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Preparedness of European pediatric oncologists to integrate AI in the clinical routine

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ABSTRACT

Background: Artificial intelligence (AI) holds promise in pediatric oncology, yet its full potential faces challenges. We undertook a survey aimed at assessing the viewpoints of European pediatric oncologists delving into their perceptions and expectations regarding the potential influence of AI in their clinical workflows.
Method: We conducted a survey by means of four hypothetical scenarios using AI and the Shinners Artificial Intelligence Perception (SHAIP) tool to assess healthcare professionals' perceptions of AI in pediatric oncology. We performed multinomial logistic regression to explore associations of responses to clinical scenarios with age and SHAIP scores.
Results: We obtained 140 responses and the analysis was performed on 108. The SHAIP questionnaire mean total score was 3.29 (SD 0.93) for the professional impact, and 2.37 (SD 0.61) for preparedness. Regarding the clinical scenarios, 34.9 % of respondents would ask for a procedure for confirming their diagnosis in case of discrepancy between AI decision support and human diagnosis; 55.8 % would be concerned about the generalizability an AI decision support system in case of lack of data from certain geographic areas during algorithm training; 47.6 % would feel uncomfortable in the informed consent process for an AI intervention; 10.2 % would no longer trust AI in case of a cyberattack affecting AI support for diagnosis.
Discussion: This survey underscores the importance of AI tools in pediatric oncology that incorporate human oversight in clinical decision-making and training AI algorithms with diverse and representative data. Our findings suggest that pediatric oncologists may not be adequately prepared for the seamless integration of AI in clinical practice.

1. Introduction

Artificial intelligence (AI) in pediatric oncology is a rapidly advancing field, demonstrating promise in enhancing clinical decision-making, streamlining diagnostics, and facilitating tailored treatment plans for patients [1]. Nonetheless, substantial challenges persist in fully realizing its potential within clinical practice. It is likely that clinicians will increasingly face pressure to incorporate AI tools into their daily practice, which necessitate their ability to adapt to a variety of potential circumstances.

One of the most important applications of AI in pediatric oncology will be supporting clinical decisions as evidence-based recommendations alone may not offer adequate support for intricate clinical decisions in pediatric oncology. The decision-making process in this field necessitates consideration of numerous factors, including but not limited to age, comorbidities, histopathology, molecular biology, staging, and the specific attributes of the local healthcare environment [2].

The accuracy of AI models, particularly those designed for Clinical Decision Support Systems in diagnosis (CDSS), has demonstrated the potential to match or even surpass the capabilities of experienced clinicians. As a result, the integration of AI tools into clinical practice is likely to introduce complexities in interpretation and present challenges to clinicians' decision-making processes [3].

The implementation of these systems will bring forth additional responsibilities for clinicians. As research advances, experimental studies involving AI-based interventions will become more prevalent. If clinical trials involving such interventions are conducted, clinicians will need to provide patients with comprehensive explanations about AI, along with the associated risks and benefits of each intervention, while having scarce experience of this technology [4].

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Finally, this technology will likely extend the risks associated with cyber threats and data leakage and even malicious attack to AI models that can affect patient safety and undermine trust in AI by clinicians and patients [5,6].

All these aspects hold particular significance in the context of pediatric oncology due to the rarity of conditions, the inherent difficulty in developing generalizable models, constraints in data availability, and the inherent vulnerability of pediatric patients. Although some publications have explored the perception of oncologists for adults, at our best knowledge, there is no published information regarding the perception of AI as a clinical tool in pediatric oncology.

For this reason, we conducted a survey to gauge the perspectives of European pediatric oncologists regarding these matters and to explore how they perceive and anticipate the potential impact of AI on their practices.

2. Methods

We devised four hypothetical scenarios, each presenting challenging situations that might arise in clinical activities after the implementation of AI tools. Subsequently, we created a questionnaire to elicit healthcare workers' responses when confronted with these scenarios. The

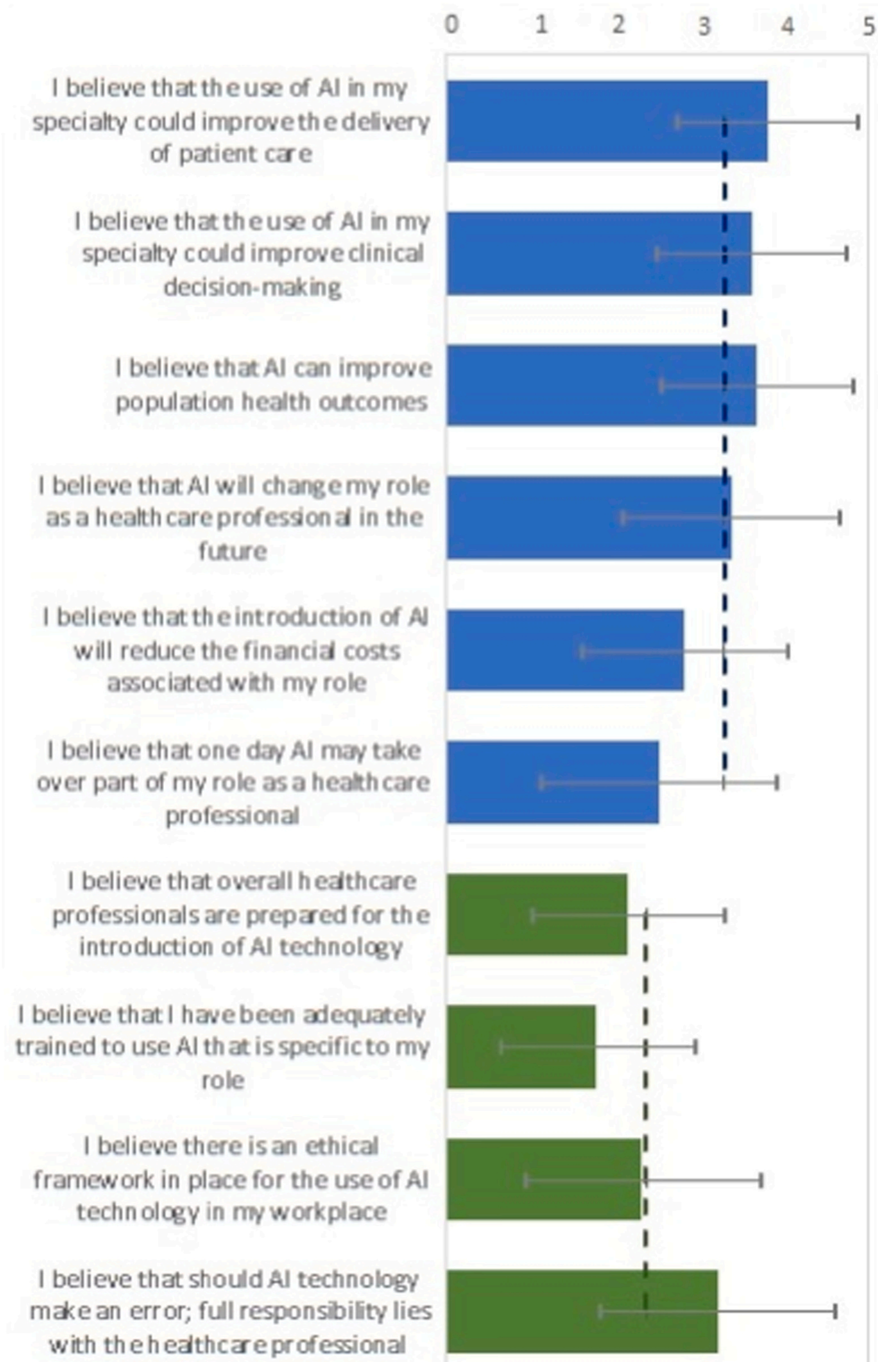

Fig. 1. SHAIP tool scores. Blue bars represent the average score for each item within the 'Perception of Professional Impact' SHAIP subscale, while green bars represent the average score for items within the 'Perception of Preparedness for AI' SHAIP subscale. *The dashed blue line represents the overall mean score for the 'Perception of Professional Impact' SHAIP subscale, and the dashed green line represents the overall mean score for the 'Perception of Preparedness for AI' SHAIP subscale.*

questionnaire encompassed sociodemographic information, information on perceptions of healthcare professionals on AI, and closed-response options for each scenario, allowing healthcare professionals to select the option that most closely aligned with their opinion. To explore perceptions about AI, we employed the Shinners Artificial Intelligence Perception (SHAIP) tool [7], designed specifically for healthcare professionals who have not yet integrated AI technology into their practices. The SHAIP questionnaire consists of 10 items, each probing various aspects of professional impact and readiness for AI, with responses ranging from 1 (indicating the lowest level of agreement or readiness) to 5 (indicating the highest level of agreement or readiness).

We invited pediatric oncologists in the European Union through various information channels, including social networks. The survey was hosted on the SurveyMonkey platform (San Mateo, CA, USA) and was accessible from July 15 to September 30, 2023. We conducted a descriptive analysis and a multinomial logistic regression to explore the association of responses to clinical scenarios with age and SHAIP scores.

As this study did not involve patients and the questionnaire was anonymous, a formal protocol was not submitted to an ethical committee. Nonetheless, we communicated the survey to the Bambino Gesù Children's Hospital Ethical Committee.

3. Results

The invitations sent by social networks generated a total of 2662 visualizations, while we obtained 140 responses (5.3 %) by healthcare professionals. Among these, two respondents were located outside of European countries, six were duplicated entries, and 24 did not complete the questionnaire in its entirety. Consequently, we included 108 responses in the analysis.

The mean age of the respondents was 48.5 years (SD 10.5), with 59.3 % of them being female. Geographically, 37.4 % of respondents were from Southern Europe, 28.0 % from Western Europe, 22.4 % from Northern Europe, and 12.2 % from Eastern Europe (Supplementary Table 1).

Regarding the SHAIP questionnaire, the mean total score for the professional impact was 3.29 (SD 0.93), while the score for preparedness for AI was 2.37 (SD 0.61), indicating a generally positive perspective on AI's impact and a more cautious stance about preparedness. The scores to the single items of the SHAIP questionnaire are reported in Fig. 1.

The item with the highest score in terms of professional impact was "I believe that the use of AI in my specialty could enhance patient care delivery," whereas the lowest score was recorded for "I believe that AI might eventually assume some of my responsibilities as a healthcare professional." In relation to preparedness, the highest score was obtained for "I believe that if AI technology makes an error, the healthcare professional should bear full responsibility," and the lowest score was observed for "I believe that I have received sufficient training to effectively utilize AI tailored to my role".

The responses to the pediatric clinical scenarios are illustrated in Table 1.

In the scenario of discrepancies between AI and human clinicians, 32.1 % of the participants expressed the need for more information before trusting an AI application's recommendation to remove a potentially malignant skin lesion. Meanwhile, 34.9 % would opt for a biopsy to verify the diagnosis.

In the scenario on generalizability, 55.8 % of participants voiced concerns about the validity and generalizability of the system. This group apprehended that the algorithm might not faithfully represent the unique cases prevalent in their specific healthcare settings.

In the scenario of providing appropriate information for informed consent, we observed that 47.6 % of the HCPs had reservations about handling sensitive data.

Regarding cybersecurity and cyber attacks, 10.2 % of the participants would halt all clinical activities relying on digital systems, expressing a complete loss of trust in AI applications. On the other hand,

Table 1
Responses to questions about behavior in clinical scenarios (N = 108).

Scenario	Response	N (%)
Discrepancy between clinical judgment and output of an AI CDSS for the classification of a potentially malignant skin lesion	Would request a biopsy	37 (34.9)
	Would need more details about the accuracy of the AI model to take a decision	34 (32.1)
	Would consult with a colleague	35 (33.0)
Lack of data from clinical centers in Europe during the development of a CDSS on cardiotoxicity effects of pharmacological treatments for cancer	Would be concerned about validity and generalizability in local setting	58 (55.8)
	Would be not concerned about generalizability	46 (44.2)
Informed consent process in a clinical trial where AI uses radiology, clinical laboratory results and genetics for classification of tumors and precision treatment	Would have problems in explaining to patients how AI works	50 (47.6)
	Would be confident in explaining risks and potential benefits of AI	55 (52.4)
Cyberattack corrupting an AI system for the automatic diagnosis of brain tumors	Would stop clinical activities and not trust AI anymore	11 (10.2)
	Would ask for more information before using the AI system again	69 (63.8)
	Would be looking forward to the restoration of the system to use that again	28 (25.9)

25.9 % were confident in the hospital's procedures and looked forward to the restoration of the AI-based system. The majority (63.9 %) preferred a cautious approach, wanting detailed information on the data breach and measures taken before resuming AI usage.

Neither age nor SHAIP scores were associated with responses in each clinical scenario.

4. Discussion

This survey highlights several crucial considerations.

While pediatric oncologists express confidence in the potential of AI to enhance the quality of care, they acknowledge a lack of adequate training for integrating AI into their clinical practice. This perception aligns with similar sentiments in other medical specialties [8,9]. Consequently, there exists an immediate need and an opportunity to establish specialized training programs tailored to the field of pediatric oncology, accounting for the unique complexities within this discipline.

Maintaining human oversight of AI-generated outputs remains essential. This is well perceived by respondents who feel that AI will improve the decision making process but also think that the responsibility of the clinical decision is of the healthcare professionals. Notably, one-third of the respondents indicated that they would seek advice from a colleague if there was a discrepancy between an AI-based Clinical Decision Support System (CDSS) and a human diagnosis. Equally interesting, another one-third of survey participants would request more information regarding the accuracy of the AI model when faced with a discrepancy. These findings carry significant implications for the ongoing discussions surrounding liability in medical decisions, potentially expanding the scope to include other stakeholders [10].

Furthermore, in the second scenario, concerns regarding generalizability and model explainability, particularly in relation to the data used for training AI algorithms, were evident. Nearly half of the respondents expressed apprehension about the data employed in algorithm training. These findings emphasize the significance of providing comprehensive information about the performance of AI CDSS in scientific publications as recommended by published guidelines [11].

Undoubtedly, AI holds immense potential for mitigating medical errors. However, the impact of AI Clinical Decision Support Systems (CDSSs) on the clinical decision-making process in pediatric oncology is likely to vary depending on the healthcare setting and the associated level of risk in their clinical implementation. AI tools can prove to be exceptionally valuable in healthcare environments where specialized clinical expertise is scarce. Reducing the time required for diagnosis and initiating appropriate treatment can significantly influence the prognosis of pediatric cancer patients [12].

Regrettably, the prospect of a rapid increase in the availability of specialized healthcare professionals is unlikely, as specialists tend to be concentrated in third-level reference clinical centers, and resources for specialized healthcare are limited. While technology cannot replace the invaluable clinical experience of healthcare professionals, accurate CDSSs have the potential to serve as a powerful tool for enhancing the quality of care and expediting the patient journey for children with cancer.

In order to create tools that can effectively support clinical decisions, particularly in settings where specialist expertise is limited, AI tools for clinical purposes should be trained on extensive datasets comprising diverse and representative patient cohorts to ensure their generalizability. Meeting these criteria is not just a practical necessity but also an ethical imperative for any entity engaged in the development of AI Clinical Decision Support Systems (CDSSs). Any data selection process used for training diagnostic algorithms in pediatric cancer must be carried out diligently to minimize bias and avoid producing algorithms with poor external performance. It is essential to acknowledge that, even with the most rigorous bias minimization strategies, no AI tool can be completely free of errors [13].

While pursuing explainability is essential, AI-based, non-knowledge based CDSSs offer the possibility to base the final clinical decision on a discussion between the AI tool and the clinician. Recent advancements in multimodal AI and Large Language Models offer the opportunity to rejuvenate clinical diagnostic reasoning and create CDSSs that engage in discussions with human healthcare professionals, rather than simply providing binary outputs. This approach can contribute to more informed and sound clinical decision-making [14].

However, if we aspire to deploy reliable AI-based Clinical Decision Support Systems (CDSSs) at scale, we must confront the challenges associated with data access. As evidenced in the second scenario of our survey, significant limitations in data access for AI tool development does not always align with the perception of reduced model generalizability [15].

Half of the respondents expressed discomfort with the idea of explaining how AI functions during the informed consent process in a clinical trial where AI serves as an intervention. As previously reported, the need for educating clinicians is evident, as it directly impacts their confidence in conducting the informed consent process and their ability to provide supporting evidence for these interventions. Additionally, concerns about trust in AI systems during a cyberattack scenario appear to be less prevalent and are more commonly found among older clinicians. Interestingly, this aligns with the uncertainty surrounding healthcare professionals' readiness for the introduction of AI and the existence of an ethical framework in their workplace. These observations underscore the fact that the integration of AI into clinical routines represents a systemic shift that should involve healthcare professionals and their organizations.

The results of our survey align with observations made in other studies. The key findings highlight a general confidence in the positive impact of AI, particularly in areas such as disease screening and the automation of repetitive tasks, which were identified as significant advantages of artificial intelligence [16]. There is also a perceived need for enhanced educational programs, coupled with concerns regarding liability in medical decisions supported by AI [16].

In the context of cancer, a separate study noted high expectations regarding the role of AI in cancer prediction, early detection, grading, and classification [17,18], alongside concerns about the lack of standardization of cancer health data [17].

Our study represents the first exploration of pediatric oncologists' perceptions of AI. Furthermore, we leveraged a combination of a standardized tool for gauging the impact and preparedness of healthcare professionals, along with realistic clinical scenarios. However, it is important to note that our study had a limitation in its focus solely on European healthcare professionals. Additionally, since participation in the study was voluntary, it may have attracted respondents who were particularly interested in this topic. Consequently, the perception of AI's impact and preparedness in the clinical setting could be more moderate when considered on a broader scale.

To implement AI tools in pediatric oncology, there is an urgent imperative to transition swiftly from proof-of-concept studies to large-scale investigations that can furnish robust evidence in support of AI tools. Currently, the ethical quandary revolves around striking the right balance between the potential for enhancing the quality of healthcare through AI and preserving ethics and privacy [19]. International initiatives are actively addressing the regulation of health data access for AI tool development and are exploring privacy-preserving technologies for data sharing. The ability to manage uncertainties, a crucial skill possessed by human clinicians, can be augmented by improving education efforts and developing AI-based CDSSs that adhere to deep-seated ethical principles and design considerations that prioritize human autonomy. This becomes particularly paramount in pediatric cancer where urgent solutions are needed for improving the outcomes of child patients.

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CRediT authorship contribution statement

Diana Ferro: Writing – review & editing, Data curation, Conceptualization. **Ileana Croci:** Visualization, Validation, Methodology, Formal analysis, Data curation. **Francesco Fabozzi:** Writing – review & editing, Writing – original draft, Conceptualization. **Angela Mastronuzzi:** Writing – review & editing, Writing – original draft, Validation, Investigation, Funding acquisition, Conceptualization. **Alberto Eugenio Tozzi:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper, There are no patents involved in this work. None of the authors declare that they have known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ejcped.2024.100213.

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