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Editorial

Artificial Intelligence and infectious diseases—charting a new frontier

The intersection of Artificial Intelligence (AI) and infectious diseases marks one of the most significant evolutions in modern medicine. In an era defined by emerging pathogens and antimicrobial resistance (AMR), traditional approaches to infectious disease surveillance, diagnosis, and management are increasingly being complemented by data-driven technologies. AI encompasses machine learning, deep learning, and advanced analytics and is becoming a powerful tool in enhancing precision and speed in combatting infectious diseases.

One of the most immediate contributions of AI lies in diagnostics. Rapid and accurate identification of infectious agents remains central to clinical care, as conventional methods are often time-intensive. AI algorithms can analyse clinical data, imaging, and laboratory results to support early diagnosis and decision-making. For example, machine learning models trained on radiological images have demonstrated utility in identifying patterns consistent with respiratory infections. Similarly advanced AI algorithms could analyse microscopic images to rapidly and accurately identify pathogens. These advances would reduce diagnostic delays and support clinicians where specialist expertise may be scarce.

AI has demonstrated remarkable potential in disease surveillance and outbreak prediction. By integrating diverse datasets—including climate variables, population mobility, and epidemiological trends—AI systems can identify early warning signals of outbreaks and model disease spread. The global experience during the COVID-19 pandemic highlighted both the promise and limitations of such technologies. AI-based platforms were able to detect unusual clusters of pneumonia even before formal recognition of a pathogen or an outbreak, illustrating the capacity of AI for real-time surveillance. However, the pandemic also underscored the importance of data quality, transparency, and coordinated human responses if AI is to be used as a beneficial tool.

AMR remains a pressing challenge, particularly in low- and middle-income countries. AI can play an important role in addressing AMR by predicting resistance patterns, optimising antibiotic prescribing, and supporting stewardship programmes. Predictive models developed through analysis of local microbiological and clinical data could guide empiric therapy, reducing inappropriate antibiotic use and preserving the efficacy of existing drugs. Furthermore, AI is accelerating drug discovery by identifying novel antimicrobial compounds and repurposing existing agents, offering hope in the fight against multidrug-resistant organisms.

AI is also reshaping personalized medicine in infectious diseases. Risk stratification models can identify patients at higher risk of severe outcomes, enabling targeted interventions and efficient allocation of healthcare resources. In diseases such as dengue, tuberculosis, and sepsis, AI-driven tools can assist in prognostication and clinical management.

Importantly, AI should not be viewed as a replacement for clinical expertise but as a complementary tool that enhances human decision-making. The successful integration of AI requires interdisciplinary collaboration among clinicians, microbiologists, data scientists, and

policymakers. Healthcare professionals must undergo education and capacity building to effectively interpret and apply AI-driven information effectively.
Despite its promise, the integration of AI into infectious disease practice is not without challenges. Data availability and quality remain fundamental limitations, especially in settings such as Sri Lanka, where digital health infrastructure is still evolving. Many AI models are developed using datasets from high-income countries, raising concerns about their applicability in local contexts, and this can hinder clinical trust and adoption.

Despite these challenges, the adoption of AI in infectious diseases presents a timely opportunity for Sri Lanka. Investments in digital health infrastructure, strengthening of surveillance systems, and development of locally relevant datasets can enable the country to harness AI for improved public health outcomes. Collaborative partnerships between academia, healthcare institutions, and technology sectors will be essential to drive this innovation. With careful stewardship, AI has the potential to redefine how we understand, detect, and respond to infectious diseases, ultimately improving patient care.

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