Editorial

Artificial Intelligence in Laboratory Medicine

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The latest hype of recent years in modern day digital world is most probably 'Artificial Intelligence' or AI. Artificial intelligence (AI) refers to the creation of computer systems capable of performing tasks that historically only a human could do, such as reasoning, making decisions, or solving problems but without direct human input. Use of AI is being noticed in many aspects of our life previously unimaginable. Without exception, both health care and laboratory medicine are transitioning into an era of AI and labs are turning to artificial intelligence (AI), machine learning (ML), and data analytics (DA) to keep pace as the world becomes data-driven and with the goal to provide accurate, readily available, and contextualized data.[1] Automation and AI can fundamentally change the way laboratory medicine is practiced and can improve diagnostics through more accurate detection of pathology, better laboratory workflows and improved decision support. Artificial intelligence (AI) has the potential to transform laboratory medicine. It can be used to improve laboratory automation, data analysis, laboratory information management, decision support, and patient diagnosis and treatment. It can help to reduce turnaround time, increase accuracy, and improve efficiency of laboratory testing. For example, AI can be used to automate the pre-analytical process, such as sample identification and tracking. It can also help to optimize laboratory workflows and prioritize urgent samples. In addition, AI can be used to analyze large amounts of laboratory data to identify patterns and trends, which can aid in disease diagnosis and treatment decision making.[2,3]

Over the decades, laboratory testing has experienced a revolutionary development that has resulted in all routine chemistry and hematological testing being fully automated. Automation currently offers methods for specimen sorting, processing, transportation, sample introduction, and storage in addition to performing tests. In recent years, the term 'laboratory automation' has also been used to refer to a broader procedure in which a number of equipment, frequently connected in series, are equipped with the ability to automate the pre-analytical, analytical, and post-analytical phases of testing. A complex information system that monitors and manages these operations, improves performance, self-monitors analytic performance, and interfaces with the laboratory information system (LIS) lies at the heart of these arrangements. Historically, Chemistry and Haematology departments have been the earliest to adopt robotics and algorithms into its workflow. Since the 1970s, when MYCIN was created at Stanford to diagnose blood-borne bacterial infections, AI has been focused on disease diagnosis and therapy. Around 1984, a knowledge-based Artificial Intelligence (AI) programme named "EXPERT", a consultation system-building tool, was developed at Rutgers University for enabling sequential laboratory testing and interpretation.[4,5] Today, medical laboratories have a great opportunity to benefit from artificial intelligence techniques. Some hospitals around the world have begun to adopt fully automated medical laboratories to analyze medical cases. Artificial intelligence can integrate a lot of data, analyze them, and detect accurate patterns, which contributes to alerting doctors about the physiological changes in the patient's body and dealing with them.[6] Today's clinical labs are already using advanced robotics to test minute volumes of blood, serum and other body fluids from thousands of samples in a day to give highly accurate and reproducible answers to clinical questions, in scales almost difficult to perform by humans. These machines are driven by

conventional algorithmic programmes, which represent and use data, iterate repetitively and exhaustively using a decision sequence, using numbers and equations, finally presenting a number or result within confidence limits.[5]

However, implementing AI in laboratory medicine requires careful consideration of ethical, legal, and social implications, as well as appropriate data management and governance. It is true that AI is capable of processing an amount of data well beyond the reach of a single human mind, improving diagnostic accuracy, detecting diseases before they express, improving prevention, designing patient-centred care pathways, enhancing epidemiology, supporting population health management, and reducing the negative impact of social determinants of health.[7] But the same technologies pose some critical threats to patient privacy and safety, care providers safety from liability, opportunities for employment, patient engagement, clinician trust and scientific progress itself.[8] Implementation of AI in desired fields is yet another challenge. With evergrowing digitalization and automation, clinical laboratorians will surely be confronted with the challenges associated with evaluating, implementing, and validating AI algorithms in their practice. So understanding the advantages and uses of AI, along with the state-of-the-art and limitations, will be useful to practicing laboratory professionals and clinicians. Moreover, the introduction of new technologies requires willingness to change the current structure and mindset toward these technologies, which are not always well understood.[9] To get all the benefits AI presents, while keeping its drawbacks to a minimum, drastic changes are needed in the medical community. There is a need for general AI training to the various health care stakeholders as identified in a recent publication on the need to introduce AI training in medical education.[10] One strategy to the implement new AI tools could be to implement it alongside existing tools, so that practitioners can feel comfortable with the new tools and experience their added value in practice firsthand while awaiting further research studies on the clinical evidence, implementation, and benefits of AI. We believe that with proper implementation, AI in laboratory medicine can help with reducing health care costs, improve access to generate better insights, and enhance the quality of care delivered to the patient.

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