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Viewpoint

The Future of Artificial Intelligence (AI), Healthcare, and the Health Workforce

AI will be important for the health of both rich and poor countries

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A new technology, "Generative Artificial Intelligence" (GAI, referred herein as AI), has taken the world by storm since Chat GPT was launched last year. It has the potential to be a game changer for both the urban medical specialist and the frontline health worker. And it arrives at a moment when in many if not most countries, the need for health workers vastly outstrips the available workforce and resources, whether in terms of the numbers of people, funding, or situations requiring attention.

It also comes at a juncture in history when the global community has begun to look to the intersectoral dimensions of health. At the just completed COP 28 (Conference of the Parties), 123 countries up to this point endorsed the "COP 28 Declaration on Climate and Health" (1), which included a commitment to pursue the following:

"Facilitating collaboration on human, animal, environment and climate health challenges such as by implementing a One Health approach; addressing the environmental determinants of health; strengthening research on the linkages between environmental and climatic factors and antimicrobial resistance; and intensifying efforts for the early detection of zoonotic spill-overs as an effective means of pandemic prevention, preparedness and response."

Although modern science and technology have enormously benefitted practitioners with medical advancements, including vaccines, drugs, laboratory technology and equipment, computers, smartphones, and much more, there are always new health topics to be learned and new diseases emerging that need to be diagnosed and treated.

Dr. Eric Topol, director of the Scripps Translational Science Institute, in La Jolla, California (2), describes cutting-edge AI medical diagnosis in the truly excellent TED talk below.

https://www.ted.com/talks/eric_topol_can_ai_catch_what_doctors_miss

Likely to get less attention, and less glitzy is a focus on frontline health workforce needs, both in developed and developing countries, and benefitting from emerging AI capacity. But first, let's take a step back to put AI in perspective, what are the promises and what are the possible drawbacks.

The health sector and AI

With regard to health, AI can be a tool to use statistical algorithms to analyze medical data to predict future outcomes, identify hidden patterns, and collect information for future applications.

There are many applications used for supporting functions in many sectors and enterprises that are relevant here, including, for example, in the administrative area as well as legal and financial tasks. For the healthcare sector explicitly, it is a means to support physicians, dentists, nurses, and other health practitioners in several critical areas:

- decision-making,
- diagnosis,
- prognosis,
- treatment, and
- administrative tasks

But as with all new tools, it is dependent on user acceptance, training, and the wherewithal to make effective use of the technology and systems. Such tools can be invaluable for doctors, nurses, other medical professionals, and patients, young or old, men or women, the unborn or newborn, or young adults. They can help better diagnose conditions or diseases such as obstetric breech presentation, malaria, breast or colon cancers, or different strains of influenza.

Complicated tasks are another area for application, such as correctly and more comprehensively interpreting ultrasound results or chest x-rays, predicting if an infection may be prone to antibiotic resistance such as typhus salmonella, and even the extent of morbidity and possible death. All would benefit from the effective application of this new technology (3).

AI and the healthcare workforce in different settings

A brief look at different economic settings around the world reveals the extent and variety of challenges and how AI can be used to address them.

1. **High-income countries, with Europe as an example:**

Many European countries are faced with the challenge of an aging population, and as a result, many general practitioners (GPs) and specialists are set to retire in the coming years. A WHO report found that 40 percent of medical doctors are close to retirement age in around one-third of countries across Europe and Central Asia, calling the situation a "ticking time bomb".

To more efficiently use general practitioners' and clinical specialists' time, AI tools should be considered as a way for health practitioners to reduce administrative tasks, improve diagnostic accuracy, and translate into freeing up greater time for "face-to-face interactions". Among the first AI applications could well be diagnostic and treatment *task-shifting* from general and family practitioners to nurse practitioners: with the expanded assistance of AI tools the latter could become a cost-effective first -and often final or continuous- contact for the majority of all primary care patients in developed countries, such as the United States and Canada, Western Europe, and

in some Far Eastern countries like Japan, Taiwan and South Korea. with some others, such as those in Eastern Europe and other upper-middle-income countries, catching up over time.
Further, in many highly developed countries, using AI for procedural and administrative tasks might not require the same regulatory approval as for diagnostic, prescribing, and treatment AI systems.

Bart de Witte, CEO of the Hippo AI Foundation which focuses on open-source medical AI, told Euronews that soon doctors could talk to machines instead of typing out their notes. And, as he put it, "We had hospitals that went paperless, but can we go from paperless to keyboard-less (see also (2))

But probably the largest future markets for health AI are for and with the patient. Many medical technology companies around the world either have or are developing home diagnostics, and prospectively could complement this by AI-informed and -guided provision of home self-treatment, follow-up and prognosis (with only complications and complex developments being AI-transferred to specialists and hospitals): "this is your AI home doctor, how can I help you – I have all the time, I have your whole file here in front of me and your latest readings of your on-body device and your watch, so let's discuss how we can help you and how to get you better soonest …."(4). The comparison with AI-guided self-driving cars may be tenuous, but this would engender a major shift in health care for the young, middle-aged, and the elderly, and in the process increase medical and clinical efficiency enormously, with potentially huge positive opportunity-cost savings.

Low- and middle-income countries (LMICs)
In LMICs, the picture is often somewhat different, driven by their different realities and significantly larger health and medical challenges, but also here AI may become helpful beyond earlier expectations.

The shortage of healthcare workers at almost all levels, both in rural and urban areas, is by far the most pressing issue in healthcare in poorer countries. AI could well be a motivator and explore if it could assist in alleviating very specific areas that would seem to lend themselves especially to AI solutions; these would include first and foremost the field of ***pathology***: almost no poorer country around the world has even close to sufficient pathologists available and any major surgery or complex infectious disease treatment without pathology input is simply not possible.

There are even poor countries across Sub-Saharan Africa and in South- and East Asia that do not have a single pathologist in the country. AI diagnostics and identification of pathogens could well alleviate such voids through targeted and designated electronic platforms that would have sufficient bandwidth and reliable electricity and transmission provision, even using cell phones

and laptops (AI initiatives would fit well in preferred bilateral assistance programs that would carry AI and supportive energy-provision components and as such would have a *comparative advantage* in terms of global health assistance to LIMCs). Naturally, if and when multilateral agencies plan to include AI components in their global health programs, they could play an even bigger -and more systemic- role in this respect.

The same outlook would exist for the priority fields of obstetrics and women's health, surgery, and both individual and collective infectious disease diagnostics and treatment. Unfortunately, we do not see yet how AI might become useful for the very urgent and often almost completely absent field of anesthesiology, as personal attendance and experienced biochemical expertise on the patient's side is a sine-qua-non here. Hopefully, others may be more constructive in this prospect. However, we can certainly see the potential unusually high pay-off of AI applications in the crucial area of *health workforce education and training*. In LMICs this pertains first and foremost to community health workers and rural clinical and public health workers. AI could well provide virtual or better-informed training and teaching modules through telemedicine platforms, enabling both faculty and students to consult with AI-powered virtual assistants for diagnosing and managing patient cases, extending the reach of expert medical advice to remote areas (and the students and faculty posted there during their internships or residencies). The bottleneck in many poorer settings would be sufficient connectivity -both in terms of reliability and capacity- as even somewhat richer countries in Sub-Saharan Africa[1] for example, continue to suffer from unusually low levels of electricity provision (solar helps a little bit, but remains seriously deficient systemically for health care clinical or training institutions). Perhaps such networks and platforms as the Kenyan mobile phone financial services (M-PESA) (5) would be an option to build upon for AI applications and connectivity.

At a central level in LMICs, where energy capacity often is more meaningful and reliably available, AI could play a role in disease surveillance and perhaps in the early detection of outbreaks in LMICs. With its capability to analyze large volumes of health data, including some health records, some demographic information, and externally generated environmental factors, AI could well be able to do much better than currently to assist in identifying patterns and trends indicative of potential disease outbreaks.

[1] A case in point would be Rwanda, considered by many as a progressive poorer country that is moving up in its ambitions of development: it currently (2022) has a total of 275 MW of electricity for the whole country. This is equal to, for example, a really small city in the US or the EU. As such, essentially no meaningful electricity is available in poorer rural areas across Sub-Saharan Africa, South and Eastern Asia and many more remote areas in Latin-America, with subsequent limitations in terms of sustainable or reliable AI-driven health care.

For those countries and development assistance agencies that take on AI opportunities proactively, this could significantly help health authorities take timely preventive measures and allocate resources more effectively to contain the spread of infectious diseases.
AI absorption capacity in poorer countries is likely to be limited for the foreseeable future to central or regional institutions with adequate development budgets, expertise, and infrastructure, such as National Statistical Bureaus, Ministries of Health (sometimes larger Provincial or State Health Departments – using data from previous and current health and population surveys) or National Planning Commissions and their offices across the country, as well as military or intelligence institutions involved with health development. In addition, a few larger regional hospitals and medical schools and their teaching hospitals -drawing on their access to other university departments, especially those in information technology will likely be able to incorporate some of the AI options highlighted above for the world's more affluent countries.

A potential AI advantage is that it could be a component of regional or region-wide surveillance institutions in LMIC regions, such as Africa: the Africa Centres for Disease Control and Prevention (CDC) and its 5 Regional hubs, for example, would be well-placed to take on larger AI development roles for the continent (https://africacdc.org/regional-collaborating-centres/)

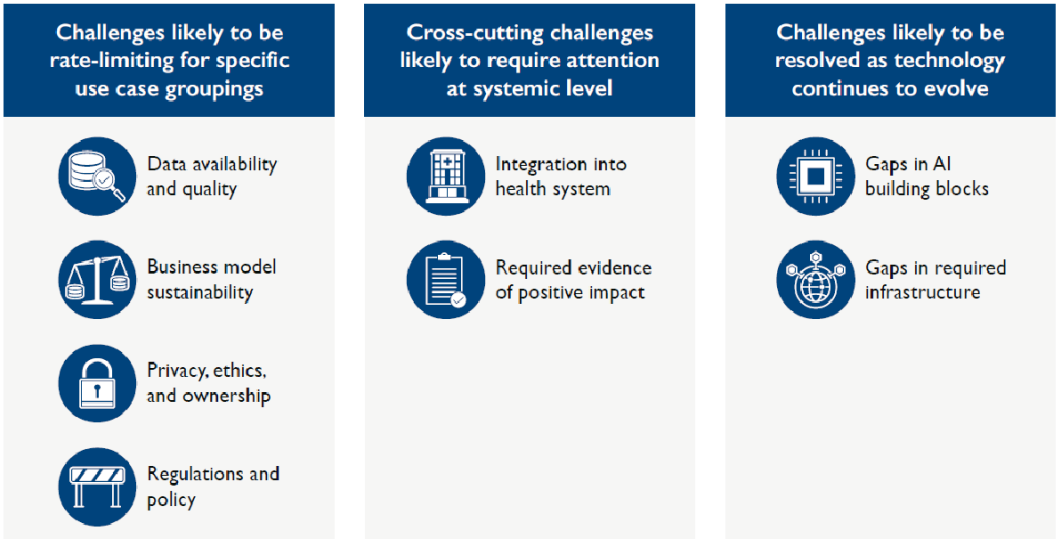
Similarly, the South Asia institution (ASEAN), and Latin-American and Caribbean institutions could become important AI health surveillance hubs, long with WHO Regional Offices and PAHO. As such, AI-powered predictive models to forecast disease outbreaks could become globally essential, in addition to allowing much better forecasting and planning models for health workforce training and deployment to prepare and respond swiftly, thereby reducing the impact of epidemics on vulnerable populations.

Unfortunately, for many outside the developed world and the opportunities in LMICs outlined above, this may be a bridge too far and aspirational, sometimes in the extreme. It will be no easy task to take a new disruptive technology innovation and have already stressed health workers and health systems accept and make use of such new tools in circumstances of often exceptionally limited resources.

As properly highlighted in a joint report by USAID and the Rockefeller and Bill & Melinda Gates Foundations, this will especially be true when it comes to health practitioners in poorer countries and would need to involve enormous strengthening of pre-service and in-service training, a crucial Achilles heel of many if not most LMICs health systems.

The report, entitled, "Artificial Intelligence in Global Health: Defining a Collective Path Forward", looks at four different AI application groupings and found eight common key challenges (6) faced by all AI technologies in LMIC contexts.

Figure 9: Challenges Facing AI Use Cases in Global Health



While the challenges vary, they all share commonalities: for example, the type of data required for AI population health tools differs from those for patient-facing AI tools, but data availability and quality are challenges for both. Gaps in AI building blocks and gaps in the required infrastructure for AI (such as smartphone penetration and 4G access, not available in 50+ poorer countries and populations) remain major obstacles but are likely to see some improvements in several of them.

Taken all together for the world as a whole, there is reason to expect that AI will have a big imprint on the health workers we will be facing at our next visit to the nurse practitioner, doctor, or clinic, and what health prevention and disease management will look like in the not-too-distant future.

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