

Potential and pitfalls of artificial intelligence application in medical diagnostics

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Artificial Intelligence (AI) has emerged as one of the most transformative innovations in healthcare, particularly in the field of medical diagnostics (1). By applying machine learning algorithms, deep learning models and access to large datasets, AI systems can detect patterns, interpret complex imaging and predict disease outcomes with remarkable accuracy (2,3). These advances have raised expectations for reducing diagnostic errors, improving efficiency and expanding access to care. In radiology, for example, AI has improved breast cancer screening sensitivity (4), while in pathology, deep learning tools have demonstrated accuracy comparable to human experts in histologic classification (5).

Despite these advances, AI adoption in clinical practice faces important challenges. Diagnosis is a complex process that requires not only data interpretation but also clinical expertise, contextual judgment and ethical responsibility. Real-world studies have shown that AI systems trained on homogeneous datasets may underperform in diverse populations, resulting in disparities in diagnostic accuracy (6,7). This issue is particularly relevant for the Eastern Mediterranean Region, where health systems are heterogeneous and data infrastructure remains underdeveloped.

During the COVID-19 pandemic, some countries in the region piloted AI-based triage systems to optimise resource allocation (8). However, limitations such as the lack of high-quality regional data, insufficient workforce trained in AI and weak regulatory frameworks continue to hinder effective integration (9). Therefore, although AI offers significant promise, its safe and effective use requires careful evaluation, local validation and investment in infrastructure and capacity building. This paper explores the potential and pitfalls of AI in medical diagnostics, with emphasis on the Eastern Mediterranean Region.

Complexity of diagnosis and the role of human clinicians

Diagnosis is not solely a matter of data analysis; it involves an intricate interplay of clinical expertise,

patient history, physical examination and contextual understanding—factors that AI cannot fully replicate (5). The clinician's ability to interpret subtle clinical signs, comprehend patient narratives, appreciate psychosocial factors, and apply ethical reasoning remains central to quality care (6). Human empathy, communication and ethical responsibility are integral to the diagnostic process, shaping patient trust and adherence (7).

AI algorithms are typically trained on large datasets, which may lack diversity or regional specificity, limiting their generalisability (8). Biases inherent in training data can result in disparities in diagnostic accuracy across populations, raising concerns about equity and fairness (9). For the heterogeneous populations in the Eastern Mediterranean Region, with their varied genetic backgrounds, environmental exposures and disease patterns, AI tools developed elsewhere may underperform or yield misleading results if not properly adapted and validated locally (10).

For instance, a published case report described how overreliance on an AI dermatology tool resulted in the misclassification of a malignant lesion as benign, underscoring the importance of clinical correlation and physician expertise (11).

Risk of overreliance and deskilling

A critical pitfall is the potential for clinicians to over-rely on AI outputs, diminishing their own analytical skills and clinical reasoning over time. This “automation bias” can lead to acceptance of AI-generated diagnoses with inadequate scrutiny, risking the propagation of errors or overlooking atypical presentations (12). Maintaining clinical vigilance and fostering continuous education in critical thinking are essential to counterbalance this risk (13).

A systematic review reported that automation bias led clinicians to accept erroneous AI recommendations in nearly one-third of simulated diagnostic scenarios (14). More recent evaluations in radiology also confirmed that uncritical reliance on AI outputs increased the risk of overlooking atypical presentations (15).

Transparency and explainability

Many AI systems function as “black boxes,” providing recommendations without transparent reasoning (16). This opacity challenges the ability of clinicians to understand, trust and justify AI-derived conclusions, complicating shared decision-making with patients. Recent developments in explainable AI, including methods such as the local interpretable model-agnostic explanations (LIME) and SHapley additive exPlanations (SHAP) have been proposed to provide clinicians with interpretable insights and improve accountability (17).

Ethics, legal and regulatory considerations

Responsibility for diagnostic decisions, patient safety and clinical outcomes remains with health care professionals. Ethical dilemmas emerge when AI errors cause harm, raising questions about liability and informed consent (17). Regulatory frameworks must evolve to address the unique challenges posed by AI, ensuring rigorous validation, quality control and patient data protection, especially in low-resource settings (18). International frameworks such as the European General Data Protection Regulation (GDPR), the United States Health Insurance Portability and Accountability Act (HIPAA), and the United States Food and Drug Administration (FDA) guidelines on AI/ML-based medical devices provide concrete examples of regulatory approaches that could inform regional policy development.

Infrastructure and capacity building

Successful AI implementation requires robust digital infrastructure, data governance and interoperability standards, which are often lacking in parts of the Eastern Mediterranean Region (19). The region faces major challenges due to the limited availability of large, valid and regionally representative datasets, which are essential for the safe deployment of AI systems. The shortage of a trained workforce familiar with AI and data science further constrains adoption. Recent reports by

the WHO Regional Office for the Eastern Mediterranean emphasise the urgent need to build shared regional data repositories and capacity-building programmes tailored to the regional context. For example, Egypt has launched pilot projects in electronic health records, while Jordan and Lebanon continue to face difficulties in securing the necessary infrastructure and human resources (20). Investment in clinician training is paramount to empower health workers with the skills to interpret AI outputs critically and integrate them effectively into clinical workflows (21).

The path forward

To harness the full potential of AI, it is imperative to adopt a balanced, multidisciplinary approach. AI should complement, not replace, human clinical expertise, serving as an advanced decision support system. Collaborative efforts involving clinicians, data scientists, ethicists, and policymakers are essential to develop culturally sensitive, regionally validated AI tools tailored to local health care challenges (20).

In conclusion, although AI represents a revolutionary advancement with potential to improve diagnostic accuracy and health care delivery, it must be integrated thoughtfully and ethically, preserving the irreplaceable role of the human clinician. By embracing AI as an augmentative partner rather than a substitute, health systems in the Eastern Mediterranean Region can enhance patient outcomes while upholding the core values of medicine (21). To achieve this, policymakers should prioritise the development of regional data infrastructure and regulatory frameworks, health care leaders must invest in training programmes to prepare clinicians for AI integration, and researchers should generate empirical evidence and case studies tailored to the Eastern Mediterranean context. Only through such coordinated actions can AI be safely and equitably harnessed for the benefit of patients across the region (21).

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