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# Al for chronic pain in children: a powerful resource

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## Abstract

Given the lack of scientific evidence, chronic pain represents an arduous challenge, especially in the pediatric field. In this complex scenario, artificial intelligence (AI) could support diagnosis, therapy, and research. However, the great potential of AI must be combined with the protection of data and the most fragile patients.

Keywords AI, Artificial intelligence, Pain, Chronic pain, Cancer, Machine learning, Children, Pediatric pain, Cancer pain

Chronic pain in children is certainly a hot topic, both in terms of research and assistance [1]. Conducting rigorous and well-structured studies in this field is difficult and expensive. This difficulty translates into a lack of evidence that complicates pain management in this population [2]. Consequently, pain physicians deal with chronic pediatric pain with difficulty [2]. In this situation, artificial intelligence (AI) can be a powerful resource [3]. For example, the lack of well-established tailored approaches is a key issue. Personalized pathways should evaluate not only the patient in his entirety, but also and above all in his uniqueness [4]. This is even more true and evident in the case of children. The word "children" includes very different categories of patients, from patients of just a few months of age to adolescent featuring completely different anatomical-physiological and pathological characteristics [5]. Approaching the same painful pathology in an infant or adolescent certainly involves not only two different thera-

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<sup>2</sup>Department of Anesthesia and Critical Care, Unit of Anesthesiology, Intensive Care Medicine, and Pain Medicine, Department of Medicine, Surgery, and Dentistry, University of Salerno, Baronissi (Salerno), Italy pies, but also two distinct diagnostic procedures. Completing this intricate picture is the correlation between rare pathologies and pain, thus representing children who are sometimes orphans among orphans [6]. Notably, the WHO establishes that these are precisely the patients who deserve the gold standard of pain treatment [7].

Gold standards which to date, precisely because of what was expressed above, can be assured.

In this scenario, artificial intelligence (AI) can prove to be a powerful resource. When properly developed, this complex set of technologies has the potential to deliver remarkable benefits. For example, AI can analyze very large and multidimensional datasets allowing easier diagnosis of pain, especially in patients in whom cultural and/ or cognitive barriers are present [8, 9].

Moreover, pain assessment and management in patients with cognitive impairment is often extremely challenging. The use of AI approaches, embedding objective features useful for automatic pain assessment such as facial expressions and crying with vital signs and the patient's history [10], would allow a more accurate and timelier diagnosis [11]. Additionally, AI-based methods such as those derived from machine learning models have been implemented for defining pain trajectories [12]. More properly, AI could predict those morbid conditions at real risk of developing chronic pain. The ability to quickly analyze a huge flow of data would allow the



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creation of alerts that would allow the physician to make the final diagnosis [13].

These instruments represent valid help. Another promising application of AI technology in managing pediatric chronic pain is its capability to support the entire family. From a family-centered perspective, it is crucial to have a tool that facilitates interaction between all family members and the doctor, ensuring the best possible support for the patient [14, 15]. This is beneficial not only in terms of trust, but also and above all logistics since specialized centers dealing with pediatric pain are generally third level, and therefore not widespread throughout the territory [16]. Therefore, technology implementation can reduce, if not eliminate, distances [17]. Various AI-driven interventions for pain management have demonstrated positive outcomes. For instance, an AI-powered interactive toy reduced perceived postoperative pain by 25% and enhanced coping strategies by 20% compared to conventional methods [18]. Likewise, AI-assisted relaxation techniques significantly decreased preoperative anxiety (p < 0.05) and led to notable improvements in caregiverreported quality of life [19].

However, all these important innovations are not without risks. Although AI is a powerful tool, it cannot and must not replace physicians for diagnosis and therapy. Furthermore, pivotal ethics issues emerge. For example, the use of sensitive data, especially in children, requires severe and stringent data retention policies. A possible data leak could cause damage to privacy, and to healthcare processes. Furthermore, using algorithms in an indiscriminate and uncontrolled manner would mean creating potential bias, labeling patients with pathologies and/or conditions that do not belong to them. All technological innovations in medicine represent a great opportunity, but also a challenge that needs to be governed. It is no coincidence that the European Union has dealt with this topic with an official act in order to regulate the use of AI [20]. However, the rules are not enough, and crossing over into the field of bioethics is mandatory. Finally, in addition to technical training, equal emphasis must be placed on developing soft skills, particularly bioethics. This becomes even more critical when treating a child, who is not only inherently vulnerable but also requires care that extends to the entire family.

#### Abbreviations

Al Artificial Intelligence WHO World Health Organization

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#### Data availability

No datasets were generated or analysed during the current study.

### Declarations

#### Ethics approval and consent to participate

Not competent.

**Consent for publication** 

Not competent.

#### **Competing interests**

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