

Editorial

Rethinking Molecular Diagnostics: Why Artificial Intelligence Must Lead the Next Revolution

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The persistent emergence of infectious diseases is not a regional problem instead it has become a global dilemma. ⁽¹⁾ WHO has been repeatedly warning against the rise of infectious diseases and to counter the situation by uplifting the public health care measures. ⁽²⁾ Disease from the past and most recently the emergence of COVID-19 pandemic has further made it evident that unprepared diagnostic systems can gravely amplify the health and economic toll of outbreaks. ^(3,4) Yet, despite the critical situation, countries like Pakistan are relying on diagnostic frameworks which are not well aligned with the demands of modern health care. Our resource constrained country has to act in time to overcome the problems that are posed by sophisticated instrumentation which requires complex laboratory infrastructure, costly reagents, requirement of highly trained professionals and limitation at point of care diagnostics. ⁽⁵⁾

Advanced molecular diagnostics such as real time-based assays, next generation sequencing and CRISPR based tools are well known for their capability of precise pathogen detection and targeted therapy guidance. ⁽⁶⁾ But their availability is mainly limited to state of art urban health care settings. Pakistan being dominated by rural population thus faces a tough challenge to provide such well-equipped diagnostic center in its resource limited areas. Therefore, it's also essential to ensure that our future investments are not directed towards the technologies which are misaligned with the existing health care facilities. Misguided consideration of such facts might create a diagnostic divide that is difficult to ignore. ^(7,8)

Against these circumstances, rapid evolution of Artificial Intelligence (AI) offers a compelling and pragmatic avenue for transformation. Besides the absence of technology, the failure to integrate innovation into a practical and scalable system is also direly required. The AI-enabled approaches have been distinctively recognized for their ability to overcome expensive health care solutions by harnessing data-driven algorithms, computational power, and easy to use digital platforms. ⁽⁹⁾ The use of computational tools such as machine learning, neural networks and deep learning has made AI competent to analyze complex data sets with precision, identify subtle patterns, and report the predictions with accuracy and at speeds otherwise impossible by humans. ⁽¹⁰⁾ These AI based approaches are thus forming a transformative health care approach which serves as a trustworthy assistant for clinical decision and solve the puzzled problems of medical diagnostics. Such abilities also provide sustainable solutions to shift the complex laboratory setups into more data driven, knowledge based and user-friendly approaches providing a relevant opportunity to the underprivileged areas. Now, this is a point where tables have turned around and AI positions itself as key player for clinical decision-making being able to redefine the landscape. The success of the whole system also depends upon the democratization of AI based diagnosis which means that AI is helpful in building such point of care that can provide accessible opportunities particularly in remote areas. Clearly, the discussion is not only about improved efficiency it is about better scalability, cost effectiveness and Fair and equal opportunity provision. ⁽¹¹⁾

But the prime question is how to come up with the strategies that can cope up with orchestrating AI in mainstream of clinical diagnostics. As the Pakistani young population is becoming competent and highly skilled professionals in the areas of analytical and computational capabilities with each passing year. The prime problem is that firstly the poor health sector policies and secondly the economic constraints and infrastructural limitations have strictly hindered the translation of this human capital into healthcare innovation. Now AI is ready to bridge this gap by enabling locally adaptable, cost-effective diagnostic solutions that are less reliant on physical infrastructure and more on intellectual and digital capacity. Pakistan as a low middle income country should rigorously take steps to incorporate the viable approach to build a safe future for health care.

Ultimately, the transformative potential of AI is not merely a glimmer of hope, but it is a forward-looking approach that effectively combines the technological advancements to build an equitable and resilient health care system. foster interdisciplinary collaboration and strengthen digital and research ecosystems. By doing so, diagnostic solutions can evolve to become more scalable, accessible, and contextually relevant.

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