International AI in Medicine Education Working Group

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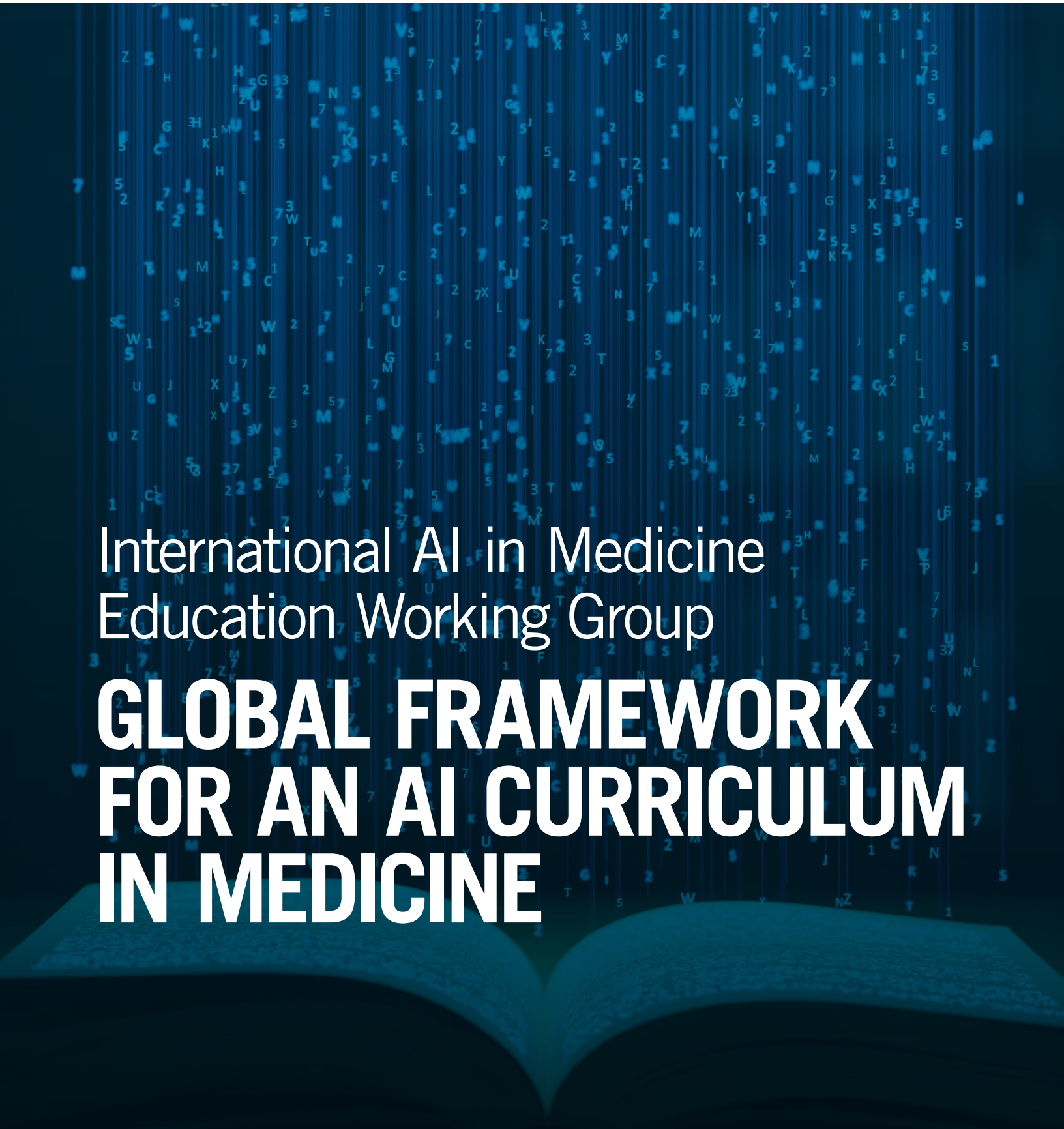

International AI in Medicine Education Working Group

GLOBAL FRAMEWORK FOR AN AI CURRICULUM IN MEDICINE

WHO WE ARE

The Artificial Intelligence (AI) in Medicine International Education Working Group is a consortium of representatives from universities and healthcare centers worldwide dedicated to advancing AI education in medicine. The group provides a forum for collaboration, knowledge exchange, and the development of high-quality educational resources in AI and medicine that can be used globally.

PURPOSE

This framework outlines the essential elements of an adaptable curriculum designed to support medical education in AI. It highlights key concepts that enable learners to think critically about AI in medicine. We will periodically update this document and welcome feedback on its content and shared resources. We have made this framework freely accessible to the global community, provided appropriate attribution is given.

TARGET AUDIENCE

The AI in Medicine Education Framework is intended to support healthcare professionals and trainees at all levels. It is designed to be flexible and accessible to individuals with diverse experiences and roles within clinical teams. We recommend tailoring case studies and examples to specific clinical roles and specialties to ensure maximum relevance and impact.

How To Cite This Framework

APA STYLE

International AI in Medicine Education Working Group. (Year). *Global Framework for an AI Curriculum in Medicine*. [URL]

If citing a specific term from the glossary, please include the term name (e.g., reinforcement learning) and retrieval date (if applicable). Example:

International AI in Medicine Education Working Group. "Reinforcement Learning." *Global Framework for an AI Curriculum in Medicine*, Year, [URL]. Accessed [Date].

CORE ELEMENTS OF THE CURRICULUM

The AI and Medicine curriculum consists of seven parts, which is accompanied by 24 learning objectives in total. The description and rationale for each part are briefly described below:

PART 1 Fundamentals

PART 2 Quality of Evidence

PART 3 Responsible Healthcare AI

PART 4 Deployment, Monitoring, Evaluation

PART 5 Leadership and Change Management

PART 6 Anticipate Future Trends and Disruptive Innovations

PART 7 Case Studies

DETAILED DESCRIPTION OF COMPONENTS

Part 1: Fundamentals

Fundamentals introduces learners to the foundations of artificial intelligence in medicine. It begins by defining AI as a field of computer science, outlining the main categories of machine learning (ML) techniques, and describing key healthcare applications. Core concepts such as supervised and unsupervised learning, deep learning, natural language processing (NLP), and large language models (LLMs) are explained, with attention to how different approaches address distinct clinical problems depending on the type and quality of available data. The section also introduces methods for evaluating model performance, including internal validation using development data and external validation with new datasets. Learners are familiarized with common performance metrics, such as accuracy, sensitivity (recall), specificity, precision, positive predictive value (PPV), negative predictive value (NPV), AUROC, F1 score, and calibration, while noting that the most clinically relevant metrics vary by application. Depending on the course format, this may or may not include instruction on calculation. Finally, the section provides a brief overview of the regulatory environment in jurisdictions where AI in medicine is most advanced, alongside an introduction to ethical issues related to the development, use, and evaluation of AI.

Part 2: Quality of Evidence

Medical AI must be grounded in strong evidence. This section equips learners to critically appraise AI research, assess model validity, and determine applicability to clinical scenarios and patient populations. Learners are introduced to frameworks for evaluating levels of evidence, such as the Melnyk & Fineout (2023) approach for both quantitative and qualitative research. The section also highlights methods being developed within machine learning to help users judge the reliability of AI outputs. These include approaches that provide confidence scores, flag when a model is being applied to data very different from what it was trained on, or issue warnings when predictions may be less trustworthy.

Part 3: Responsible Healthcare AI: Ethics, Governance, and Clinical Assurance

This section examines the ethical and governance frameworks that shape the responsible use of AI in medicine, including the Rome Call for AI Ethics, the EU AI Act, the OECD AI Principles, the UNESCO Recommendation on AI Ethics, and the FUTURE-AI guidelines. Learners consider ethical, legal, and regulatory requirements to ensure fairness, accountability, transparency, and privacy in healthcare applications. Topics include bias mitigation strategies, explainability, regulatory compliance, adverse event reporting procedures, and liability considerations. The section also evaluates AI tool accuracy and limitations, addressing issues such as algorithmic errors and hallucinations, while reinforcing the importance of maintaining sound clinical judgment. Learners are encouraged to reflect on broader implications, including the environmental impact of high-powered computational models, and to consider how patient consent should be integrated throughout AI development and deployment.

Part 4: Deployment, Post-Deployment Monitoring, Evaluation and Oversight

This section moves from theoretical understanding to practical application by presenting a framework for health information technology deployment that considers computing infrastructure, clinical context, human-computer interaction, people and workflows, organizational policies and culture, external regulations, and systems for monitoring and evaluation. Learners gain an overview of the AI lifecycle, with emphasis on how challenges at each stage, before, during, and after deployment, influence implementation outcomes. Insights from peer-reviewed literature on how health systems have approached AI implementation are explored, alongside concepts from human factors and human error research that inform safer and more effective deployment.

Part 5: Leadership and Change Management

The successful adoption of AI in healthcare requires capable leadership, organizational readiness, and cultural transformation. This section highlights the role of healthcare leaders and educators in anticipating and addressing concerns related to professional identity, clinical autonomy,

and workflow disruption. Learners are equipped with strategies to manage resistance, foster interdisciplinary collaboration, and support the integration of AI into medical institutions. The section also underscores the critical role of clinical expertise throughout the AI lifecycle, from problem definition and data management to model development, implementation, ongoing evaluation, and continuous improvement.

Part 6: Anticipate Future Trends and Disruptive Innovations

AI in medicine is a rapidly evolving field, and this section prepares learners to anticipate and adapt to future trends. Learners are encouraged to engage with industry thought leaders, peers, conferences, seminars, and curated online platforms to stay current. The section explores emerging technologies such as quantum computing, swarm intelligence, and generative AI, with an emphasis on critically assessing how these innovations may reshape healthcare delivery, medical research, and policy. It also highlights resources to support continued AI education, tailored to discipline-specific and regional contexts. Finally, learners are introduced to strategies for innovation discovery, including decision-tree frameworks that link emerging technologies to the problems they aim to solve while anticipating the new challenges they may create.

Part 7: Case Studies

Case studies serve as an essential bridge between theory and practice. This section provides learners with real-world examples of AI tools, their development, implementation, and clinical impact, drawing out lessons learned and common challenges. Learners engage in analytical approaches to reviewing studies, building critical thinking, decision-making, and problem-solving skills in alignment with the International Society for Technology in Education (ISTE) standards for educators and learners. Case-based scenarios are used to explore the integration of clinical judgment with AI recommendations, including strategies for resolving discrepancies between machine outputs and clinician instincts. Through these examples, learners reflect on how the interplay between AI and clinical expertise evolves with experience and across diverse healthcare contexts.

LEARNING OBJECTIVES BY CURRICULUM COMPONENT

Part 1: Fundamentals

1. Define and apply key concepts of artificial intelligence, algorithms, and data use, and explain their role in healthcare.
2. Describe current applications, emerging trends, and appropriate uses of AI in clinical decision-making, patient care, and healthcare management.
3. Identify opportunities and challenges for future AI applications in clinical decision-making and management, recognizing both benefits and limitations.

Part 2: Quality of Evidence

4. Critically appraise healthcare AI literature, including study design, validation methods, and statistical rigour, to support evidence-based practice.
5. Evaluate the reliability, reproducibility, and clinical relevance of AI models, distinguishing between proof-of-concept research and validated clinical applications.

Part 3: Responsible AI in Medicine + Assurance

6. Compare and contrast major AI ethics frameworks and evaluate their application in healthcare.
7. Analyze ethical, legal, and regulatory considerations, and apply principles to ensure fairness, accountability, transparency, and privacy in clinical practice.
8. Implement bias mitigation strategies and compliance protocols, and evaluate AI tool accuracy, limitations, and errors while maintaining appropriate clinical judgment.
9. Assess the broader implications of AI implementation, including adverse event reporting, liability, and balancing clinical benefits with environmental impacts.

Part 4: Deployment, Post-Deployment Monitoring, Evaluation and Oversight

10. Assess the strengths and limitations of AI models in practice, considering data quality, generalizability, explainability, and clinician acceptance.
11. Examine the role of human–computer interaction (HCI) in deployment, ensuring usability and alignment with clinical workflows.
12. Design and apply strategies for real-world testing, post-deployment monitoring, and continuous evaluation to ensure long-term safety, fairness, and effectiveness.
13. Identify regulatory and governance mechanisms for oversight, including risk and bias mitigation, and patient safety.
14. Reflect on the justification for applying high-powered computational models in patient care, considering societal and environmental impacts.
15. Evaluate the costs of establishing and maintaining AI models within healthcare systems.

Part 5: Leadership and Change Management

16. Develop leadership skills to drive AI adoption, including managing organizational change, fostering collaboration, and addressing stakeholder concerns.
17. Lead AI initiatives from ideation to implementation, ensuring alignment with institutional priorities, healthcare policies, and social license.
18. Identify and address cultural and structural barriers to adoption, and promote responsible, sustainable integration of AI in healthcare.

Part 6: Anticipate Future Trends and Disruptive Innovations

19. Analyze emerging AI trends and disruptive innovations, including deep learning, federated learning, quantum computing, and generative AI.
20. Evaluate the potential impact of future AI technologies on clinical practice, medical research, healthcare policy, and patient outcomes.
21. Foster a proactive and adaptive mindset to anticipate and respond to evolving AI-driven transformations.
22. Explain how emerging innovations align with the problems they aim to solve and anticipate the new challenges they may introduce.

Part 7: Case Studies

23. Apply foundational concepts by analyzing real-world AI implementations, mapping patient journeys, and situating AI tools within broader healthcare systems.
24. Strengthen problem-solving and critical thinking skills by evaluating case studies of AI deployment, identifying common challenges, pitfalls, and successful strategies.

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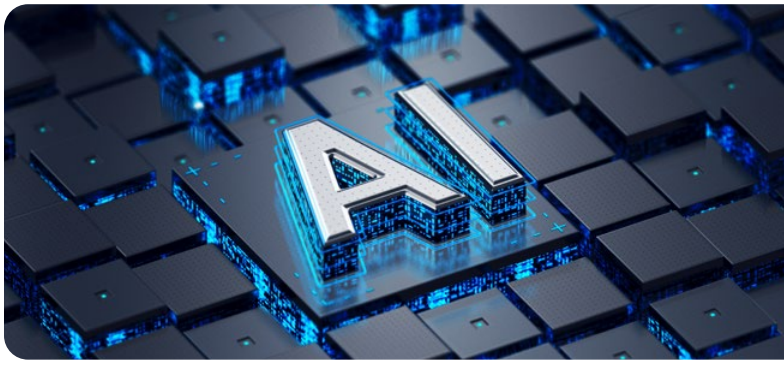

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