sup>2–5</sup>

One of the first paediatric pain ED epidemiology studies was performed in Canada in 1996.<sup>3</sup> 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.<sup>4</sup> 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.<sup>5</sup> 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  $\leq 18$  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.<sup>6</sup> We followed the STrengthening the Reporting of OBservational studies in Epidemiology guidelines for reporting observational studies.<sup>7</sup>

### Data source

The NHAMCS ED data set has been collected yearly since 1992 to describe US ED visits and utilisation.<sup>8</sup> 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.<sup>8</sup> 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.<sup>9</sup> 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

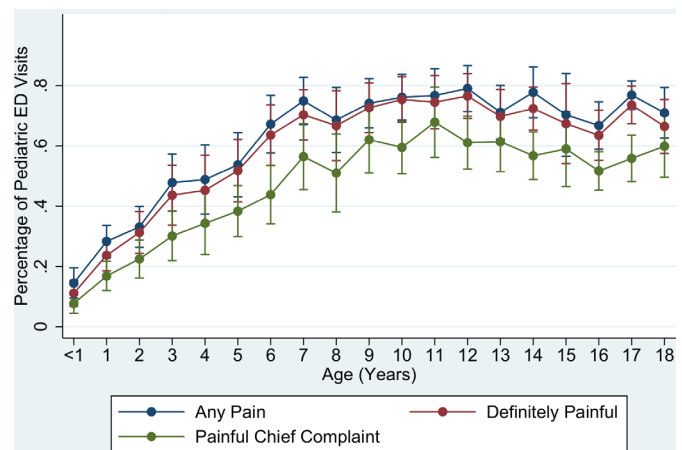
Patients and/or public were not involved in this study.

### 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 <b>55.57%*</b> <b>(53.27%, 57.85%)</b>	Non-pain-related ED visit <b>44.42%*</b> <b>(42.15%, 46.72%)</b>	P value
<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

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.<sup>5</sup> 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.<sup>2 10</sup>

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.<sup>11</sup>

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,<sup>5</sup> 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.<sup>12</sup> Also, Native American adolescents were noted to have the highest rate of all the race/ethnicity groups for any substance abuse and opioid abuse.<sup>13</sup> 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.<sup>10 14 15</sup> White children, for example, are more likely to receive opioid prescriptions than non-white children.<sup>16</sup> 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,<sup>5</sup> 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.<sup>17</sup> 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.<sup>8</sup>

## 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).<sup>6</sup> 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](https://www.cdc.gov/nchs/ahcd/datasets_documentation_related.htm).

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