

ARTIFICIAL INTELLIGENCE (AI) IN HEALTHCARE: PROSPECTS AND LIMITATIONS FOR PAKISTAN AT THE BLURRY CROSSROADS

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In 2018 researchers at Oxford developed an artificial intelligence (AI) system that could diagnose scans for heart anomalies and lung cancer, promising an estimated 50% savings in British NHS's annual spending on pathology services.¹ Around same time, Digital Diagnostics, a US based technology firm, received the first ever FDA clearance for an AI diagnostic platform that could diagnose diabetic retinopathy without physician input at the point-of-care.² Over recent years, we have seen plethora of similar developments at the crossroads of medical science and emerging technologies, in particular AI and its popular subsets like machine learning, robotics and expert systems. At this year's annual meeting of the New Champions (AMNC 2023) organized by World Economic Forum (WEF) in China, leading field experts predicted a wide spectrum of healthcare sector transformations with technological foresight, ranging from radical advancements in medical imaging, computational embryology, deep phenotyping, efficiency in drug development cycles, preventive medicine and precision health.³ While one can argue about the tenacity of many developments or even brush aside some of the claims as stereotypical rhetoric fuelled by corporates to prospect markets for technologies in nascence; it is hard to deny that a radical technological transition is knocking at the door of medical field.

As medical academics and practitioners, the emerging landscape calls for imminent and consequential thought leadership to steer the field's adaptation with the changing dynamics in the larger ecosystem. This thought leadership is important because the initial

response to the expanding frontiers of research and development at the juncture of medical science and AI tend to draw diverse, rather contrasting opinions: at one end there are exciting new possibilities for quality improvement in healthcare system, professional aggrandizement and socioeconomic sustainability; at the other, there is tacit, sometimes even stated, scepticism about efficacy of "physician-less" systems as well as the classical future-of-work debate raising concerns about the diminishing share for humans in the evolving work-pie. The role of AI chatbots in medical research, specifically in the context of publishing original, novel and reliable works, adds more contention to a readily complex problem of bracing new technologies. The challenge grows manifold for medical professionals in developing countries like Pakistan, where the institutional logics and technology gaps with developed countries typically hinder, or at least slow down the pace of technology acceptance in any field. The editorial is intended to draw attention of Pakistani medical fraternity towards prospects of employing AI in broadening the quality and scope of medical research and practice

For medical practice and clinical research, AI applications offer unprecedented possibilities in identifying and analysing patterns in large datasets both on clinical and basic sides. Some exciting trends in context include: (1) breakthroughs in medical image acquisition technologies have ushered in the big medical data era where imaging data is complemented with massive amounts of electronic medical records (EMR) and physiological records, analysis of which may not be judiciously harnessed without AI interventions, to materialize precision medicine,⁴ (2) in contrast to traditional pathology approaches, AI based solutions within the field of immune-oncology are contributing in new drug development and translational research creating

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crucial opportunities for understanding tumour micro-environment by deciphering complex pathophysiology and discovery of novel biomarkers.^{5,6} (3) AI models are not only improving diagnostic efficiency and accuracy but also offer reliable predictions of prognostic indicators like patient outcome, drug efficacy, and resistance before therapeutic interventions, all converging into more personalized healthcare delivery.⁷

First world countries are readily taking serious strides by channelling funds towards leveraging AI's potential to reshape the medical sciences and clinical practice. 'AI in Medicine (AIM)' program housed at Mass General Brigham (MGB), the largest hospital-based research enterprise in the United States, with annual funding of more than \$2 billion is quintessential case in point. The program brings together a number of investigators from Harvard affiliated hospitals and academic institutions, in a bid to drive AI driven cross-pollination of clinical and technical expertise areas.⁸ Unfortunately, developing countries like Pakistan face economic constraints that limit the possibilities of research and development initiatives comparable to cutting edge programs like AIM but we can always tap prospects for collaborations with counterparts in leading nations and align our research agenda to gain from their experiences and contribute to the global body of knowledge through contextual peculiarities of our region.

Community medicine and public health policy in Pakistan are among two top contenders for initiating work in integrating AI approaches to attend to different sectoral challenges in all three facets of public health i.e. health promotion, disease prevention, and treatment services. After COVID-19 pandemic there is a visible rise in predictive analytics globally in public health policy which also led to realization that localization of AI usage for policy is crucial to mitigate detrimental effects of overlooking local considerations relevant to population health.⁹ Stakeholders in Pakistan can draw inferences from experiences of other nations in comparable socio-economic strata. For example in a neighbouring country, an ongoing initiative to combat TB involves use of machine learning in developing a

decision support system enabling TB health workers to timely detect medication non-adherence which is one of the biggest challenges in ending the disease due to risks of reinfection or development of multi-drug resistant strains.^{10,11} There is a huge potential for customizing some of the regionally tested interventions to tackle indigenous issues like dengue epidemics, mother and child health problems, etc.

For new research undertakings with AI intersection, however, a word of caution is appropriate. As the technology is in infancy, AI tools, particularly generative AI which creates new content using existing textual, graphic or other forms of content, can misdiagnose or fail to detect critical conditions due to unintended anomalies in training data or technical glitches. These tools can create or amplify biases in healthcare delivery due to underlying algorithmic misalignments or oversights in training data collection. Sometimes the outcomes may raise questions of transparency and explainability as modern AI doesn't essentially mimic natural intelligence (NI). Data privacy issues and threats to cybersecurity are also among noted areas of concern. At the end of the day, with current state of the art, AI can be at best regarded as a supporting instrument in a man-machine relationship where man stays in lead.¹² This word of caution is equally valid for scholarly medical research where, like all scientific research fields, several types of generative AI tools are available off the shelf today, including text-to-text generators such as ChatGPT, text-to-image generators, tools that generate software codes or audio recordings and text-to-text generators that form a class of Large Language Models (LLMs) capable of recognizing, summarizing, translating, predicting, and generating content using very large datasets.¹³ While we need to advocate for a localized regulatory regime to guide AI applications in furthering medical research and practice in Pakistan, we must acknowledge that as an emerging technology, the institutionalization frameworks are in nascence worldwide and there will be a time to achieve stability through international standards and benchmarks. It is therefore imperative that meanwhile researchers, academicians and practitioners in Pakistan work colla-

boratively with local fraternity as well as build collegial networks in the countries at the frontiers of AI enabled healthcare emergence to update with this wave of medical innovation in tandem with the evolving global practices.

It is the need of the hour to register a call for locally contextualized research entailing scholarly and practice oriented wider conversations, to develop novel approaches to brace AI in healthcare system, leveraging its complementing force to augment human-centred healthcare delivery. Healthcare sector has historically been through several radical transitions over centuries. In AI we are potentially seeing another major transition taking place right now and missing the bandwagon is not an option, for the promise is too phenomenal and impactful for society at large.

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