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Emerging role of artificial intelligence in global health care

Ghadeer Alhussain [a], Alexandra Kelly [a], Ellerose I. O'Flaherty [a], Darragh P. Quinn [a], Gerard T. Flaherty [a,b,*]

[a] School of Medicine, University of Galway, Galway, Ireland
[b] School of Medicine, International Medical University, Kuala Lumpur, Malaysia

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Introduction

The Covid-19 pandemic has accelerated the greater integration of digital technology into education and healthcare. Artificial Intelligence (AI), which may be defined as intelligence displayed by machines to simulate human cognitive functions such as the ability to learn, recognise patterns, plan, and make decisions, has emerged as a promising development in health technology. While concerns have been expressed about the impact of AI on doctor-patient communication and maintenance of clinical oversight [1], significant enthusiasm surrounds its potential for improving workflow efficiency and reducing harm resulting from human error. This commentary will explore the current status and future prospects of AI in addressing the major challenges in global health as portrayed in the United Nations Sustainable Development Goals (UN SDGs), first published in 2012 [2]. It will first consider some of the established applications of AI in healthcare before considering how AI may influence the reform of health systems and stimulate progress towards the advancement of global health priorities.

AI and the Covid-19 pandemic

The increasing influence of AI in society gained traction during the Covid-19 pandemic. The Covid-19 pandemic has witnessed a greater focus on the communication of health-related information to the public but it has also resulted in a simultaneous 'misinfodemic', which has undermined attempts at global vaccination. AI has a role to play in countering pseudoscientific misinformation. Machine learning techniques can be utilised to highlight trends and harness the power of sentiment analysis on social media platforms [3]. This can aid in highlighting the origins of misinformation and curtailing the propagation of unfounded rumours. Instagram, for example, is programmed to remove posts that contain claims that violate their Covid-19 and vaccine policies. For posts that have not been discredited by health experts, Instagram automatically applies informational labels about vaccines and Covid-19. These labels direct users to more credible sources of information from health care professional agencies such as the WHO and the CDC, providing factual information which debunks common vaccine myths.

Applications of AI in clinical practice

Burnout of overstretched health care professionals (HCPs) is a pressing global health concern. AI can help in reducing the burden imposed on HCPs by maintaining patient records, pattern recognition processes, which can highlight trends and determine appropriate treatments, calculating mortality risks, and training practitioners. Medical chatbots have the ability to rapidly share up-to-date information, support HCPs with clinical interviews and diagnosis, and encourage behaviours such as hand-washing and social distancing. Chatbots with the ability to offer emotionally supportive responses may be successful in

* Corresponding author at: School of Medicine, University of Galway, Galway, Ireland.
E-mail address: gerard.flaherty@nuigalway.ie (G.T. Flaherty).

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reducing the long-term psychological impact of social isolation.

Global health system challenges include the rising burden of chronic illness, age-related multi-morbidity, polypharmacy and disability, increased demands on public health services, heightened public expectations, and economic austerity policies that limit healthcare expenditure. Machine learning may act as a catalyst to achieving fundamental global health system reforms by improving access, equity and efficiency of public health service provision. Table 1 summarises key applications of AI in the area of health systems management.

AI and the sustainable development goals

Almost all of the 17 Global Goals and 169 targets set out in the UN SDGs have at least an indirect relationship to human health. SDG 3 is specifically devoted to health. It undertakes to "ensure healthy lives and promote well-being for all at all ages" by 2030 [2]. This goal is underpinned by 13 focused targets, which relate to a diverse array of deliverable global health outcomes, including maternal and childhood mortality, epidemics of communicable disease, tobacco control, mental health, and road traffic accidents [3]. Vinuesa and colleagues have previously tabulated evidence from AI studies that address each of the SDGs. We will consider some salient global health-related examples in this article.

SDG 3.1 pledges to reduce the global maternal mortality ratio by the year 2030 to below 70 per 100,000 live births [4]. An AI algorithm has been used to improve the detection of early and late pre-eclampsia and gestational hypertension with a low false positive rate. The authors estimate that 1 in 5 of pregnancies screened positive by this model would develop pregnancy-related hypertension. This method of detection is superior to a sole reliance on maternal history [5]. Communicable diseases, including HIV-AIDS, tuberculosis and malaria, are the subject of SDG 3.3. Genotyping to determine resistance to combination antiretroviral therapy for patients with HIV is unavailable in poorer countries. Computational models that accurately predict response to antiretroviral therapy have been developed and tested on cases of the disease from India and Southern Africa [6]. Machine learning has also been applied to the automated digital detection and quantification of malarial parasites, which could have a significant impact on the ability of laboratories in resource poor settings to diagnose and treat malaria [7].

There is considerable scope for computational intelligence in the prevention and management of chronic illness. AI-based digital technology has already empowered patients to self-monitor various personal health parameters such as heart rate, blood pressure, physical activity and sleep, using data derived from wearable sensors. Promotion of adherence to long-term medications, motivational goal-setting, and early identification of drug-drug interactions continue to benefit from the use of AI innovations. AI is also showing promise in the areas of mental health (SDG 3.4) and substance abuse (SDG 3.5). Machine learning has been applied to the prediction of non-fatal suicide attempt risk, using Danish national suicide registry data. Individuals ranking in the top 5% of AI-predicted risk accounted for over 40% of all suicide attempts [8]. Although some safety concerns exist surrounding the use of autonomous vehicles based on AI technology, it is likely that these will be resolved over time and that AI will yield additional applications in the reduction of injury and death from road traffic collisions globally (SDG 3.6). The global disease burden attributable to environmental pollution (SDG 3.9) has also prompted innovation in developing AI-based solutions. A recent study from China points to the use of machine learning techniques to analyse anthropogenic air pollution, for example [9].

Table 1
Potential AI solutions to global health system challenges.

Global Health System Challenge	Potential AI Solution
Increasing demand for health services	Remote patient monitoring
	Prediction of sepsis
Health administrator workload	Electronic health record analysis
	Analysis of unstructured clinical notes
Lack of workflow efficiency	Extraction of codes from death certificates
	Robotic process automation
Chronic illness management	Identification of skin lesions and abnormalities in radiographic images, biopsies and cytologic smears
Hospital readmissions	Robotic surgery
	Patient self-monitoring from wearable devices
	Drug adherence reminders
	Drug-drug interaction alerts
	Use of chatbots for mental patient communication
	Prediction of readmission from discharge notes

Concerns about AI and health inequities

The reliance of AI on data could pose a major barrier to its implementation in low and middle-income countries (LMIC), with significant investment being required to compile sufficient data, requiring resources not abundant in the developing world. Data are particularly lacking on the most marginalised in society, leading to datasets being inaccurately skewed towards those who have more access to healthcare. Concerns about a lack of investment in translation to diverse languages and scripts in the developing world are justified when many AI technologies are designed by and for high-income populations. The case of a skin cancer-detecting AI technology which proved ineffective for people of colour as the machine-learning was based on predominantly white populations in high-income countries acts as a warning against perpetuating racial disparities in healthcare through AI [10]. If AI technology is to be a tool for tackling global inequality, it must be responsibly implemented.

Ethical considerations

Although the emerging use of artificial intelligence in health care has allowed progress to be achieved in terms of diagnosis and prognosis, there are ethical considerations surrounding its use. As AI is interposed within the doctor-patient relationship, the integrity of informed consent may be jeopardised. This can be seen in everyday life with people downloading mobile health apps, such as those that help track menstruation, improve medication adherence, and provide dietary guidance. The use of these applications requires merely the signing of a user agreement, as well as the acceptance of regular updates, and changing terms of service, which compromise transparency for the user. While a human would be able to ensure understanding and compliance of their patients, in the case of these mobile apps the user is the only advocate for their own consent and medical knowledge. The so-called black box algorithm, whereby humans, even those who design AI models, cannot completely understand how they combine variables to make predictions, undermines the time-honoured scientific method, which lies at the heart of medical practice. It remains to be seen how the medical community will respond and adapt to these unique challenges.

Conclusion

Artificial intelligence offers exciting potential in the area of accurate health information access and delivery, improvement in the efficiency of health system workflows and in lessening the burden on HCPs. Most of the health-related UN SDGs and targets would benefit from the application of AI and machine learning. However, considerations regarding how AI could inadvertently introduce further inequality into healthcare in LMIC as well as the ethical conundrum of preserving the integrity of consent should not be ignored as this technology becomes more established in mainstream clinical practice.

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CRediT authorship contribution statement

GTF was responsible for study conception. GA, AK, EO and DQ contributed equally to the preparation of the first draft of the manuscript, which was edited for significant intellectual content by GTF. All authors read and approved the final version of the manuscript.

Declaration of Competing Interest

None declared

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