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Editorial

Artificial Intelligence Surge in Healthcare—Can the Law Keep Up with the Algorithm?

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Phenomenologists can very well understand how the term Artificial Intelligence has gained popularity and is found to be associated with various concepts, predictions, social, political, economic, military, and legal implications, along with a threat to human intelligence, across global communities [1]. A global shift from human intelligence to artificial intelligence can be seen so fast that the Gen X can claim to experience and witness this transformational change in their lifetime. Gen X, being tech-savvy, not tech-dependent, is facing this burden of paradigm shift [2]. Artificial intelligence can be explained as the simulation of human intelligence, and programming and training machines to think, analyze, interpret, perform tasks specific to human cognition, like problem solving, recognizing patterns and improving over time with changing scenarios and complexity levels [3,4].

AI is no longer a future; rather, it is our present now. It reads X-rays, MRI, scans, automates triage, flags early-stage cancers, and offers mental health, nutrition, and lifestyle chatbots [5-7]. Celebrating the success of AI in medicine and healthcare, the question looms whether our laws are evolving fast enough to ensure accountability, safeguard patients and healthcare clients, preserve human dignity and implement ethical, inclusive and equitable standards across communities [8,9,10]. Globally, the AI adoption has risen from 20% in 2020 to 47% in 2024-2025. The pace of growth in the clinical AI tools market is entering mainstream workflows [11]. The challenges of data governance, algorithm training, robustness, consensus, legal and ethical liability have been in debate since 2017 onwards, resulting in the formulation of regulations and laws in various regions and countries globally [12,13]. WHO and FDA published an ethical AI technology regulatory framework and now continuously issue guidance documents and frameworks to ensure the safety of the AI system [14,15].

Pakistan is not behind in the race of AI technology in healthcare, but the development of regulations and laws is not fast enough to keep pace with and tackle the emerging ethical, legal, privacy, and liability dilemmas. There is a growing generation gap between tech-savvy and tech-dependent populations (Figure 1). Pakistan lacks dedicated AI regulations targeting the healthcare sector innovations. In 2023, the Digital Health Policy was launched, offering vague guidelines, leaving large healthcare organizations (hospitals) to navigate ethical, explainability, responsibility, traceability, and governance dilemmas ad hoc [16].

A study in 2025 reviewed the FDA documentation on AI healthcare product approval processes for the transparency and evidence rigor in terms of clinical benefit, bias reduction, procedures for testing, and validation, etc., and many were found to be missing. The procedure for approving these technologies was inadequately mentioned. Based on these shortcomings, strengthening the regulatory review and ensuring equity and inclusivity are the principles to be emphasized [17]. The critical concepts of systematic errors like the ‘Algorithmic Bias’, and ‘Black Box AI’ are important topics while discussing AI regulations. The Algorithmic Bias means the algorithms are applied to a population on which it is not trained, or in other words, it is inadequately informed and trained. The Black Box AI is the concept that deep learning AI and other complex models, when used, are difficult for humans to understand, interpret, or give reasoning for [18].

Figure 1: Generational AI dependency spectrum: From balanced to symbiotic

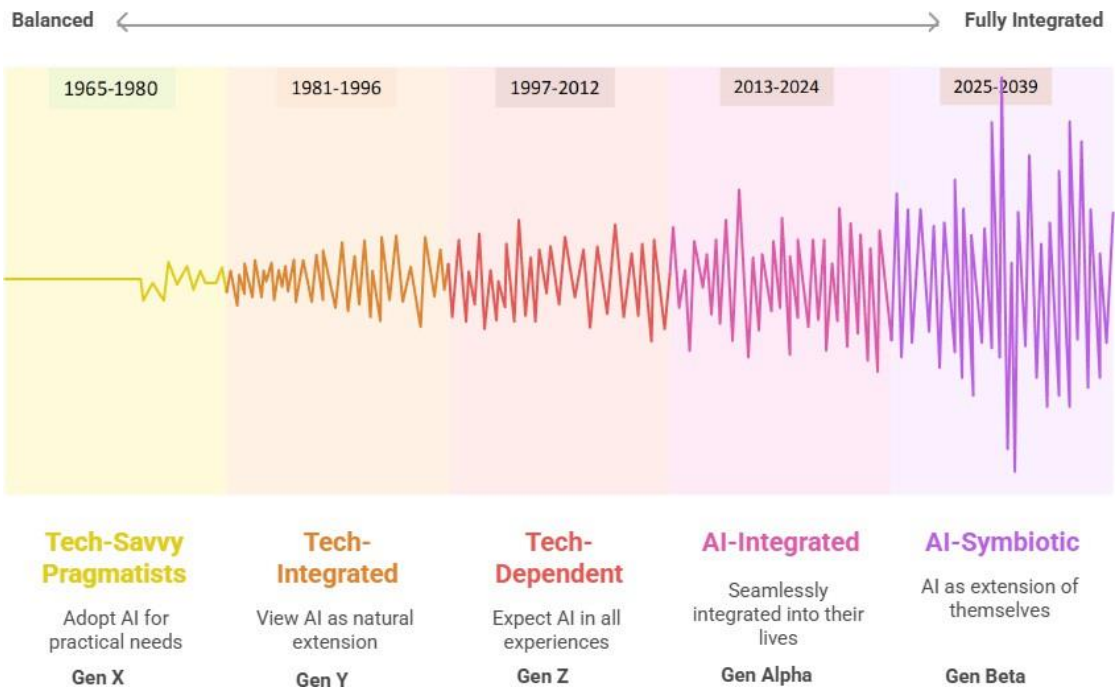
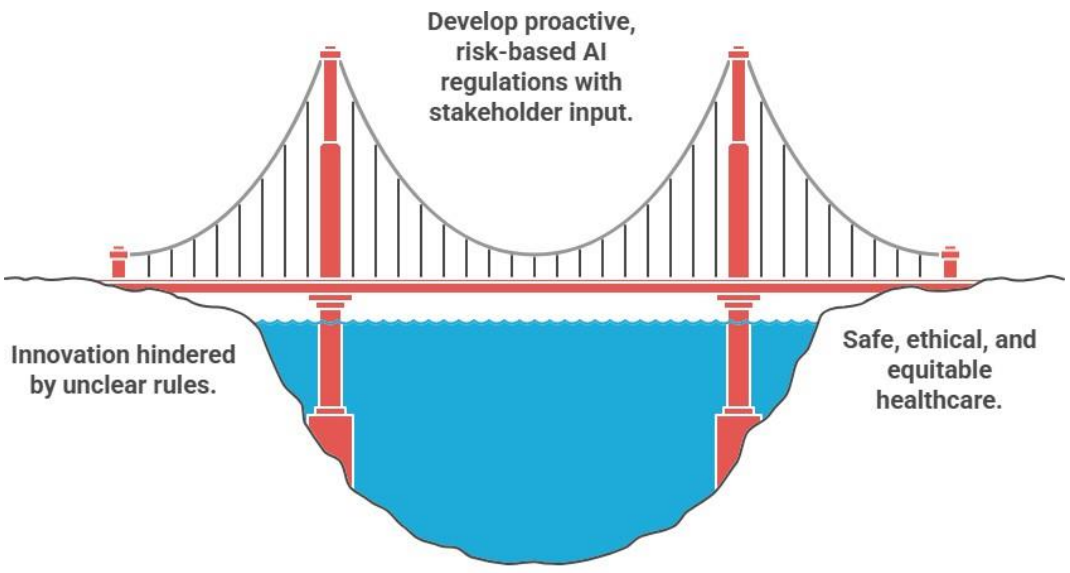


Figure 2: Healthcare AI: Balancing Innovation with Effective Regulation



Regulatory gaps in a nutshell are *liability loopholes* (when AI misdiagnoses a patient, then who is accountable?) [19], *consent* in AI (traditional way of informed consent doesn't address AI's unpredictability) [20], *Data colonialism* (low-income countries provide training data for AI but can't access that tool due to

proprietary barriers) [21], *Environmental costs* (carbon footprints are escalated harming public health like 552 metric tons of CO_2 emerging from GPT-3 training) [22], *adversarial attacks* (AI inputs can be manipulated by hackers, like altering MRI pixels and forcing misdiagnosis) [23]. If we think about the implications or the unseen risks, the common ones are *Clinical Deskilling* (clinicians' diagnostic abilities may get eroded due to overreliance on AI) [24] and *Ghost Protocols* (also called 'Zombie AI', abandoned algorithms can persist in hospitals without updates) [25]. Every technology has associated risks but using and creating them wisely following the ethical norms needs to be emphasized and regulated. Stakes are high so innovation needs to be balanced by accountability globally as well as locally at the meso and micro levels.

Change is inevitable, and the pace is fast. Healthcare policy makers and stakeholders are required to take steps towards investing in AI technological sector, the policy formulation, laws and regulations. In conclusion, AI regulations should be dynamic so that living policies can evolve, and we must consider global equity and climate-conscious AI. These are evidence-informed options shared as a way forward for global and local policies and laws.

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