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Perspectives on the future of artificial intelligence in paediatric radiology

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A call to reflect

Dear Reader,

Gupta and Guarnera [1] note in the opening editorial of this special collection, that the question facing paediatric radiologists is no longer whether artificial intelligence (AI) will influence our specialty, but how we can engage with it critically, ethically and effectively while keeping the needs of children at the centre of our decision-making. The articles in this collection demonstrate just how far AI in paediatric radiology has progressed in a relatively short period of time. The collection spans foundational concepts, ethical frameworks, workflow optimisation, global health considerations, subspecialty applications and original research studies that move the field beyond theoretical discussions and into practical implementation.

The 2021 *Pediatric Radiology* AI special issue, which I had the honour of guest editing with Safwan Halabi [2], introduced many paediatric radiologists to the emerging possibilities of machine learning and algorithm-assisted imaging. Five years later, the conversation has matured. Rather than asking what AI might be capable of, we are increasingly asking which AI tools are sufficiently safe, equitable and clinically valuable to justify implementation in routine paediatric practice. The papers within this collection reflect that shift. They move beyond technological enthusiasm to grapple with questions of foundation models, multimodal AI and data mining [3,4]; ethical data governance and collaborative use of paediatric imaging datasets [5]; workflow optimisation and implementation [6]; global health equity and AI deployment in resource-constrained healthcare systems [7,8]; subspecialty-specific applications across neuroradiology, musculoskeletal imaging, cardiovascular imaging, chest imaging, abdominal imaging, interventional radiology and oncology [9–15]; AI-supported precision learning and radiology education [16]; and original research evaluating validation, reproducibility, workflow integration, medicolegal implications, AI and research, and patient benefit through applications such as bone age assessment, Cobb angle measurement, infant magnetic resonance imaging optimisation, neonatal lung disease diagnosis, fracture detection and imaging recommendation systems [17–27].

So, as we stand on the threshold of what may be the most transformative technological era in the history of medical imaging, it is worth reflecting on a fundamental truth: the future of AI in paediatric radiology will not be determined solely by advances in computer science. It will also be determined by the choices we make as clinicians, researchers, educators, regulators and advocates for children.

In this editorial, I propose six priorities that should guide the next phase of AI development and implementation in paediatric radiology.

1. Keep children at the centre

One of the recurring themes throughout this collection is that children cannot be viewed simply as small adults. Paediatric imaging presents unique challenges related to developmental anatomy, disease prevalence, imaging protocols, radiation exposure, consent and safeguarding. Consequently, AI systems developed primarily using adult datasets cannot automatically be assumed to perform equally well in children and indeed have been shown not to perform equally well in children [28]. Gupta and Guanera state, "…clinical priorities mean that paediatric validation cannot be assumed but must be specifically demonstrated." [1]. I would go a step further, to say, "…clinical priorities mean that paediatric validation cannot be assumed but must be specifically demonstrated and explicitly documented."

This issue contains examples of AI applications across multiple systems. Collectively, these papers illustrate both the breadth of opportunity and the complexity of applying AI across diverse paediatric populations. There are important questions which must be answered. Does the technology improve diagnostic accuracy? Does it reduce unnecessary imaging? Does it improve access to specialist expertise? Does it reduce radiation exposure? Does it shorten the diagnostic journey for children with rare diseases?

The future success of AI in paediatric radiology must be judged not by algorithmic performance alone, but by demonstrable improvements in outcomes for children.

2. Embed equity, diversity and inclusion

A significant risk facing healthcare AI is not technological failure but the potential that existing inequities will be made worse.

AI systems are only as representative as the data upon which they are trained. If datasets disproportionately reflect patients from high-income countries, large academic centres or specific demographic groups, algorithmic outputs may perform less well in under-represented populations. Such disparities may be difficult to detect and could inadvertently worsen existing inequalities in healthcare delivery.

Global equity, ethical data stewardship and AI implementation within resource-constrained health systems explored in manuscripts within this collection remind us that equity is not an optional consideration to be addressed after deployment; it is a prerequisite for trustworthy AI. For paediatric radiology, equity has multiple dimensions. It includes equitable representation of different ages, ethnicities and disease groups within training datasets. It includes equitable access to AI technologies across healthcare systems. It includes ensuring that children with rare disorders, who are often omitted from large datasets, are not excluded from the benefits of technological progress. It also includes addressing geographical inequities. Many regions continue to face severe shortages of paediatric radiologists. Well-designed AI tools have the potential to support clinicians working in underserved settings and improve access to specialist expertise. However, this potential will only be realised if researchers, vendors and professional societies actively prioritise inclusion of low- and middle-income countries, lower social groups and those living in more deprived areas within individual countries in development, validation and implementation programmes.

The future of AI in paediatric radiology must be measured not only by innovation but by inclusion.

3. Strengthen national and international collaboration

No single institution, country or professional group can address the challenges of paediatric AI independently.

The relatively small size of paediatric datasets, particularly in rare diseases, necessitates collaboration. National and international partnerships are essential to generate sufficiently large, diverse and representative datasets for algorithm development and validation. Collaboration is also required to establish consensus standards for data quality, reporting, benchmarking and post-deployment monitoring.

This special collection exemplifies the value of such collaboration. Contributors represent multiple specialties, disciplines and geographical regions. Collaboration must extend beyond academia. Clinicians, data scientists, industry partners, regulators, patients and families all have important perspectives. Meaningful engagement with children and parents will be particularly important as the use of AI becomes more visible within clinical pathways.

There is also a need for greater collaboration between paediatric radiology societies themselves. The recent multi-society statement on AI implementation in paediatric radiology is one such example [29]. The statement (from an international group of authors) emphasises AI regulation, procurement, implementation, post-market surveillance and education, while advocating for diverse paediatric datasets and child-specific evaluation frameworks.

The future of AI in paediatric radiology must built through collaboration rather than competition.

4. Prioritise governance, regulation and post-deployment monitoring

AI implementation does not end once an algorithm has been purchased and deployed.

Historically, medical devices have often been evaluated before adoption but monitored relatively little thereafter. AI systems challenge this paradigm. Algorithms evolve. Clinical environments change. Patient populations vary. Performance may drift with time.

Recognising these challenges, regulators and policymakers are increasingly developing frameworks for AI governance. The World Health Organization has emphasised that AI should be developed and deployed according to principles of transparency, accountability, inclusiveness and protection of human rights [30]. The European Union has established a unified legal framework for the regulation of AI systems [31], while in the UK a National Commission has been established to "*review current regulations and provide recommendations for a new regulatory framework for AI in healthcare*" [32].

The next generation of AI governance should move beyond pre-market approval towards continuous lifecycle evaluation. Hospitals, vendors and professional organisations must develop mechanisms for monitoring algorithm performance after implementation, identifying unintended consequences and responding rapidly when problems arise.

The future of AI in paediatric radiology must include robust regulation.

5. Clarify liability and accountability

One of the most pressing unanswered questions in healthcare AI concerns liability. When an AI-assisted diagnosis contributes to patient harm, where does responsibility lie? With the reporting radiologist? The healthcare institution? The software developer? The vendor? The regulator? At present, answers remain uncertain.

The increasing sophistication of AI has exposed tensions within existing medico-legal frameworks. If clinicians are expected to independently verify all algorithmic outputs, the efficiency benefits of AI may be reduced. Conversely, if AI outputs are accepted uncritically, patient safety may be compromised and accountability may become diffuse.

The challenge becomes even greater when considering increasingly autonomous systems and there is a need for careful consideration of accountability before widespread adoption. Professional societies, legislators, regulators and insurers must work together to establish clear guidance. Ambiguity benefits no one—least of all patients.

The future of AI in paediatric radiology must specify clear lines of accountability and liability.

6. Investment in education and the future workforce

To practice safely and efficiently, radiologists of the future must understand the strengths and limitations of AI tools. They must be equipped to evaluate algorithms critically, identify bias, interpret outputs safely and communicate effectively with patients and colleagues. AI-related education should therefore become a core component of professional development at all career stages.

Training programmes must ensure that future radiologists retain fundamental interpretive skills, and specific to paediatric radiology where so many variants exist, is the appreciation of "normal". AI should augment expertise, not replace it. The paediatric radiologist of the future will continue to provide clinical judgement, multidisciplinary leadership, ethical oversight and patient advocacy—roles that extend far beyond image interpretation alone. Children (and their parents and guardians) will still require clinicians who can navigate uncertainty, communicate compassionately and integrate imaging findings within a broader clinical context.

The future of AI in paediatric radiology will depend not only on technology but on people.

A call to act

I am grateful to have been invited to contribute a closing editorial to this AI Collection and thank the Guest Editors for this opportunity. While this editorial is almost at its end, the future of AI in paediatric radiology remains unwritten. Technological progress is inevitable. Equitable progress is not.

If we wish AI to improve healthcare for all children rather than a privileged subset of them, we must act now. Researchers must prioritise diverse and representative datasets. Professional societies must champion inclusion and international partnership. Journals must promote transparency in AI development and reporting and encourage submissions from under-represented regions (something we know they have done poorly in the past [33,34]). Vendors must demonstrate algorithmic performance across diverse populations and healthcare settings. Regulators must ensure that safety, accountability and equity are considered alongside innovation. We, as paediatric radiologists, must remain active participants in shaping the future.

The greatest strength of this special collection lies not in the algorithms it describes but in the breadth of perspectives it brings together. Contributors from different countries, healthcare systems and subspecialties have collectively demonstrated that the future of AI in paediatric radiology will be strongest when it is collaborative, multidisciplinary and globally inclusive. In summary, the future of AI in paediatric radiology should not be measured by the number of algorithms developed, publications produced or companies launched. It should be measured by the extent to which AI improves the lives of children and their families, regardless of geography, ethnicity, socioeconomic circumstance or disease rarity. Achieving this vision will require transparency, collaboration and leadership.

Dear Reader, the future of AI in paediatric radiology rests with us.

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