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REGULAR ARTICLE

Nationwide study of headache pain in Italy shows that pain assessment is still inadequate in paediatric emergency care

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ABSTRACT

Aim: Italian national guidelines on pain management were published in 2010, but there is little information on how effective pain management is in paediatric emergency care, with other countries reporting poor levels. Using headache as an indicator, we described pain assessment in Italian emergency departments and identified predictors of algometric scale use.

Methods: All Italian paediatric and maternal and child hospitals participated, plus four general hospitals. Data on all children aged 4–14 years admitted during a one-month period with headache as their chief complaint were abstracted from clinical records. Multivariable analyses identified predictors of algometric assessment, taking into account the cluster study design.

Results: We studied 470 admissions. During triage, pain was assessed using a standardised scale (41.5%), informally (15.5%) or was not recorded (42.9%). Only 32.1% of the children received analgesia in the emergency department. The odds ratios for predictors of algometric assessment were non-Italian nationality (3.6), prehospital medication (1.8), admission to a research hospital (7.3) and a more favourable nurses-to-admissions ratio of 10.8 for the highest versus lowest tertile.

Conclusion: Despite national guidelines, paediatric pain assessment in Italian emergency care was suboptimal. Hospital variables appeared to be stronger predictors of adequate assessment than patient characteristics.

INTRODUCTION

Pain is one of the most common complaints on admission to emergency healthcare (1), but its management remains challenging, particularly in children. Despite the publication of several guidelines (2,3), there is evidence that the management of paediatric pain is inadequate in many healthcare settings (4). Pain is often not assessed or assessed incorrectly (5). Although child self-reporting is considered the most reliable indicator of the existence and intensity of pain, evaluations are often made by the healthcare staff or by questioning parents. Consequently, the pain perceived by the child is often poorly identified and inadequately treated (6). Because of heavy workloads and quick patient turnover, emergency care represents a particularly problematic context (7–10).

In Italy, national guidelines on the pain management of children, which were endorsed by the Ministry of Health, were published in 2010 (11). Since then, pain

Abbreviations
FLACC, Face, Legs, Activity, Cry, Consolability behavioural pain assessment scale; NRS, Numerical Rating Scale; VAS, Visual Analogue Scale.

Key notes

- This study described pain assessment in Italian emergency departments, using headache as an indicator, and identified predictors of algometric scale use in 470 admissions.
- During triage, pain was assessed using a standardised scale (41.5%), informally (15.5%) or was not recorded (42.9%), and only 32.1% of patients received analgesia in the emergency departments.
- We also found that hospital variables appeared to be stronger predictors of adequate assessment than patient characteristics.

management has been defined as a child's right and regulated by law (12). Hospitals are required to assess pain using validated tools and record algometric data, to provide analgesic treatment according to the guidelines and to monitor therapeutic efficacy and safety. However, it is not known to what extent these rules are followed in the care of individual patients, particularly in the emergency care setting.

In 2013, the Italian multidisciplinary Pain In Paediatric Emergency Room (PIPER) study group was established with the objective of improving pain assessment and treatment in paediatric emergency care. As a first step, we carried out a survey of policies and reported practices of pain management in a national sample of paediatric emergency departments (13). We found that less than 50% of the surveyed hospitals carried out routine pain assessment at triage, about one-third did not use pain rating scales and almost half did not have protocols for pain management. We subsequently performed a retrospective cohort study in the same hospitals to investigate pain management in individual children admitted to emergency departments, using headache as indicator.

This article presents the results of the second study and aims to describe the practices of pain assessment and treatment of all patients admitted over a one-month period with headache as the chief complaint. It also explores the factors associated with the use of standardised pain measurement scales.

METHODS

All 14 of the Italian paediatric and maternal and child hospitals were invited to participate in this study, as well as five general hospitals that had a separate paediatric emergency room. One of the general hospitals declined to participate because they did not have the computerised medical records system they needed to identify the patients and retrieve the relevant clinical data. In 2010, the 18 participating emergency departments diagnosed and admitted more than 600 000 children.

For the purposes of this study, the term emergency department includes triage, emergency rooms and short stay observation.

Study design and instrument

We used a retrospective study design to recruit all patients who met the study eligibility criteria and were admitted to the participating emergency departments between March 1, 2011 and March 31, 2011. The eligibility criteria were headache as the main presenting complaint, accompanied or not accompanied by associated symptoms, and age between four and 14 years. This age range was selected because, as a rule, in Italy patients up to 14 years of age are cared for by paediatricians. Initial admissions and planned readmissions for the same headache episode, to complete the diagnostic work-up, were considered as a single admission. Children were followed up to discharge from the emergency department.

Data were abstracted from the clinical records using a precoded structured questionnaire and agreed definitions (14). The questionnaire included the following: (i) the patient's demographic and clinical data, namely gender, age in years, weight, nationality, presence of any chronic disease, whether they were referred by a physician and their mode and time of arrival at the hospital; (ii) characteristics of the headache, namely duration, associated symptoms, any medication administered for the headache in the previous 12 hours and their colour-coding at triage; (iii) pain assessment carried out at triage, in the emergency department and before discharge, together with the method of any pain assessment, such as a standardised pain rating scale, and the level of any measured pain and (iv) the type and dosage of medication administered in the emergency department and, or, prescribed at discharge.

The questionnaire was piloted in three of the participating hospitals, using a different set of admissions with the same eligibility criteria.

The data were collected by trained abstractors (14). A dedicated training workshop was held before the start of the data collection, including discussions on the study aims, methods and definitions adopted. Practical sessions of data abstraction were also carried out, using real anonymised records of paediatric patients with headaches.

The questionnaires were anonymised to preserve confidentiality, and the key linking the questionnaire code to patient's clinical records was kept at the treating hospital. The study protocol was approved by the ethics committees of the participating hospitals. As the data collection was retrospective, based solely on clinical records, and the patients' identities were protected, the requirement for informed consent was waived by the ethics committees.

Statistical analysis

Data computerisation and analysis were carried out at the Bambino Gesù Paediatric Hospital in Rome. For the purpose of this article, we used data concerning pain assessment and management, including pharmacological treatment, and the demographic and clinical characteristics of the patients. Selected data from the hospital study database were also included.

The results of the indirect pain assessment were recorded on an ordinal scale as none, mild, moderate and severe. Scores derived from the use of algometric scale assessments were also recorded as no or mild pain (0–3), moderate (4–6) and severe (7–10).

Results were summarised as absolute and relative frequencies. The chi-squared test or, when required, Fisher's exact test were used to assess statistical significance.

Multivariable logistic regression analysis was performed to explore predictors of pain assessment using standardised rating scales, that is algometric assessment, at any time in triage, the emergency department or before discharge. The cluster option was used to account for the nonindependence of observations within the same hospital (15). The variables that were initially considered for inclusion in the multivariable model were patient gender plus those

associated with the outcome variable at a $p < 0.10$ level. These included the child's age (coded as 4–6, 7–10 and 11–14 years), nationality (Italian or otherwise), duration of headache (<12, 12–24 and over 24 hours) and colour code at triage (white for nonurgent, green for standard and yellow, for a potentially serious condition). We also explored the presence of associated symptoms, any existing diagnosis and any medication given to the children for their headache before they were admitted to the emergency department. The hospital characteristics we examined were type of hospital (general versus paediatric or maternal and child hospital), whether it was a clinical research centre, the annual number of paediatric admissions to the emergency department (coded as tertiles) and the number of nurses and physicians per 10 000 annual emergency department admissions (coded as tertiles).

The statistical analyses were carried out with the Stata statistical software, release 11 (StataCorp 2009, College Station, TX, USA).

RESULTS

Characteristics of the study population

A total of 470 admissions with headache as the chief presenting complaint were recorded during the study period (Table 1). Most of the children were Italian (91.5%) and 82.1% were seven years or older. More than half the patients (53.7%) had been symptomatic for more than 24 hours on admission to the emergency department. Seven of ten (70.6%) patients reported one or more associated symptoms: 101 (21.5%) patients had neurological symptoms, 84 (17.9%) had fever and 81 (17.2%) patients had vomiting (data not shown). At triage, 80% of the children were assigned the colour code green, indicating a standard nonurgent condition.

As expected, given the study sampling strategy, most cases were reported by paediatric or maternal and child hospitals (Table 1). Emergency departments in the highest tertiles for medical and nursing staffing per annual admissions cared for 36% and 33% of children, respectively.

Table 1 Characteristics of the study population (n = 470)

	n	%
Patients' variables		
Gender		
Male	239	50.8
Female	231	49.2
Age (years)		
4–6	84	17.9
7–10	189	40.2
11–14	197	41.9
Nationality		
Italian	430	91.5
Non-Italian	40	8.5
Duration of headache		
≤3 hours	62	14.4
>3 to 12 hours	85	19.8
>12 to 24 hours	52	11.1
>24 hours	231	53.7
Diagnosis already known		
No	424	90.2
Yes	46	9.8
Any associated symptom		
No	138	29.4
Yes	332	70.6
Any medicine for headache before admission		
No	311	66.2
Yes	159	33.8
Colour code at triage		
White	26	5.5
Green	376	80.0
Yellow	68	14.5
Hospital variables		
Type of hospital		
General	58	12.3
Paediatric/Mother and Child	412	87.7
Clinical research hospital		
No	357	76.0
Yes	113	24.0
Annual ER pediatric admissions		
≤22 000	101	21.5
>22 000–39 999	217	46.2
≥40 000	152	32.3
Physicians-to-admissions ratio (per 10 000)		
Lowest tertile (<0.77)	140	29.8
Intermediate tertile (2.77–3.83)	160	34.0
Highest tertile (≥3.83)	170	36.2
Nurses-to-admissions ratio (per 10 000)		
Lowest tertile (<4.45)	121	25.7
Intermediate tertile (4.45–6.69)	195	41.5
Higher tertile (≥6.69)	154	32.8

Pain assessment

Figure 1 shows the algometric assessments, carried out using validated pain scales, that were recorded in the clinical records. At triage, 195 (41.5%) patients were assessed using a standardised pain rating scale, while 73 (15.5%) were only assessed informally, on the basis of staff judgement or by questioning the child or the parents. No pain assessment was recorded in the clinical records of the remaining 202 patients (42.9%).

After triage, pain scales were used in 66 cases in the emergency department and in 49 cases before discharge. Overall, 205 children (43.6%) underwent at least one assessment using a pain rating scale during admission, 65 (13.8%) had two and 40 (8.5%) had three assessments.

A total of 268 children had their pain assessed at triage, including informal evaluations, and the level of pain was classified as severe in 64 (23.9%) cases, moderate in 104 (38.9%) and mild or absent in 100 (37.3%) (data not shown). Compared with informal assessments, algometric measurements appeared to yield more graded scores (Fig. 2). The difference between the distributions was statistically significant ($p < 0.001$), although this finding should be interpreted with caution given the observational nature of the study.

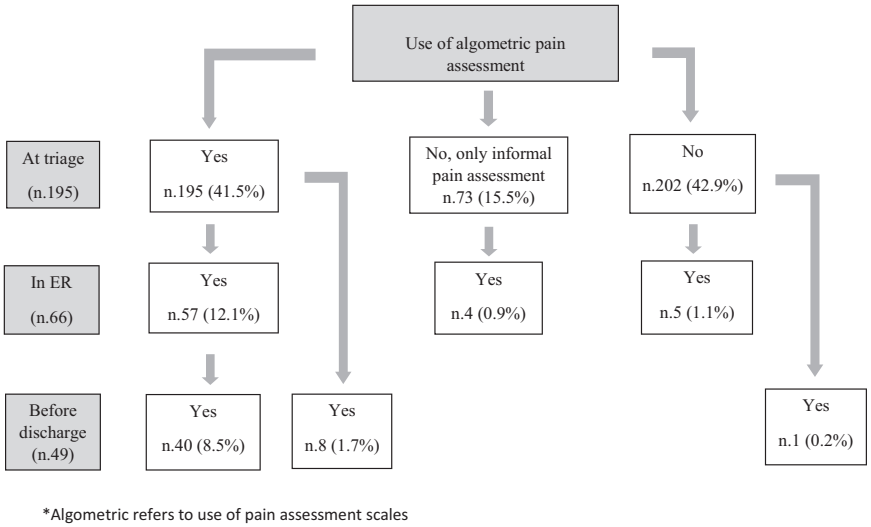

Figure 1 Algometric assessment of pain from triage to discharge (n = 470).

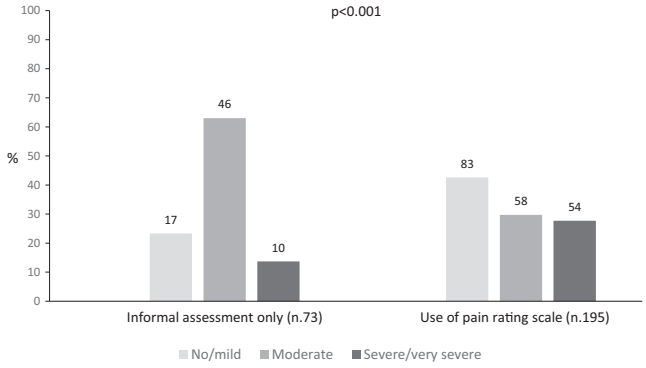

Figure 2 Level of pain recorded at triage by type of assessment (informal only versus use of pain rating scales, n. 268).

The type of pain rating scales used is shown in Table 2. The Numerical Rating Scale (NRS) was the most frequently used tool for older children, in 60.8% of those aged 11–14 and 46.2% of those aged 7–10 years, followed by the Visual Analogue Scale (VAS). The scales used for young children under the age of seven were the Face, Legs, Activity, Cry, Consolability (FLACC) behavioural scale, in 26.7% of cases, and the Wong-Baker Faces pain rating scale, in 23.3% of cases. The use of the NRS and VAS in children under the age of seven, and the FLACC in older patients, is not consistent with algometric recommendations.

Univariable and multivariable associations between any algometric assessment during admission and predictors are presented in Table 3. Taking into account the cluster effect of the hospital in computing the univariable odds ratios (OR) generally led to higher p values, that in some cases became non-significant. In the multivariable model, factors that significantly increased the likelihood of at least one algometric assessment before discharge were non-Italian nationality, with an OR of 3.6 and a 95% confidence interval (95% CI) of 1.8–7.1, and pharmacological treatment for headache in the 12 hours before admission (OR 1.8, 95% CI 1.0.3.2), while older age (11–14 years) showed a marginally significant effect (OR 1.8, 95% CI 0.9–3.6).

Table 2 Type of pain rating scale used by patient age (N = 205)*

	FLACC behavioural scale		Wong-Baker Faces rating scale		NRS		VAS		Total	
	n	%	n	%	n	%	n	%	n	%
4–6 years	8	26.7	7	23.3	8	26.7	7	23.3	30	100
7–10 years	7	9.0	7	9.0	36	46.2	28	35.9	78	100
11–14 years	3	3.1	0	–	59	60.8	35	36.1	97	100
All children	18	8.9	14	6.8	103	50.2	70	34.2	205	100

Chi square (6 d.f.): 40.57, $p < 0.001$.
*Data refer to all children with at least one algometric assessment.

Table 3 Predictors of any algometric* assessment: results of uni- and multivariable logistic regression analysis

	Children with any algometric assessment			Univariate logistic regression model†			Multivariable logistic regression model†		
Predictors	n	%	p	OR	95% CI	p	aOR	(95% CI)	p
Gender									
Male	105	43.9	0.888	1.0		0.898			
Female	100	43.3		1.0	0.7–1.5				
Children's age (years)									
4–6	30	35.7	0.079	1.0		0.147	1.0		0.217
7–10	78	41.3		1.3	0.8–2.0		1.4	0.9–2.2	
11–14	97	49.2		1.7	1.0–3.1		1.8	0.9–3.6	
Children's nationality									
Italian	178	41.4	0.001	1.0		0.002	1.0		<0.001
Other	27	67.5		2.9	1.5–5.7		3.6	1.8–7.1	
Duration of headache									
≤12 hours	54	36.7	0.017	1.0		0.079			
>12–24 hours	22	42.3		1.3	0.6–2.5				
>24 hours	119	51.5		1.8	1.1–3.1				
Any associated symptom									
No	49	35.5	0.022	1.0		0.089			
Yes	156	47.0		1.6	(0.9–2.8)				
Diagnosis already known									
No	179	42.2	0.063	1.0		0.094			
Yes	26	56.5		1.8	(0.9–3.5)				
Any medicine for headache before admission									
No	118	37.9	0.001	1.0		0.009	1.0		0.043
Yes	87	54.7		2.0	1.2–3.3		1.8	1.0–3.2	
Colour code at triage									
White	9	34.6	0.066	1.0		0.230			
Green	174	46.3		1.6	(0.6–4.8)				
Yellow	22	32.4		0.9	(0.3–2.7)				
Hospital type									
General	8	13.8	<0.001	1.0		0.013			
Paediatric/Mother and Child	197	47.8		5.7	(1.4–22.6)				
Clinical research hospital									
No	111	31.1	<0.001	1.0		0.003	1.0		0.019
Yes	94	83.2		8.9	2.2–54.2		7.3	1.4–38.6	
Annual ER pediatric admissions ER									
≤22 000	30	29.7	<0.001	1.0		0.399			
>22 000–39 999	122	56.2		3.0	(0.6–15.9)				
≥40 000	53	34.9		1.3	(0.2–7.4)				
Nurses/admissions ratio (/10 000)									
Lowest tertile (<4.45)	8	6.6	<0.001	1.0		0.002	1.0		0.007
Intermediate tertile (4.45–6.69)	110	56.4		18.3	2.6–130.8		9.7	1.6–59.1	
Highest tertile (≥6.69)	87	56.5		18.3	3.5–94.9		10.8	2.4–48.7	
Doctors/admissions ratio (/10 000)									
Lowest tertile (<2.77)	39	27.9	<0.001	1.0		0.289			
Intermediate tertile (2.77–3.83)	61	38.1		1.6	0.2–11.7				
Highest tertile (≥3.83)	105	61.8		4.2	0.6–28.6				

*Algometric refers to use of standardised pain assessment scale.
†Uni- and multivariable logistic models take into account the hierarchical nature of the database (hospital and patients).

Hospital variables independently associated with algometric pain assessment were a clinical research role (OR 7.3, 95% CI 1.4–38.6) and a more favourable nurses-to-admissions ratio. This latter variable showed a trend effect, with odds ratios increasing from 9.7 for the intermediate to 10.8 for the highest tertile.

Pharmacological treatment of headache

About one-third of the children received medication for headache before admission (33.8%) or in the emergency department (32.1%), and a larger proportion (66.6%) was prescribed one or more medicines at discharge (Table 4).

Table 4 Medicines administered and/or prescribed at discharge (n = 470)*

Type of medicine*	Within 12 hours before triage n	%	In ER n	%	Prescribed at discharge n	%
Paracetamol	84	17.9	48	10.2	137	29.1
NSAIDS	53	11.3	63	13.4	110	23.4
Opioids	0	–	3	0.6	0	–
Analgesic association (paracetamol/codeine)	6	1.3	33	7.0	44	9.4
Sedatives	0	–	2	0.4	2	0.4
Antiemetics	0	–	3	0.6	11	2.3
Drugs specific for headache	2	0.4	1	0.2	8	1.7
Antibiotics	5	1.1	5	1.1	54	11.5
Corticosteroids	4	0.8	2	0.4	10	2.1
Other drugs†	3	0.6	6	1.3	15	3.2
Any of the above	159	33.8	151	32.1	313	66.6

*More than one drug per patient possible.
†Other drugs included anticonvulsants, antihistaminics, mucolytics and bronchodilators, gastroprotective agents, antispasmodics, probiotics, rehidratation solutions and oxygen.

Paracetamol was the most common analgesic used before admission to emergency care and prescribed at discharge, followed by nonsteroidal anti-inflammatory drugs. Opioids were used most often in association with paracetamol.

More specific drugs for primary headache were rarely used before discharge from the emergency department, and the same was true for antibiotics and corticosteroids. Parenteral therapy was used very rarely (11 cases).

Of the 139 children who received analgesia in the emergency department, only 20 (14.4%) started treatment in triage before their medical assessment (data not shown).

DISCUSSION

This study showed that in a national sample of consecutive patients admitted to Italian paediatric emergency departments with headache as the chief presenting complaint, pain measurement was carried out using standardised scales in only 41% of cases. In 15% of the children, the assessment was only informal, based either on staff judgement or parents' opinions, while in as many as 43% pain was not measured at all. In more than 10% of the algometric assessments, the choice of scale was inappropriate for the child's age. Pain reassessment occurred in less than 15% of cases after triage. Less than one-third of the children received analgesic treatment while they were in the emergency department. Children not born in Italy, older children and those already treated for headache before admission to the emergency department, were more likely to receive at least one algometric pain assessment. Hospital variables, such as being a research hospital and better nurse staffing ratios, appeared to be stronger predictors of the use of pain rating scales than patient clinical and anagraphic variables.

Wide variations have been reported with regard to the use of formal pain assessment in children admitted to emergency care. A survey carried out in paediatric emergency departments in Illinois, USA, showed that only 59% of visits included pain assessments (7). A subsequent study showed that 54% of children transported by emergency ambulance to four tertiary referral hospitals in Ireland had a documented pain assessment carried out by a triage nurse when they arrived in the emergency departments (10). However, pain assessment rates below 10% have been reported (9). These rates of assessment are far below those documented in the same setting for adults (16) and indicate unjustified age inequalities for patients admitted to emergency care.

By definition, pain is a subjective condition and should be assessed as such. Consequently, most standardised scales have been developed for self-reporting (8), with the exception of those for very young or developmentally disabled children, where observed behaviour and physiological changes replace a child's answers. Several studies have highlighted the lack of agreement between the results of pain assessments based on the child, parent and staff reports, even when the same appropriate algometric scale is used (17). Parents' VAS score ratings of their children's pain have been shown to only correlate moderately with the children's own VAS pain scores, showing poor levels of agreement (18). Ratings completed by the healthcare personnel were even less accurate and generally underestimated the children's pain levels (19,20). These findings reinforce the notion that parents, and especially healthcare workers, are not adequate proxies where pain assessment is concerned and that the children themselves should be allowed to report their pain through age-appropriate tools.

In our study, algometric scales were used less often than expected and the choice of scale was not always appropriate for the child's age. These results indicate a need for more training and possibly, as regards the use of the FLACC beyond the recommended age, an attempt to save time by avoiding interrogation of the child.

The multivariable analysis showed that the patient variables independently associated with the increased likelihood of having pain measured on a standardised scale were foreign nationality, older age and having already received treatment before admission to emergency care. This latter finding may be related to the severity of symptoms, or indicate the staff's intention to measure treatment effectiveness. In the case of children not born in Italy, algometric assessment may be a way to overcome communication difficulties with the parents or with the children themselves (8).

The relationship with patient age was only marginally significant in the multivariable analysis, but there was a suggestion of a trend effect, with ORs increasing from 1.4 at 7–10 years to 1.8 at 11–14. Several studies have consistently shown that younger patients are less likely to have an algometric assessment compared to school-age children and adolescents (6,10,21). Consequently, they are also less likely to receive appropriate pain treatment (6,22). Lack of

trust in a small child's ability to correctly report pain, despite the availability of age-specific tools, may partially explain this result. The old idea that children are less sensitive to pain than adolescents and adults, or that they can overcome it without long-term consequences, may still play a role. In fact, the opposite may be true. Research has shown that the descending neural inhibitory pathways required for pain modulation mature later than the ascending and central structures for pain perception. This means that infants, especially neonates, may actually experience pain more intensively than older children (4).

In our study, the use of algometric assessments were not related to the colour code assigned at triage. However, if pain is to be considered a vital sign, the assignment of a colour code in paediatric emergency departments should also take into account the pain's presence and intensity.

An interesting finding of our study was the much stronger influence that the hospital played in comparison with the patient variables on the likelihood of algometric assessment. The adjusted ORs reached 7.3 if the hospital was also a clinical research centre and almost 11 when the nurses-to-admissions ratio in the highest tertile was compared to the lowest tertile. As far as pain management is concerned, paediatric hospitals have been reported to fare better than general hospitals and paediatric emergency departments better than mixed emergency departments (23). We found a similar result in our univariable analysis. However, this study took a further step towards identifying elements that, at least in the Italian context, may mediate a better performance. In our sample, 10 of the 14 participating paediatric or maternal and child hospitals have some research role, compared to only two of the general hospitals, and five paediatric versus one general hospital have nursing staffing in the higher tertile (13). Being a research centre may be associated with easier access to the literature and scientific databases and more opportunities to share knowledge through participation in scientific meetings and research projects. Also, emergency department crowding has been linked to decreased quality of analgesia delivery in children (24,25) and our finding on the relevance of the nurses-to-admissions ratio seems to confirm this association. The impact of nursing, but not medical, staffing is consistent with the central role of nurses in triage and pain assessment. However, the same does not hold for treatment, as we found that less than 15% of the children who received analgesia in the emergency department had already started treatment in triage.

In our study, less than one-third of the patients received analgesic treatment in the emergency department, which is consistent with previous reports (26,27), while a much larger proportion were prescribed analgesia at time of discharge. Coupled with the delayed initiation of analgesia described above, this finding indicates significant undertreatment of pain, as well as room for improvement.

This study has limitations. While the sampling of paediatric and maternal and child hospitals was exhaustive and provided reliable estimates of staff practices, only a convenience sample of general hospitals with separate paediatric triage were recruited. Because of the retrospective nature of data collection, we could only use information available in the clinical records and computerised databases, including data on pain assessment and management. This might have led to us underestimating the rate of pain measurement, as it might have been carried out but not recorded. However, recording of algometric data is considered an integral part of pain assessment and, if this is lacking, it may prevent effective treatment and monitoring. The retrospective study design was common to previous studies and had the important advantage that staff practices could not be influenced by the awareness that data collection was under way.

Assessing a child's pain can be difficult in the emergency department setting, where time is limited, anxiety levels are high and the child and family are unfamiliar with the healthcare provider and environment (5). However, specific interventions and organisational choices have been shown to improve the quality of paediatric pain treatment in emergency departments. Interventions have included staff training (28,29), implementation of protocols (29,30), patient empowerment (29), as well as audit and monitoring activities (28,29). Most of these interventions focused on nurses, and better results were obtained by programmes that were structured, multifaceted and repeated over time. In Italy, training to increase nurses' competences in algometric assessment should be accompanied by reinforcement of their role and autonomy with regard to treatment, for example by allowing nurses to initiate analgesia soon after triage, based on algometric measurements and specific protocols.

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CONFLICT OF INTERESTS
None.

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APPENDIX
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