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REGULAR ARTICLE

Multicentre emergency department study found that paracetamol and ibuprofen were inappropriately used in 83% and 63% of paediatric cases

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ABSTRACT

Aim: The Pain Practice in Italian Paediatric Emergency Departments assessed how appropriately analgesic drugs were being used by Italian clinicians, based on national paediatric pain guidelines.

Methods: This was a retrospective study that involved 17 Italian members of the Pain In Pediatric Emergency Rooms group. It comprised patients up to the age of 14 years who came to hospital emergency departments with pain and were treated with paracetamol, ibuprofen or opioids, such as codeine, tramadol and morphine.

Results: We studied 1471 patients who were given 1593 doses of analgesics. The median time to administration of analgesia was 25 minutes. Opioids were used in 13.5% of the children, and usage increased with age and with more severe clinical conditions, such as trauma: 1.6% of children under two years, 5.9% aged 3–10 and 8.0% aged 11–14. Inappropriate doses of paracetamol, ibuprofen and opioids were used in 83%, 63% and 33% of cases, respectively. The patient's age was a critical determinant of the correct analgesic dosage; for every one-year increase in the patient's age, the probability of appropriate prescriptions rose 14.8%.

Conclusion: The appropriate use of paracetamol and ibuprofen for paediatric pain in Italian emergency departments was very poor, but improved with age.

INTRODUCTION

Assessing and correctly managing pain are crucial aspects of paediatric emergency care (1,2). Pain has been reported to be the priority, or a major accompanying symptom, in 78% of paediatric visits to emergency departments (EDs) (1). One multicentre study found that pain was moderate to severe in more than 50% of cases (2).

Despite the continuous development and greater awareness of instruments, guidelines and educational and training strategies, (3–5) healthcare professionals still do not pay enough attention to pain in the ED and numerous studies have documented the inadequate treatment of pain in this setting, particularly in children. (2–5) In fact, the literature confirms inadequate evaluation, measurement and treatment of pain in patients of all age groups and in different situations (6–9).

Managing pain in childhood is influenced by age, sex, ethnic background, social-cultural aspects and neurocognitive problems in the child (10). Other explanations have been put forward for the under treatment of pain in the ED. There are definitely cultural and historical influences, but

Abbreviations
ED, Emergency departments; PIERRE, Pain practice in Italian paediatric emergency departments; PIPER, Pain In Pediatric Emergency Room.

Key notes

- We assessed how appropriately analgesic drugs were being used by 18 Italian emergency departments, by studying 1593 analgesic doses given to paediatric patients
- Based on national paediatric pain guidelines, inappropriate doses of paracetamol, ibuprofen and opioids were used in 83%, 63% and 33% of cases.
- The patient's age determined the correct analgesic dosage: for every one-year increase in the patient's age, the probability of appropriate prescriptions increased by 14.8%.

insufficient training, lack of knowledge, limited experience and fear of using the available drugs by healthcare staff may also play a role (5,11,12).

In addition, there are some real problems associated with the potential pharmacological treatment of pain, such as the lack of unequivocally defined doses of some of the analgesics, very broad dose ranges proposed for some of the drugs and the fact that many analgesics are off-label for paediatric ages (12).

These factors result in the inappropriate administration of analgesic drugs, both in terms of the choice of drug and timing (13).

The main aim of the retrospective Pain Practice in Italian Paediatric Emergency Departments (PIERRE) study was to analyse the appropriate use of the first dose of analgesics most frequently used in EDs, namely acetaminophen, ibuprofen, codeine, morphine and tramadol.

PATIENTS AND METHODS

This was a multicentre, noninterventional, retrospective study of patients aged up to 14 years, who had pain on arrival at the ED and were treated with analgesic drugs: paracetamol, ibuprofen and opioids that were limited to paracetamol plus codeine, tramadol or morphine. Our study design involved stratified sampling according to age, with patients divided into three categories of: up to two years of age, three years to 10 years and 11–14 years. These age categories were then further subdivided by the three drugs prescribed paracetamol, ibuprofen or opioids. This created nine independent groups of subjects.

We invited 22 Italian paediatric EDs from the PIPER group to participate in the PIERRE study and 18 accepted: 13 EDs were part of children's hospitals, and five were based in general hospitals. One centre was unable to retrieve the relevant data from the computerised medical records and was excluded.

Data source

The data were collected from October 2014 to July 2015, from a retrospective review of the patients' ED reports and, when present, the clinical records. The only treatments considered were those administered in the ED: including the triage area, clinic rooms, shock room, short observation area and intensive short observation unit. Any treatment given before attending the ED was not taken into consideration in this study, even if they were administered by healthcare workers assigned to urgently transport the patients. We only considered the first dose of any analgesic administered because the purpose of this study was to determine the effective dose and speed of the first treatment for acute pain in the EDs.

Inclusion and exclusion criteria and patients' characteristics

Patients were eligible if they were below the age of 14 years, presented with pain, including pyrexia, and were treated in one of the study EDs with paracetamol, ibuprofen or opioids—namely paracetamol plus codeine, tramadol or morphine. Patients whose body weight was unavailable, who had renal failure or hepatic failure or were under chronic opioids were excluded. The electronic case report files were collected for all the patients included in the study, and these covered the drugs administered, namely the type of drugs, route of administration and dose per kg. We also recorded the sociodemographic parameters at enrolment, namely sex, age and weight, and the clinical variables related to their access to the ED: body temperature, day and time of arrival at the ED, mode of access, triage code, clinical profile, diagnosis, time of administration of the first analgesic drug, mode of discharge and time of discharge. Furthermore, if the patients were discharged directly from the ED, the records also included the prescribed domiciliary analgesia and data such as the type of drug, route of administration and dose per kg.

Ethical considerations

The study was approved by the Ethics Committees of the coordinating centre and all of the participating centres and was performed in accordance with the principles of the Declaration of Helsinki. It was also registered within the Agenzia Italiana del Farmaco- Observational Study Register (code PIERRE/1).

Statistical analysis

All the statistical analyses were performed on the eligible patients whose required data had been completely and correctly recorded, namely the type of drug, route of administration and dose per kg, for at least one dose of an analgesic. A descriptive analysis is provided for the sociodemographic parameters on enrolment, as well as the clinical variables related to their ED access, including the time between the arrival and first analgesic treatment and the overall length of stay in the ED. The continuous variables are reported as means, ranges, medians, interquartile ranges (IQRs), number of missing data, and 95% confidence intervals (95% CIs). The categorical variables are reported as absolute frequency, 95% CIs and the number of missing data, as appropriate. With regard to the primary objective, which was to evaluate the appropriate degree of treatment, the variable was dichotomised into appropriate versus inappropriate doses, where inappropriate was defined as both inadequately low doses and overtreatment. Appropriate analgesic dosages were defined according to Italian paediatric pain and symptom management guidelines (4), approved by Italian Ministry of Public Health and developed with the use of national and international data. The associations between qualitative variables were measured with the chi-squared test, while the difference between quantitative variables was evaluated with the Student's t-test. Finally, we used dosage appropriateness as a dependent variable, to evaluate correlations between the covariates considered and to make adjustments for both sociodemographic factors and the baseline clinical variables, and used a logistic regression model with a forward stepwise selection of variables. Statistical computations

were performed using the Statistical Package for Social Science, version 20.0 (IBM Corp, New York, NY, USA). Statistical significance was set at $p < 0.05$.

RESULTS

Our study comprised 1471 patients who were given a total of 1593 doses of analgesic drugs, which was a mean of 1.08 doses per patient. The distribution of the drugs administered according to age group is shown in Table 1.

Characteristics of the patients

Table 2 shows the characteristics of the patients on enrolment, according to the type of drug administered. The mean age of children receiving opioids was significantly higher, about three years older, than the children treated with paracetamol and ibuprofen ($p < 0.0001$ for both). This age difference was associated with a significant difference in mean body weight, which was about 12.5 kg more in the opioid group than in the paracetamol and ibuprofen groups ($p < 0.0001$ for both). The chi-squared test was statistically significant regarding triage code and the assigned clinical severity in relation to the drugs administered ($p < 0.0001$). Very critical ill patients were excluded because the small numbers made the test inapplicable. During initial triage, 41.9% of higher moderately critically ill patients were treated with opioids, compared to 16.4% with paracetamol and 12.0% with ibuprofen. After clinical reassessment, 32.3% of higher moderately critically ill patients were treated with opioids, compared to 10.2% with paracetamol and 6.4% with ibuprofen.

An analysis of the triage code, indicating priority, and the clinical reassessment, indicating severity, showed concordance in 1197 cases (81.4%). With regard to greater clinical severity, there was only concordance in 29 cases (2.0%) and in cases of lesser severity, there was concordance in 245 cases (16.6%). In addition, the mode of access, excluding those cases where the mode was unknown, was significantly associated with the drug administered ($p = 0.0001$).

Table 1 Overall study population divided according to age group and analgesic drug received

Age group (years)		Drug received			
		Paracetamol	Ibuprofen	Opioids	Total
≤2	N.	219	153	23	395
	% for age group	55.5	38.7	5.8	100.0
	% of total	14.9	10.4	1.5	26.9
3–10	N.	304	221	58	583
	% for age group	52.1	37.9	10.0	100.0
	% of total	20.7	15.0	3.9	39.6
11–14	N	220	156	117	493
	%for age group	44.6	31.7	23.7	100.0
	% of total	15.0	10.6	8.0	33.5
Total	N.	743	530	198	1471
	% of total	50.5	36.0	13.5	100.0

Clinical characteristics

When we looked at the clinical characteristics of the patients when they accessed the ED, we found that 74.1% of all cases related to pain due to trauma or contusion, earache, abdominal pain, migraine and headache. We grouped chest pain, toothache, scrotal pain, backache, pain due to focal infections and menstrual pain together as other pain.

Table 3 shows the distributions of the clinical pictures according to age group and type of drug administered.

The chi-squared test showed a significant association between the clinical picture and both the age and type of drug ($p < 0.0001$ for both).

As regards the clinical pictures, earache was the most common pain (36.2%) in the youngest children, followed by trauma and bruises (21.4%) and by other types of non-trauma pain (18.9%). In patients between aged 3 and 10 years, traumatic pain was the most common (28.4%), followed by earache (24.8%) and abdominal pain (13.5%). Headache was also common in this age group, accounting for 11.6% of the clinical presentations. Traumatic pain was the most frequent form of pain (29.2%) among children aged 11–14 years, followed by headache or migraine (21.5%) and abdominal pain (18.2%).

With regard to drug use, as shown in Table 3, paracetamol was the most widely used type of analgesic for managing various different types of pain. Trauma pain and bruising were the most common reason for using the three drugs covered by this study. In fact, this type of pain was the reason for 38.1% of the prescriptions for opioids, compared to 25.7% of the prescriptions for paracetamol and 24.2 for ibuprofen. Paracetamol was much more widely used in abdominal pain, in 75.5% of cases, earache (53.6%) and, albeit to a lesser extent, in trauma or contusions (48.3%) and headache or migraine (42.0%). Ibuprofen was used predominantly for muscle and joint pain (57.7%) and commonly in other types of nontraumatic pain (44.9%), earache (43%) and sore throats (43.1%).

Time of administration

Table 4 presents the data regarding the time between admission and the first administration of analgesia, divided according to the type of drug administered.

Overall, the median time to administration was 25 minutes (interquartile range: 56 minutes), without statistically significant differences between patients treated with the three drugs we studied.

Analysis of appropriateness

With reference to the gold standards, Table 5 shows the ranges of appropriate doses for each drug and route of administration. Each dose of analgesia was then classified as appropriate, if it was within the appropriate range, under treatment or overtreatment on the basis of the drug and route of administration. There were very few cases of overtreatment: 38 cases for paracetamol (5.1%), 15 cases for ibuprofen (2.8%) and 16 cases for opioids (8.1%)—namely eight for codeine, seven for tramadol and only one

Table 2 Characteristics of the population at study entry, divided according to the drug administered

	Paracetamol	Ibuprofen	Opioids	Total
N. of cases (%)	743 (50.5)	530 (36.0)	198 (13.5)	1471
Age (years)				
Mean (95% CI)	6.45 (6.12–6.78)	6.57 (6.19–6.95)	9.69** (9.13–10.26)	6.93 (6.69–7.16)
Median	5.83	6.04	11.19	6.71
Range	0–14	0–14	1–14	0–14
Sex				
Male Number (%)	426 (57.3)	313 (59.1)	116 (58.6)	855 (58.1)
Weight (kg)				
Mean (95% C.I.)	27.07 (25.89–28.25)	28.15 (27.07–29.56)	40.72** (38.12–43.31)	29.3 (28.41–30.18)
Median	21.61	22.92	40.73	25.0
Range	5–89	5–90	7–88	5–93
Body temperature (°C)				
Mean (95% C.I.)	36.88 (36.79–36.96)	36.64 (36.56–36.72)	36.49* (36.39–36.59)	36.64 (36.68–36.79)
Median	36.69	36.49	36.45	36.59
Mode of access, N. (%)				
Autonomously	676 (91.0)	493 (93.0)	162 (81.8)	1331 (90.5)
Ambulance or other emergency transport	58 (7.8)	28 (5.3)	36 (18.2)	122 (8.3)
Unknown	9 (1.2)	9 (1.7)	0 (0.0)	18 (1.2)
Triage code (priority), N. (%)				
Not critical	47 (6.3)	36 (6.8)	9 (4.5)	92 (6.3)
Mildly critical	566 (76.2)	427 (80.6)	102 (51.5)	1095 (74.4)
Moderately critical	120 (16.2)	63 (11.9)	80 (40.4)	263 (17.9)
Very high critical	10 (1.3)	4 (0.8)	7 (3.5)	21 (1.4)
Severity code (clinical assessment), N. (%)				
Not critical	114 (15.3)	80 (15.1)	20 (10.1)	214 (14.5)
Mildly critical	547 (73.6)	414 (78.1)	108 (54.5)	1069 (72.7)
Moderately critical	75 (10.1)	34 (6.4)	61 (30.8)	170 (11.6)
Very high critical	7 (0.9)	2 (0.4)	9 (4.5)	18 (1.2)

**Opioids vs paracetamol and opioids vs ibuprofen $p < 0.0001$ – *Opioids vs paracetamol $p < 0.0001$.
Chi-squared $p < 0.0001$ (triaged patients assigned a very high critical code were excluded because the numerical smallness of this group prevented robust statistical analysis).

for morphine. We found that 49 children under 12 years old were treated with paracetamol plus codeine and half of these patients received codeine after the specific directives had been issued by the European Medicine Agency and the Italian Medicines Agency concerning the risks of this treatment.

Given the small number of patients who were overtreated, the multivariate analysis on the appropriateness variable was dichotomised into appropriate or not appropriate, with not appropriate treatment including both under treatment and overtreatment.

Figures 1 and 2 illustrate the distributions of the drugs dosages by under treatment, correct range and overtreatment, according to the type of drug administered and the age group of the patients.

The chi-squared test showed a significant association between the appropriateness of the dosage and both the age and drug administered ($p < 0.0001$), and the Student's *t*-test was highly statistically significant with regard to the appropriateness or not of the dose and the patients' weight ($p < 0.0001$).

Finally, to consider the appropriateness of the dosage as a dependent variable, logistic regression analysis was applied, using a forward stepwise model with the covariates being the drug that was prescribed, the age and weight of the patient, the clinical picture—dichotomised into trauma pain and bruising versus other types of pain—and the presence or absence of specific guidelines on the treatment of pain in children in the EDs (9,10).

Table 6 shows the results of the logistic regression analysis.

The hypothesis that the model would fit the data well was accepted, and the receiver operating characteristic test found that the area under the curve was 0.772 (95% CI: 0.747–0.798; $p < 0.0001$). For each one-year increase in a patient's age, the probability of appropriate analgesic drug prescription increased by 14.8% for the fixed value of the other variables in the model. Interestingly, the role played by the patient's weight in the model seemed to be almost a corrective factor for the age variable. Indeed, for an increase of one kilogram of body weight, the risk of inappropriate dosage increased by 1.8%, showing that for the same age, even being slightly, overweight had a negative impact on the appropriate dosage of the analgesic drug. In other words, the dose administered seemed to be more strongly influenced by the age of the patient than by his or her real body

weight. Although the proportion of inappropriate treatment was large, the presence of specific guidelines on the treatment of pain in childhood had a markedly positive effect on the appropriateness of the dose of analgesia given, more than doubling the likelihood of an appropriate prescription. Furthermore, trauma pain was treated more appropriately than other types of pain, with a difference of about 42%. Finally, as already mentioned, the risk of inappropriate dosage was significantly higher with paracetamol (+92%) and ibuprofen (+76%) than with opioids. Of the total of 1471 children, 1230 (83.6%) were discharged home, 197 (13.4%) were admitted to a ward in the hospital, and only six children (0.4%) were transferred to another hospital. With regard to the clinical pictures of the children who were admitted to hospital, 74 (37.5%) had trauma, 44 (22.3%) had abdominal pain, and 18 (9.1%) had headaches or migraines. With regard to access to the ED followed by discharge home, analgesic therapy was prescribed for home use for only 170 children (13.8%); this was paracetamol in 88 of 170 cases (51.8%), ibuprofen in 73 cases (42.9%), paracetamol plus codeine in four cases (2.4%) and other drugs in five cases (2.9%).

Table 3 Frequency distribution of the clinical pictures by drug administered

	Drug administered			
CClinical picture	Paracetamol	Ibuprofen	Opioids	Total
Trauma/bruising				
N.	189	127	75	391
% of line	48.3	32.5	19.2	100.0
% of column	25.7	24.2	38.1	26.8
Headache/migraine				
N.	73	69	32	174
% of line	42.0	39.7	18.3	100.0
% of column	9.9	13.1	16.2	11.9
Earache				
N.	171	137	11	319
% of line	53.6	43	3.4	100.0
% of column	23.2	26.1	5.6	21.9
Throat pain				
N.	32	25	1	58
% of line	55.2	43.1	1.7	100.0
% of column	4.3	4.8	0.5	4.0
Abdominal pain				
N.	148	25	23	196
% of line	75.5	12.8	11.7	100.0
% of column	20.1	4.8	11.7	13.4
Muscle or joint pain				
N.	17	45	16	78
% of line	21.8	57.7	20.5	100.0
% of column	2.3	8.6	8.1	5.3
Other nontrauma pain				
N.	59	61	16	136
% of line	43.3	44.9	11.8	100.0
% of column	8.0	11.6	8.1	9.3
Other*				
N.	47	36	23	106
% of line	44.3	34.0	21.7	100.0
% of column	6.4	6.9	11.7	7.3
Total				
N.	736	525	197	1,458
% of line	50.5	36.0	13.5	100.0

*Chest pain, toothache, scrotal pain, backache, pain due to focal infections and menstrual pain.

DISCUSSION

This study shows that appropriate use of analgesic drugs for pain treatment in Italian EDs, measured against the national guidance, was very poor. The undertreatment of paediatric pain has been confirmed in the past at numerous levels: by the lack of its evaluation and measurement and by the trivialisation of the symptoms by healthcare workers, (9,14), by the lack of priority assigned to pain in the management of patients and by the limited prescription and use of analgesics, which are often prescribed on an as needed basis (9).

There is considerable evidence to show that pain is treated less frequently in younger patients, than older patients, with the equivalent intensity of pain (12,15). This difference becomes even more marked when the management of children and adults is compared, as paediatric patients have been reported to receive significantly less pain treatment than adults for comparable diagnoses and procedures (12,16).

It has been reported that, in the paediatric ED setting, the most frequently used analgesics were paracetamol and ibuprofen (13,17). Therefore, it would be reasonable to expect widespread knowledge about the use of these drugs and good symptom management. However, this was not the

Table 4 Time of first dose according to type of drug administered

	Paracetamol	Ibuprofen	Opioids	Total
N. of cases (%)	743 (50.5)	530 (36.0)	198 (13.5)	1.471
Time to first dose (min)				
Mean	63.04	52.76	67.71	59.97
95% C.I.	53.82–72.25	45.69–59.84	52.91–85.52	54.30–65.63
Median	23	25	29	25
First quartile	5.0	7.5	13.8	7.00
Third quartile	60.0	63.3	84.0	63.0

Table 5 Parameters for determining appropriateness for each drug and route of administration

Drug	Evaluation of appropriateness
Paracetamol	Overtreatment >20 mg/kg
	In range:
	Oral: 15–20 mg/kg (in children weighing more than 50 kg. a dose of 1000 mg is in range);
	Intravenous: 7.5 mg/kg if body weight <10 kg and 15 mg/kg if body weight >10 kg;
	Rectal: loading dose for children: 30–40 mg/kg. maintenance dose 15–20 mg/kg every six hours;
	Full-term neonate: loading dose 30 mg/kg. maintenance dose: 20 mg/kg every 12 hours
	Undertreatment <15 mg/kg
Ibuprofen	Overtreatment >10 mg/kg
	In range 10 mg/kg (in any case ≥400 mg total in children with a body weight >40 kg)
	Undertreatment <10 mg/kg
Codeine (both *per os* and i.v.)	Overtreatment >1 mg/kg
	In range 0.5–1 mg/kg
	Undertreatment <5 mg/kg
Tramadol	Overtreatment >1 mg/kg
	In range 0.5–1 mg/kg orally. 1 mg/kg intravenously
	Undertreatment < 0.5 mg/kg orally. <1 mg/kg intravenously
Rapid-release morphine sulphate	Overtreatment >0.3 mg/kg
	In range 0.15–0.3 mg/kg
	Undertreatment <0.15 mg/kg
Slow-release morphine sulphate	Overtreatment >0.6 mg/kg
	In range 0.3–0.6 mg/kg
	Undertreatment <0.3 mg/kg
Morphine bolus	Overtreatment >0.1 mg/kg
	In range 0.05–0.1 mg/kg
	Undertreatment <0.05 mg/kg

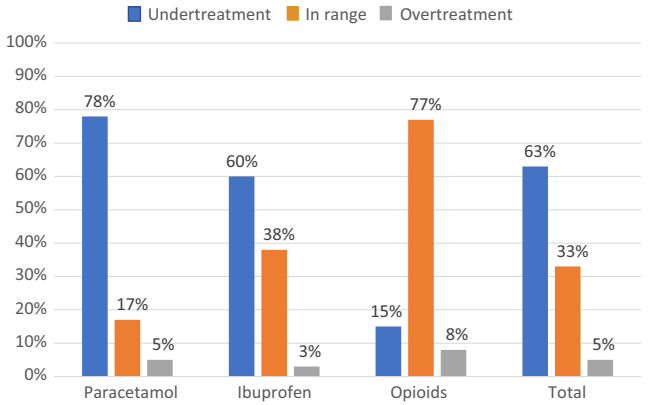

Figure 1 Distribution of drug dosages according to drug administered.

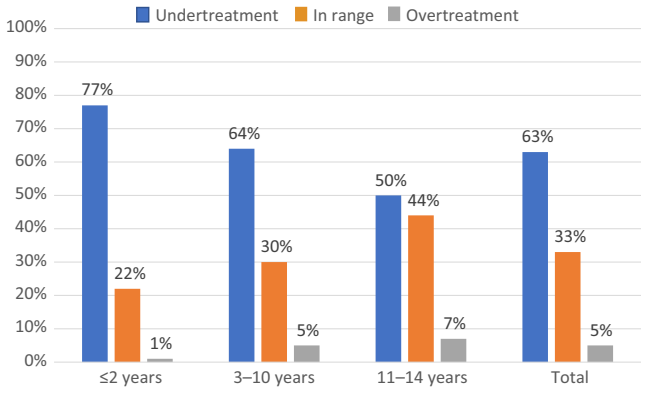

Figure 2 Distribution of drug dosages according to age group.

case in our survey as our data showed that the appropriate use of paracetamol (17.2%) and ibuprofen (37.5%) was poor.

When we analysed how appropriate the first dose of analgesic was stratified by the patient's age, we found that as patients got older, they were more likely to receive appropriate doses of analgesics.

The attitude to administrating drug doses could be influenced by many factors. Lubrano et al. (18) evaluated the appropriateness of paracetamol dosages administered for the treatment of fever, and an appropriate dose was defined as a single dose of up to 15 mg/kg and a daily dose up to 90 mg/kg/day. In line with the fever phobia phenomenon, the study showed that paracetamol was administered to 74% of children with a body temperature below 38.4°C, but in 76% of cases, the drug was administered at an appropriate daily dose (18). Therefore, even the fact that different societies assign different priorities to certain symptoms can influence the drug dosage that the patient receives to treat it.

On the other hand, overtreatment was uncommon and occurred mainly with paracetamol and opioids. It should be noted that these inappropriate doses were excessive, but far from toxic levels. One study reported accidental overtreatment with paracetamol, but stated that these were slightly less common than under treatment (19). The excessive doses reported by this study were more frequent in case of rectal and intravenous treatment routes than oral routes (19).

The use of opioids for the children has been reported to be insufficient, despite the fact that these drugs play a more important role in the ED management of pain in adults (20,21). There was also a limited use of opioids in our sample population, and these drugs were reserved mostly for children with more severe pain and older children, when compared to those treated with nonopioid drugs, as previously reported by various authors (18,22).

Interestingly, the percentage of appropriate doses was much higher for opioids (77%, Fig. 1) than for the other drugs, as it seems that clinicians were more knowledgeable about how to use them, despite the lack of data on their appropriate use in EDs.

However, our study showed that, despite the recommendations of the European and Italian Medicines Agency in

Table 6 Appropriateness of drug dose: logistic model

Variables	B	SE	Wald	df	p	Exp(B)	95% C.I.
Drug							
Paracetamol vs opioids	−2.587	0.203	179.521	2	<0.0001	0.075	0.051–0.112
			162.570	1	<0.0001		
ibuprofen vs opioids	−1.433	0.200	51.260	1	<0.0001	0.238	0.161–0.353
Guidelines (yes vs no)	0.753	0.189	15.897	1	<0.0001	2.122	1.466–3.073
Clinical picture (trauma vs other)	0.456	0.139	10.823	1	0.001	1.578	1.203–2.072
Age in years	0.138	0.031	19.505	1	<0.0001	1.148	1.080–1.221
Weight in kg	−0.18	0.008	4.763	1	0.029	0.982	0.967–0.998
Constant	−0.221	0.285	0.604	1	0.437	0.801	

B = logistic coefficients; df = degrees of freedom; EXP(B) = exponentiation of the coefficients (odds ratios for the predictors); SE = standard error associated with the coefficients; Wald = Wald chi-squared value.

2012, (23) codeine continued to be given to children under 12 years of age, even though this treatment was no longer indicated for them. More than 50% of the patients treated with codeine were under 12. The incorrect use of this opioid in the paediatric population can probably be explained by a lack of knowledge regarding the availability and the efficacy of other pharmacological and nonpharmacological treatments, as well as the reasons that led to the decision to limit the use of this drug. Moreover, numerous other factors could explain, these prescribing data, at least in part, including cultural issues, factors related to the clinical situation, training and organisational aspects. There is still a deep fear of side effects and a widespread belief that children feel less pain than adults and that pain is not a treatment priority in the paediatric population (24). Another problem is probably the lack of appropriate drug formularies for paediatric patients, which would facilitate adjusting the doses prescribed based on the patient's weight. However, our data show that inappropriate doses were significantly more frequent in younger children who tend to receive drops and syrup formulations that are easier to adjust based on the patient's weight, than items such as tablets. These aspects were also reported by Milani et al. (25), who stated that 61% of children presenting with pain to Italian EDs received less than the required dose of analgesics, namely paracetamol and ibuprofen. In that study, the under dosage was correlated to the use of suppositories and lower and higher body weight and the use of ibuprofen was associated with under dosage (25). Furthermore, some analgesic drugs are prescribed off-label in certain situations. This means that, as well as fearing the side effects of the drugs, clinicians realise that they must take a degree of responsibility for prescribing the drugs off-label. Sometimes, they do not always want to do this if the symptom is not considered a priority in the management of small patients (26).

Finally, very few studies are available regarding the promptness of analgesic administration to children in the EDs as an indicator of the quality of the healthcare system (27). We found that the median time before administration of the first dose of analgesic was just under 25 minutes and it was longer for opioids (29 minutes) than for paracetamol (23 minutes) and ibuprofen (25 minutes). The same results have been reported in another study (28). Analysing published data showed that the median waiting time for opioid administration reported in our study was similar, or better, to the time described in comparable studies; the median time for analgesia to be administered in paediatric EDs was 53 minutes, and in mixed paediatric and adult EDs, it ranged from 26 minutes (27,28). These findings show that healthcare staff working in adult EDs use opioid drugs more frequently and more appropriately.

For example, the UK guidelines for managing adult pain issued by the College of Emergency Medicine in 2014 (29), proposed a cut-off time of 60 minutes for primary analgesia and within 20 minutes for severe pain and an earlier study agreed (1).

It has been reported that, in the context of urgent and emergency paediatric care, symptoms are treated significantly more quickly if they are associated with fever than equivalent levels in patients without fever. That finding provides yet further confirmation of the influences that can affect drug prescriptions (18).

It is important to examine the strategies that could lead to an improvement in the time that it takes to provide adequate pharmacological therapy for pain in children in EDs. Taylor et al. (30) highlighted that the introduction of nursing protocols for pain management significantly modified the approach to, and interventions for, this symptom. They reported shorter time for primary analgesia, more frequent use of analgesic drugs and greater parental satisfaction with the management of their children's pain (30).

CONCLUSION

Despite the availability of numerous national and international guidelines and recommendations, the correct use of analgesia in Italian EDs has still not been achieved.

Our study found that the unsatisfactory use involved both delay in the implementation of the analgesia and inappropriate dosages of the analgesic drugs that were prescribed. Our data demonstrate a strong association between the time to analgesia and the choice of drug administered and among the type of drug and its dosage and the patient's age. One

priority is to carry out strategies and to provide initiatives that might lead to a real change in paediatric pain management. Health workers' training is probably the most important factor to work on. Adequate organisational choices and strategies that support changes are also necessary. All of these elements and public education could optimise pain management in EDs.

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CONFLICT OF INTERESTS

The authors have no conflict of interests to declare.

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