Realising the promise of digitally-enabled health

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The first digital medical tool, the Computed Axial Tomography or CT scan, was invented nearly five decades ago in 1972. It combined slices of two-dimensional images digitally into a three-dimensional visualisation of the body, which was earlier possible only *post mortem*. This was a boon to diagnosticians in a number of specialties and has saved countless lives. Coincidentally, digital technologies entered a new era around the same time with the invention of the TCP/IP protocols over 1973-74. The network of computers constituting the Internet grew steadily after these protocols became the global standard for information flow across computers. Internet use exploded after the invention of the World Wide Web in 1989 at the CERN. New industries were born, and old ones were disrupted as e-commerce, smart phones and then social media and other sharing platforms took off.

However, despite the early and consequential invention of the CT scan, the health sector has been slow to embrace digitalisation. Telemedicine never took off despite advances in internet connectivity and mobile telephony.[1] The case for unburdening hospitals overwhelmed by patient visits as well as saving time and expense through remote consultations remains strong nonetheless. Electronic Medical Records or EMRs, alternately called Electronic Health Records to reflect a broader view of patient wellbeing beyond clinical data, were supposed to be another game changer. By replacing thick dossiers of handwritten notes on a clipboard, they are meant to enhance portability and efficacious use of vital personal health information. However, they remain plagued by differing standards and suboptimal use. Patients still carry wads of paper around or paper versions of their clinical records have to be faxed around by doctors and hospitals.[2]

These days wearables in healthcare seem to be riding a wave of popularity with fitness trackers and vital sign sensors on smart watches and rings such as Fitbit, Garmin, Apple Watch and Oura expected to generate more than 30 billion dollars for the companies making them.[3] However, these fashionable wears for the affluent few are of little use when it comes to serious health conditions or expanding affordable health care for the masses.

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[1] Christina Farr, *Why telemedicine has been such a bust so far*, CNBC, 30 June 2018. 2 Laurel Ives, *NHS still reliant on 'archaic' fax machines,* BBC Health, 13 July 2018.

[3] Shanhong Liu, *Wearable device revenue worldwide 2016-2022,* Statista, 25 November 2019.

Half the world still does not have access to essential health services, and there is a global shortage of 18 million health workers – no wearable can substitute for them. An unexpectedly high percentage of expenditure on health in low and middle-income countries is out of pocket while public budgets are under strain everywhere due to rising health costs. Radically new and innovative approaches are needed for quality and affordable healthcare.

Digital technologies, especially data-driven Artificial Intelligence (AI), could play an important role but digitalisation of health faces unique challenges. Despite tremendous advances in science, we still do not know enough about the human body. Each body is unique. Each health condition has its own dynamic context. And the relation between a sick person's underlying condition and the overlay of symptoms is often not clear even to experienced physicians. Thus, reducing medical complexity to 0s and 1s computable by machines however massive the health dataset is not easy. Besides, health systems both public and private are complex aggregates of social, political and economic realities. They do not lend themselves easily to speed, standardisation and scalability so characteristic of other digital domains. They are also a warren of vested interests - expenditures on health could not have reached such unsustainable levels without them.[4] In some countries it would be very difficult to swim upstream against these interests or find ways to coopt them into digital health strategies without compromising on quality and affordable health for all.

Specifically, there are a number of immediate obstacles to deploying digital technologies at scale for health. These include public and health worker trust in these technologies and those who advocate them, protection of personal privacy as health data moves through digital networks and across users, further loss of patient and physician agency over healing in an extension of existing problems with the pills and procedures paradigm of modern medicine, data security against State or non-State malignant actors, confusion over data ownership and fair attribution of value derived from data, low quality of existing health datasets, absence of appropriate reference data and common vocabulary across clinicians and data scientists, data hoarding and lack of interoperability, absence of evaluation platforms and regulatory sandboxes for testing algorithms and other digital solutions for the best fit with local social, epidemiological, and political contexts, low levels of engagement of the digital natives in crafting digital health strategies, and lack of trained human resource that understands both domains (health and digital).

[4] *Health spending set to outpace GDP growth to 2030*, OECD, 7 November 2019

The biggest challenge, however, is of mindsets. Digital technologies continue to be looked at from the lens of the patient-provider-payer paradigm that rules the health world in affluent countries. In resource poor settings, they continue to be seen as tools or interventions to 'fix' health conditions instead of being seen as an opportunity to re-architecture healthcare delivery.

Everywhere emerging digital technologies continue to be approached from the perspective of new market-making disruptions rather than being directed from the vantage point of inclusive demand-creation and collaborative innovations for digitally enabled health. The obstacles come from some old and entrenched mindsets. A particularly insidious one is the competitive mindset on research - who publishes as the PI (Principle Investigator), who keeps the IP (Intellectual Property) and who gets the funding, which has resulted in extraordinary fragmentation of effort. Another one is the distance research often takes from the practice of a field. These two mindsets clash head-on with the collaboration and practice demands of AI and data science. Experts and insights from different domains need to come together, a degree of tinkering in the context of use is needed and an iterative learning mechanism is often needed by design for subsequent adjustments based on practice.

The potential is there despite the hype. Doctors in China, India and Africa routinely use WhatsApp or WeChat to receive diagnostic images and respond rapidly to patient queries. They also exchange experiences and readings in professional groups on social media.

Hospitals such as the Samutprakarn Provincial Hospital in Thailand, which I visited recently, have eliminated paperwork in admissions and payments, reduced fraud and streamlined workflow with digital technologies. In Estonia, patients can consult their own health records to monitor who accessed them and authorise responsible use of their data. Combining data from rapid genome sequencing and EMRs with machine learning, rare forms of diseases have been diagnosed quickly in the United States and lives saved. In France, supply chain data from health insurance schemes has been used with Artificial Intelligence to predict drug reactions and in Israel the Clalit Institute has run predictive analytics on its health data base to forecast renal failure due to diabetes years in advance. It is no surprise that many countries both developed and developing are placing digital health, data and AI at the heart of their health policies, and the World Health Organization (WHO) is elaborating a new Digital Health Strategy.

Harnessed well, digital technologies can help medical professionals diagnose disease accurately and tailor treatments—even drugs—to individual patients.

Broadly, they can help improve the efficiency of health care delivery, say through virtual agents that serve as primary touchpoints for patients, and help insurers and policy makers to devise new ways to nudge healthy behaviour and prevent disease. At a systems level, digital technologies can help reimagine care pathways, transform patient-doctor-caregiver communication and potentially rein in costs through precision public health.[5] The potential of large datasets coming together in real time to help identify public-health threats such as the ongoing novel Corona virus epidemic and the most at-risk patients is also becoming apparent.

In its survey of the digital landscape, the UN Secretary-General's High-level Panel on Digital Cooperation underlined that digital connectivity, vital as it is, would not be sufficient to advance on the Sustainable Development Goals (SDGs). It would be essential to create inclusive demand at the base of the pyramid for digitally-enabled finance and health by standing up 'digital public goods' – a combination of common rails and guardrails that lower entry barriers and allow more inclusive digital innovation and deployment. New collaborations would be needed to pool data, computing capacity and algorithmic expertise for the SDGs, and in view of the uneven spread of digital and AI capacities, the fragmentation of data and governance approaches, global collaboration will be critical for success. [6]

Thus, the approach called for is using the digital opportunity to bring new energy and collaborative geometries to solve old problems. This is the essence of digital approaches to health or for that matter inclusive finance or building a circular sustainable economy. Digital technologies are not a magic wand; they cannot 'fix' the world. They are an excuse to sweep the table of the mess we have created with old paradigms, marginalise those who benefitted from their continuation, bring in fresh and diverse voices, empower those who can thrive under the new paradigms and work with them to rewire the needed elements of cooperation for problem solving digitally. This is not revolution nor is it rent seeking by using digital technologies to shift power and profits away from one lot to another. It is about growing into a gap and creating new opportunities. It is not unprecedented either. A range of fields have demonstrated the value—and necessity—of working in partnership, including public and private sectors, academia and civil society. Examples include scientific collaborations such as the European Center for Nuclear Research (CERN), Laser Interferometer Gravitational- Waves Observatory (LIGO) or the European Southern Observatory's "Extremely Large Telescope (ELT) or health related collaborations such as GAVI and the Global Fund.

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[5] Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, Basic Books New York, 2019.

[6] *The Age of Digital Interdependence*, Report of the UN Secretary-General's High-level Panel on Digital Cooperation, June 2019.

get there. The best we can do is to bring 'excellent people' together from across the globe and have them ask the questions that will get us to the answers.

This effort could be channeled along two axes. First, building a neutral and trusted platform that allows different constituencies – governments, international organisations, foundations, academic and research institutions, private sector and civil society – to come together in a hubs and spokes architecture dedicated to digital health. Such an architecture would require strong regional collaboration hubs in the emerging geographies of innovation in addition to a light coordination hub at the neutral centre which acts as a convener for problem solving and as an escrow for digital public goods and the trusted flow of data and algorithms. A role for the Geneva-based WHO in orchestrating the interplay of national and international efforts would be important. Private sector, which in the AI and data space has relatively more human, computing and data resources than in other cutting edge technology fields from the past, would need to be engaged from the outset.

Second, putting together a series of collaborative analytical and research projects that build up a set of questions to be answered, research and implementation problems to be solved and repositories of possible ways to engage, cooperate and build capacity. These 'pathfinder projects' need to span both longer term projects on data and AI with a time horizon of 20-25 years as well as shorter term implementation science questions around digital health with a time horizon of 2-5 years.

If these two axes of effort can successfully come together in the next two years, we can forcefully demonstrate that digital platforms and AI are not just for rich countries and big companies with big data. They are an unprecedented opportunity to promote the quality of the most important resource for sustainable development: human beings, particular the next generation. This effort can also create global public good beyond the health space by promoting global trust and collaboration, and by shaping the 'why', 'how' and 'what' of data and AI use before they are baked in pell-mell by commercial and political competition.

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About I-DAIR:

The I-DAIR Project seeks to advance the UNSG's High-level Panel on Digital Cooperation's recommendations related to digital health, and targets set at the World Health Organization (WHO) on universal and quality health coverage. The pathway proposed is the co-creation with diverse stakeholders of an international platform to promote responsible and inclusive AI research and digital technology development for health inter alia by moving towards data for health as a global public good and by addressing key governance, validation, benchmarking and collaboration challenges in research on AI and digital health.
The incubation effort based at a WHO Collaborating Centre at the Graduate Institute of International & Development Studies was initially convened by Fondation Botnar and is since also supported by the Geneva Science & Diplomacy Anticipator Foundation (GESDA).

The project started in September 2019 with a focus on clarifying the value-add for national and regional efforts in the context of international priorities for digital health and putting together the key policy and scientific partnerships as well as resource commitments required to establish the Collaborative. A set of pathfinder projects are also being identified through consultations, which will continue till May 2020.

Post-June 2020, these pathfinder projects will be pursued through global inter-disciplinary teams and would allow the Collaborative to develop meta understandings on issues such as governance approaches for safe, secure, inclusive and effective deployment of data/AI in the area of health, benchmarks, capacity-building, collaboration geometries for AI/digital research for global health, and other enablers for pooling human, financing, computing and data-related resources for global health. The launch of the Collaborative is currently envisaged for the second half of 2021.

The goal of the project is to co-create a neutral trusted platform for enabling global research collaborations on digital health and AI for health, and for convening stakeholders to develop and share global public goods as well as solve problems for the inclusive, equitable and responsible deployment of data and AI for health. The 'how' of I-DAIR involves federating three ideas: research & innovation in deploying digital health and AI for health ('federated research'), use of data/AI ('federated learning'), and economic value-creation ('federated value'.