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RESEARCH

Knowledge and attitudes toward pediatric pain management among final-year medical students in Italy: a multicenter observational study

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Abstract

Pain management in pediatric patients is a critical aspect of healthcare, yet there is limited research on the knowledge and approaches of medical students regarding this topic. This study investigates the approach to pediatric pain management among final-year medical students. A cross-sectional survey was administered to final-year medical students from six universities located in Northern, Central, and Southern Italy between May and July 2024. The questionnaire (16 items) assessed the students' knowledge and attitudes toward acute pain management in pediatric patients. Descriptive and inferential statistics were used to analyze the data. A total of 321 students completed the survey. The majority (49%) of students reported limited training (< 1 h) in pediatric pain management during their studies. Only 42% of respondents believed that neonates feel pain more intensively than adults, while 38% thought the same for children up to 3 years. old While 81% recognized that pediatric pain can be measured with age-specific tools, 60% would avoid using opioids for severe pain in children. Seventy-five percent of students reported routinely using analgesia before painful procedures, but 33% would not treat abdominal pain before surgical evaluation in a suspected appendicitis case.

Conclusion: There are relevant gaps in the education of medical students on pediatric pain management in Italy. Traditional old views on pain are widespread among final-year medical students. Targeted educational interventions are needed to address these issues and ensure that future healthcare providers are adequately prepared to manage pediatric pain.

What is Known

- *Pediatric pain is often undertreated due to misconceptions among healthcare providers about their pain perception and the long-term consequences of untreated pain.*
- *Studies investigating knowledge and attitudes toward pediatric pain management have primarily focused on physicians or nurses, with limited evidence on medical students' preparation in this area.*

What is New

- *This study reveals significant gaps in knowledge and outdated attitudes toward pediatric pain management among final-year medical students in Italy*
- *Barriers to the use of opioids for severe pain management in children are already widespread among medical students*

Keywords Pain · Management · Treatment · Students · Training · Barriers

Introduction

Effective pain management in pediatric patients is a crucial component of healthcare, particularly in reducing short- and long-term negative consequences associated with untreated pain [1]. Despite advancements in this field, pain is often under-treated, especially in neonates and infants [2, 3]. Inadequate pain treatment in pediatric settings has been

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documented in both emergency departments [4] and inpatient wards [5–7]. This tendency is partially due to misconceptions among healthcare providers and caregivers about pain perception in young children [8, 9]. Furthermore, studies show that medical professionals, including pediatricians, may lack adequate training in pain management, leading to suboptimal care [10, 11].

Medical students represent a critical group whose knowledge and attitudes will shape their future clinical practice [12]. While some studies have addressed pain management education [13, 14], few have specifically explored pediatric pain education, and these remain limited in number and scope. For example, Cohen and Bennett (2006) reported the outcomes of a short problem-based learning session on pediatric pain during a clinical rotation, which showed short-term improvements in knowledge of assessment tools and opioid use [15]. Ameringer et al. (2012) evaluated a web-based module and observed gains in knowledge, confidence, and self-reported attitudes among U.S. medical students [16]. While these studies are relevant, they were conducted in single academic settings, thus limiting their generalizability, and may not reflect the current state of pediatric pain education. More recent research has focused on nursing students, revealing widespread misconceptions and insufficient preparation regarding pediatric pain management in diverse settings [17–19]. However, their findings cannot be directly applicable to medical students.

To address these gaps, we conducted a multicenter study involving final-year medical students to investigate their knowledge and attitudes toward pediatric acute pain management.

Methods

This study employed a cross-sectional design using an online anonymous questionnaire to collect data from final-year medical students at six Italian universities located in Northern (Milan and Pavia), Central (Florence and Pisa), and Southern (Messina and Naples) Italy, as previously described [20]. The questionnaire was developed by five pediatricians with an expertise on pain management and included 2 demographic questions and 16 items exploring various aspects of pediatric acute pain management, including the duration of teaching received on the topic, knowledge of neonatal pain perception, familiarity with pain assessment tools, and attitudes toward the use of paracetamol, ibuprofen, and opioids in children. The questions and possible answers are reported in the supplementary online material (Supplementary Table 1). All questions were closed-ended. The first draft of the questionnaire underwent pilot testing with five pediatricians who possessed expertise in fever-related surveys, as well as five pediatric residents and five final-year medical students. Modifications were made to the survey based on their feedback. Following this, two students completed the questionnaire on two separate occasions, spaced 14 days apart, and their responses to questions were consistent across both rounds.

The final version of the survey (uploaded in the supplementary online material) was divided into five sections: demographics, educational, understanding of pain in pediatrics, attitudes towards pain management, and clinical scenarios.

First section. The first section collected demographic information and university attended (two questions).

Second section. Participants were also asked about the time dedicated during their courses to pediatric pain management, whether they had encountered specific sections on the topic in their study materials and self-assessment preparation on the topic (three questions).

Third section. Participants' understanding of pediatric pain, particularly in neonates and young children were investigated: pain perception in neonates and young children, long-term effects of painful experiences and pain measurement tools (six questions)

Fourth section. The survey examined participants' perspectives on attitudes on managing acute pain in pediatric patients, covering topics such as: timing of pain treatment, procedural pain management, pharmacological treatments and routes of administration (five questions).

Fifth section. Respondents were presented with clinical scenarios to assess their practical decision-making covering acute abdominal pain and use of non-pharmacological techniques (two questions).

The survey was implemented on LimeSurvey and the link to access the questionnaire was sent by email to all final-year medical students of the six participating universities in May 2024. Two reminders with one month interval were made between June and July 2024. No incentive was given to the participants.

Data were analyzed using descriptive statistics (absolute and relative frequencies) and inferential tests, comprising chi-square and Fisher's exact test, to identify differences based on regional areas of the students (Northern, Center and Southern Italy). The R program was used for statistics. A p value < 0.05 was considered as significant. The study was approved by the ethical committee of the University of Milan (61/23, June 3, 2023). All respondents provided a written consent to participate.

Results

A total of 321 (40%) out of 812 students who accessed the survey, agreed to participate. A total of 200 (64%) students were female. The respondents were 151 (47%) from

Table 1 Students' education on pediatric pain. Data are given as absolute frequency and percentage

	N (%)
Teaching time dedicated to pediatric pain	
No time	96 (30%)
< 1 h	62 (19%)
1–2 h	90 (28%)
2–4 h	55 (17%)
> 4 h	18 (6%)
Topic pediatric pain deepened by means of a textbook	
Yes	114 (36%)
No	207 (64%)
Own know-how adequacy on pain	
Not adequate at all	70 (22%)
Inadequate	149 (46%)
Adequate	88 (28%)
Very adequate	14 (4%)

Northern, 59 (18%) from Central, and 111 (35%) from Southern Italy. There were no missing data.

Approximately half of the students (49%) reported receiving no teaching time or < 1 h on pediatric pain during their training. Most students (64%) reported never having read any specific section focused on acute pediatric pain in their university textbooks or other study material. A substantial part of respondents (68%) indicated that the knowledge they acquired on pediatric pain management during their studies was "not adequate" or "not adequate at all" for their future profession (Table 1).

Only 42% and 38% of respondents reported that neonates and children up to 3 years of age, respectively, feel pain more intensively than adults. Most respondents considered that painful experiences in neonates and children up to 3 years of age have persisting effects into adulthood. More than 80% of respondents were aware that specific instruments exist to measure pain in children, and 51% were aware of the existence of a numeric rating scale for this purpose (Table 2). Two-thirds of students (65%) reported that pain should be

Table 2 Student's knowledge of pediatric pain. Data are given as absolute frequency and percentage

	N (%)
Pain in neonates (younger than 1 month)	
The neonate experiences pain in a similar way to an adult	151 (47%)
The neonate experiences pain, but significantly less intensively than an adult	36 (11%)
The neonate experiences pain significantly more intensively than an adult	134 (42%)
Pain in children during the first 3 years of life	
The child experiences pain in a similar way to an adult	184 (57%)
The child experiences pain, but significantly less intensively than an adult	16 (5%)
The child experiences pain significantly more intensively than an adult	121 (38%)
Painful experiences in neonates have consequences until adulthood	
No	35 (11%)
Probably not	121 (38%)
Probably yes	117 (36%)
Yes	48 (15%)
Painful experiences in children have consequences until adulthood	
No	7 (2%)
Probably not	40 (12%)
Probably yes	163 (51%)
Yes	111 (35%)
Pain in children	
Cannot be measured because it is a subjective experience	13 (4%)
Cannot be measured because there are no specific measurement tools for children	34 (11%)
Can be measured using the same tools used in adults	14 (4%)
Can be measured with specific tools based on the child's age	260 (81%)
Awareness of numeric rating scale to measure pain	
No	10 (3%)
Yes, only for children	3 (1%)
Yes, only for adults	144 (45%)
Yes, for both children and adults	164 (51%)

treated as soon as possible. Nearly half of the students (46%) considered the rectal route the preferred method for paracetamol administration, as it provides a faster effect. Only 40% of students reported willingness to use opioids to treat severe pain in children (Table 3). The answers regarding the clinical scenarios are given in Fig. 1.

Considering answers and the geographical area of the universities, most questions revealed no significant regional differences in knowledge and attitudes (Supplementary Table 2). However, some differences were observed for knowledge about pain in neonates and the use of opioids.

Discussion

This study identified significant gaps in the education of final-year medical students in Italy regarding pediatric pain management, which appeared to be largely independent of the geographical area of their universities. The discussion will focus on the assumptions related to perceptions and effects of pain in neonates and young children, the pharmacological and non-pharmacological approaches to pain management, and the potential implications for medical education.

It is now widely recognized that neonates and young children experience pain more intensively.

than adults due to the immaturity of their nociceptive system [21]. Studies have shown that the descending inhibitory pain pathways in neonates are underdeveloped, leading to a greater sensitivity to painful stimuli. Moreover, immature neurotransmitter systems result in prolonged pain responses, emphasizing the critical need for appropriate pain management strategies in this population [22]. Additionally, untreated pain in neonates can disrupt the development of the nociceptive pathways, potentially leading to long-term consequences such as hypersensitivity, anxiety, or altered pain reactivity in later life [23, 24]. However, for decades, it was erroneously believed that young subjects either do not perceive pain or perceive it much less than adults [21]. These outdated assumptions historically led healthcare providers to underuse analgesics and anesthetics in neonates and infants, including during invasive procedures [21, 25, 26]. Similarly, misconceptions have been observed also among parents and caregivers potentially leading to an inappropriate approach to pain management in their offspring [27, 28]. Despite advancements in pain management over recent decades, misconceptions about pediatric pain perception persist, as evidenced by the responses of final-year medical students in this study.

Table 3 Students' attitudes on managing acute pain in pediatric patients. Data are given as absolute frequency and percentage

	N (%)
Timing of acute pain treatment in children	
Pain should not be treated to promote tolerance to the symptom	1 (-)
Pain should be treated as soon as possible	209 (65%)
Pain should be treated only if it persists (e.g., for at least 2 h)	90 (28%)
Pain should be treated only if it is unbearable	21 (7%)
Paracetamol and ibuprofen effectiveness for minor acute pain	
Paracetamol and ibuprofen are equally effective	97 (30%)
The effectiveness of paracetamol and ibuprofen depends on the child's age	80 (25%)
Ibuprofen is more effective	82 (26%)
Paracetamol is more effective	62 (19%)
Rectal (compared to oral) route for paracetamol administration	
Preferable because faster action	147 (46%)
Preferable because more effective	25 (8%)
Preferable because fewer side effects	23 (7%)
Only when the drug cannot be administered orally	126 (39%)
Willingness to use opioids for acute pain in children	
No, because they are not as effective in children as in adults	8 (3%)
No, because they cause dependence more frequently than in adults	20 (6%)
No, because they cause more frequent side effects in children than in adults	165 (51%)
Yes, for severe acute pain	128 (40%)
Use of pain relief for repeated acute painful procedures	
Always before each procedure	240 (75%)
Always after the procedure	40 (12%)
Only the first few times	29 (9%)
Never, to develop pain tolerance	12 (4%)

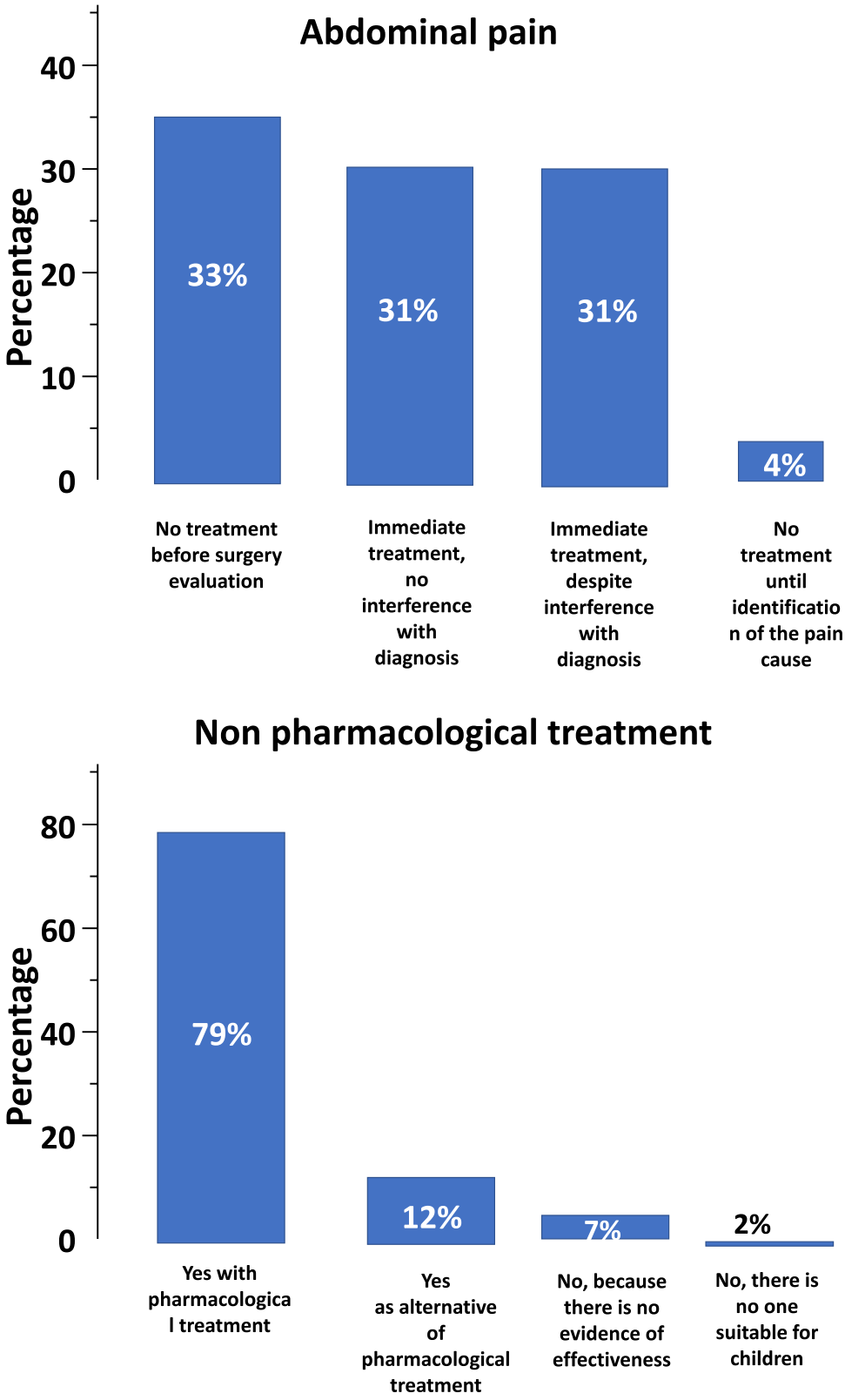

Fig. 1 Answers to the two clinical scenarios. In the upper panel, the histograms report the percentages of answers to the question "How would you manage abdominal pain in a 5-year-old child presenting in your clinic, whom you want to refer to the emergency department for suspected acute appendicitis?" In the lower panel, the histograms report the percentages of answers to the question "If a 6-year-old child with a fractured finger arrives at the emergency department, would you use non-pharmacological techniques, such as distraction or relaxation, to help reduce pain?"

More than 60% of the students considered that neonates do not feel or feel pain less intensively than adults. Furthermore, only a minority believed that untreated pain in neonates and young children might result in long-term effects extending into adulthood. These findings suggest that outdated traditional views persist among many final-year medical students, rather than evidence-based perspectives.

The first-line approach to managing acute pain in children involves both pharmacological and non-pharmacological treatments [29, 30]. Literature supports the efficacy of various non-pharmacological interventions, including respiratory and relaxation techniques, cognitive-behavioral approaches, distraction, and use of technology in mitigating pain in childhood [31]. A USA study conducted in 2012 among third- and four-year medical students found that only 12.5% would have used non-pharmacological treatments for pain. In this survey, approximately 90% of final-year medical students would use these techniques with or without pharmacological treatments. These discordant results might be explained by an increased awareness over the last years about the potential of non-pharmacological techniques. Although the results of this survey suggest a consistent and appropriate approach to pain management through non-pharmacological methods, they also show significant heterogeneity in knowledge regarding the effects of pharmacological treatments, including paracetamol and ibuprofen. Furthermore, many students preferred the rectal administration of paracetamol, believing it to have a faster onset of action. Studies among board certified pediatricians have documented that these assumptions are associated with inappropriate dosages of this drug for pain management [3, 32]. Furthermore, rectal administration is generally considered to lead to a slower absorption rate [33]. Considering the use of opioids, 60% would not administer them to children. Most students believe that these drugs are associated with adverse effects more frequently in children compared to adults. These findings indicate that barriers to opioid use are already widespread among medical students. Given the underuse of opioids in various healthcare contexts due to entrenched misconceptions that are difficult to change among professionals, studies are needed to evaluate the long-term effects of educational interventions aimed at overcoming these barriers among medical students [34].

In this study, approximately half of the final-year medical students reported receiving less than 1 h of teaching on pain management. Furthermore, two-thirds of them perceived themselves to be not competent in this area. These data were widely reported by students from all involved universities. Since inappropriate approaches during the medical training tend to persist into clinical practice [12], we speculate that an inadequate teaching time dedicate to this topic, could contribute to the persistence of inadequate pain management practices among healthcare providers. While the study of specific pediatric diseases is essential in the medical curriculum, knowledge and attitudes regarding pain management are equally critical. Although beyond the scope of this survey, the knowledge and beliefs of physicians should be considered in the context of interprofessional healthcare teams [35, 36]. Similarly, the training of medical students could be integrated into an interprofessional educational approach to improve pain management [37–40]. Notably, in 2012, the IASP Pain Curriculum for Physical Therapy provided a comprehensive framework for integrating pain education into healthcare curricula, which remains relevant today [41]. Overall, this study supports the hypothesis that advancing pediatric pain education among healthcare students is crucial, alongside research to assess its impact on future professional knowledge, attitudes, and patient outcomes [42].

This study has limitations. It relies on self-reported data, which may be subject to response bias. Knowledge concerning off label use of medication in pediatric pain therapy was not investigated in the current survey. The study was cross-sectional. Longitudinal studies would be useful to track changes in knowledge and attitudes as students' progress into their medical careers. Although the questionnaire was pilot tested, we did not follow a formal guide for the design and conduct of this self-administered survey [43]. Finally, there are currently more than 40 medical faculties in Italy. This study included students from six universities, which may not be fully representative of all medical students nationwide. Although 812 students accessed the survey, the total number of final-year medical students at the included universities exceeds 1,100. It is unclear whether students who did not participate overlooked the invitation or saw it but chose not to respond. If the latter is true, this could suggest that a considerable percentage of students were not interested in the topic. This hypothesis is supported by a previous survey on pediatric fever, conducted in the same universities, in which nearly 700 final-year medical students participated [20].

Conclusion

This study showed that outdated and inappropriate views on pediatric pain are still widespread among final-year medical students. This finding underscores the need for improved education on pediatric pain management in Italian medical schools. Future studies should evaluate the effects of such educational interventions among medical students.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00431-025-06197-3.

Author contribution Conceptualization: Gregorio P. Milani, Franca Benini, Paola Marchisio, Diego Peroni, Elena Chiappini. Methodology: Gregorio P. Milani, Giorgia Cai, Anna Comotti, Paola Marchisio, Maria Lorella Giannì, Gian Luigi Marseglia, Eugenia Bruzzese, Katia Cuppari, Diego Peroni, Franca Benini, Elena Chiappini. Formal analysis: Anna Comotti. Data acquisition or interpretation: Gregorio P. Milani, Giorgia Cai, Anna Comotti, Paola Marchisio, Maria Lorella Giannì, Gian Luigi Marseglia, Eugenia Bruzzese, Katia Cuppari, Diego Peroni, Franca Benini, Elena Chiappini. Writing—Original Draft: Gregorio P. Milani. Writing—Review & Editing: all authors.

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Data availability The data supporting the findings of this study can be obtained from the corresponding authors upon appropriate request.

Declarations

Ethics approval The Ethical Committee of the University of Milan (Italy) approved the study. The study was conducted in accordance with the Declaration of Helsinki.

Consent to participate Each participant provided a written informed consent to participate.

Conflict of interest Gregorio P Milani received grants from Angelini S.P.A. and Reckitt Benckiser Healthcare S.P.A. and act as advisory for scientific projects. Furthermore, Gregorio P Milani is one of the Editors of European Journal of Pediatrics.

Generative artificial intelligence Generative artificial intelligence was used to improve readability and language of the manuscript.

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