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Artificial intelligence in acute medicine: a call to action

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Introduction

On November 30, 2022, OpenAI released ChatGPT, the first chatbot and virtual assistant powered by large language models (LLMs). In just five days, ChatGPT attracted over 1 million users and reached 200 million monthly active users worldwide within fifteen months. This sudden surge of interest in artificial intelligence (AI) has expanded its potential from a niche concept to a mainstream obsession.

AI and machine learning were already making strides in medicine and healthcare, but with the advent of prescriptive and generative AI, new opportunities emerged to redefine how healthcare professionals diagnose, treat, and monitor patients [1]. AI has the potential to enhance diagnostic precision and provide personalized care by bridging the gap between digitalized medical data, clinical decisions, and optimized healthcare delivery.

The term "Augmented Intelligence" may be more fitting than "Artificial Intelligence," as it emphasizes AI's role as a collaborator that enhances human intelligence rather than replacing it. As large language models become more advanced, it is important to address the technical, ethical, social, and practical challenges they present.

AI's role is evolving from a mere tool to an assistant and potentially to a colleague. Just as human colleagues are expected to adhere to strict ethical and professional guidelines, AI systems must also be designed with similar standards in mind to support healthcare professionals and maintain integrity and trust in clinical settings.

Establishing clear guidelines and regulations for augmented intelligence will be vital for integrating AI into healthcare teams [2]. This ensures that AI enhances care delivery in a safe, reliable, and trustworthy manner without compromising patient safety and autonomy and that it benefits all communities, including those in low-resource settings and minority groups.

This insight is derived from the collaborative perspectives of 22 experts from a 3-day international AI roundtable at the ISICEM conference in Brussels in March 2024. It sheds light on the current situation and challenges regarding AI in acute medicine and urges stakeholders to work together to leverage AI-enabled care and expand acute medicine's reach.

Real-world applications and future implications

Several papers have demonstrated that predictive models could recognize patterns or identify early warning signs of critical conditions, potentially leading to more timely interventions and improved patient outcomes [3].

AI systems can combine data from diverse sources such as imaging, electronic health records, and wearable devices to offer a holistic view of a patient's condition. They can also help extract usable information from the current data overload that everyone in healthcare is exposed to. AI systems can then help make clinical decisions that align with real-world complexities and patient-specific needs, providing healthcare professionals with a comprehensive understanding that improves care delivery.

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AI systems could also streamline note-taking, documentation, and correspondence between healthcare providers and patients [4]. Additionally, AI could help in research. Current research in acute settings has several limitations. Populations of acutely ill patients are highly heterogeneous, and diseases are exceptionally dynamic. Unsurprisingly, randomized controlled trials have often failed to show positive results. AI could significantly improve trial design and execution by offering new ways to address these challenges. AI could identify precise patient phenotypes for accurate inclusion criteria, ensuring that trials enroll the most suitable participants [5]. It can also assist in real-time monitoring of trial participants, providing early signals of efficacy or adverse effects. Additionally, predictive models can help adapt trial designs dynamically, allowing investigators to adjust interventions based on emerging data.

Creating digital twins of patients and healthcare systems will enable researchers and clinicians to simulate potential outcomes, optimize resource allocation, and effectively guide care delivery. By developing accurate, data-driven digital twins, healthcare professionals can conduct controlled experiments and identify the best strategies to deliver truly personalized precision medicine. This digital "dry run" could reduce the risks and costs of testing novel treatments in vulnerable patient populations. Before jumping to these implementations, however, further research must prove how AI models can truly discriminate association from causality or how they can help investigators reduce uncertainty in their models, make trial design more efficient, and, ultimately, improve clinical outcomes [6].

Current challenges to AI implementation

Research has shown that AI can predict clinical trajectories in research settings but moving towards actionable AI or AI-enabled care, where insights directly guide clinical decisions in real-time, remains a significant challenge.

Establishing standardized data frameworks and promoting their adoption is vital to facilitating the seamless exchange of healthcare data across systems. Data fragmentation obstructs the development of robust AI models and hinders their smooth integration into clinical workflows.

In ICUs, for instance, patients often present a wide range of conditions, making it challenging to classify their medical phenotypes without detailed patient data. Real-time data gathering and analysis are crucial to effectively identify individual patient phenotypes, a practice that is not commonly implemented. The establishment of collaborative real-time data networks is essential, as no single ICU can independently gather all necessary information.

AI-based clinical decision support systems often lack situational awareness due to limited training in replicating real-world clinical decision-making processes. This gap can hinder AI systems from understanding clinical context and providing valuable input for clinical decision-making.

Concerns about privacy, data security, and transparency can be alarming for patients, families, healthcare organizations, and governments.

Clinician acceptance is hindered by the 'black box' problem, where models are not easily interpretable. Deep learning models may require more transparency, leading to skepticism among clinicians who need help understanding how a system arrives at its conclusions."

A call to action: a framework of actions for implementing AI in Acute Care

Overcoming these challenges necessitates a comprehensive framework prioritizing the following core elements:

1. *Social Contract for AI*: Develop a social contract with input from clinicians, data experts, policymakers, patients, and families to ensure that AI tools respect patient rights and autonomy while upholding ethical standards.
2. *Human-Centric AI Development*: Empower rather than replace healthcare professionals. Systems must be designed to enhance clinical decision-making while maintaining the clinician-patient relationship [7]. Do this most inclusively, driving improvements for everyone.
3. *Data Standardization and Infrastructure*: Establish unified standards and infrastructure to enable seamless data sharing and foster collaboration. For instance, OMOP, FHIR, and i2b2 can play pivotal roles in creating robust data structures that support AI integration.
4. *Federated Real-Time Networks*: Create real-time clinical research networks to enhance collaboration and enable data aggregation to study rare events. This will also improve phenotyping and allow clinicians to tailor treatments based on precise patient subtypes, moving toward a personalized and actionable AI model.
5. *Education and Training*: Provide healthcare professionals with the training to utilize AI tools effectively, understand their strengths and limitations, understand and accept uncertainty, and interpret probabilistic information. At the same time, build a "learn while doing" culture with AI-augmented human systems continuously improving their models as they analyze new data and adapt to changing clinical landscapes.

Fig. 1 DALL-E interpretation of the viewpoint. DALLE Open AI 2024

6. *Collaborative Research and Development*: Encourage partnerships between the public and private sectors to drive research that addresses critical needs in acute and critical care. This should be inclusive, with a specific focus on not leaving behind minorities and low-resource settings.

Conclusion and call to action

Integrating AI in medicine can transform healthcare delivery, but achieving this vision requires a concerted effort—Fig. 1. Stakeholders must embrace a unified approach to AI integration, advocating for robust data infrastructures, ethical frameworks, and collaborative networks that can harness the full potential of AI. By focusing on data standardization, real-time ICU networks, education, and working on a new "social contract for AI between all stakeholders," we can move toward a future where AI-enabled care brings acute medicine where and when it is needed, ultimately improving patient outcomes, and enhancing the clinician-patient relationship.

Round table taskforce. Brussels 17–18 March 2024

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