



Technology, Innovation  
& Global Health



Wilton Park



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Report

## Artificial intelligence and global health

Wednesday 27 – Friday 29 June 2018 | WP1626

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### Executive summary

Artificial intelligence (AI) will redefine health service delivery and change the way we think about our own health care and the health of our families. It will impact every aspect of the health system from personalised care to large scale health systems driven by terabytes of data, from precision medicine to preventing epidemics, and potentially will play a key role in all countries achieving Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs).

Exponential changes in technologies, happening at a speed that is hard for regulation and policy to track, let alone keep up with, signals huge promise for global health, but those advancements may carry with them the risk of unintended consequences. The impact of AI on economic, social, ethical and political issues therefore warrants close attention. Will AI in fact exacerbate inequality and lead to greater disparities in access to quality health than currently exist today? What does the intersection between AI and health care provision in low and middle income countries (LMICs) mean for health providers, ministries of health, donors and others who are seeking to improve health provision in LMICs? These and other similar questions shaped the dialogue at the three day Wilton Park meeting on AI and Global Health.

### Key points

- **Governments need to be involved** in the development and implementation of AI to ensure the rights of individuals are protected and the deployment of AI technologies are properly regulated. This is not simple against a backdrop of rapid change.
- **World changing AI needs massive interdisciplinary collaboration underpinned by ethical thinking.** Thought leaders who might typically not work together – academics, ethics experts, computer scientists, sociologists, philosophers, health experts and others – need to join forces. However, collaboration is costly and hard to do, within organisations, across sectors and over borders (so it needs to be funded).
- **Meeting the needs of all, including the most vulnerable is critical.** AI has the potential to exacerbate the health and digital divide between developed and developing countries, between those who create or own the technologies and those who use it, as well as those whose jobs are replaced (not just augmented) by AI.
- **Inclusion is key.** Diverse perspectives, communities and under represented individuals need to be part of the conversation with leaders from tech, social science and health. How to make that happen, across multiple geographies?

- **Ethics need to be embedded into the development of AI technologies to promote fairness, equity and access.** Ethical innovation needs to be at the core of development of AI. This means investment, intentional thinking and being aware of and mitigating for bias. Designers of advanced AI systems are stakeholders in the moral implications of their use, with a responsibility and opportunity to shape those implications.
- **Don't forget the human in the loop.** Machines can rationalise and streamline, they can predict and diagnose, but the interaction between health professionals and their patients remains critical. The patient is the customer and as such should be at the centre of health care. The 'high-tech' is only part of the solution and needs to function at the service of humanity, rather than the other way around.
- **Democratisation of AI in terms of access to data, transparency of data and sharing of data is critical.** Data gives formidable power to whoever controls it. Should data be open, a 'global public good'? And if so, who pays? How data is accessed, analysed and used relates closely to issues of accountability and trust in AI.
- **Research.** AI research must be robust, operate within secure restraints and be accountable to a broad range of stakeholders. More broadly, a culture of cooperation, trust and transparency should be fostered among researchers and developers of AI.
- **Be grounded, but also be bold.** Those operating in the field of global health and AI can build on work that is already happening to help improve health service delivery to those living in hard to reach areas. But is this bold enough? AI has the potential to be more than 'enabling' and 'improving'. It has the potential to disrupt the sector dramatically and to be transformative for health outcomes.

"AI has the potential to fundamentally transform the way that healthcare is provided in LMICs"

## Introduction

This Wilton Park meeting provided the opportunity for an exploration of Artificial Intelligence (AI) in health in low and middle income (LMICs). It brought together experts and disrupters in healthcare, IT developers and entrepreneurs, and donors and philanthropists, from LMICs and developed countries. The purpose of the meeting was two-fold: (1) to examine how new AI technologies might be transformative to improve global health and make progress towards health SDGs and UHC, and (2) to examine the intersection between AI and health care provision in LMICs and the opportunities and implications for health providers, ministries of health, donors and others who are seeking to improve health provision in LMICs.

"AI systems will be instrumental for governments in tracking disease more effectively and enabling them to predict or respond quickly to potential global health pandemics"

There was broad agreement that AI has the potential to fundamentally transform the way that healthcare is provided in LMICs. With the promise of improving access to, and quality of, health service delivery, AI could play a prominent role in helping countries achieve UHC and the health SDGs. AI is already supporting virtual diagnostics and remote patient care, providing interactive training for health workers and helping people keep track of their own health and the health of their families.

Some of the big shifts that AI will enable in global health will be an increased focus on health promotion and disease prevention; better identifying (and treating) specific diseases such as cancer; and vastly improved medical processes such as diagnosis and medical imaging. In addition, AI technologies have the potential to streamline health operations, leading to better allocation of medicines and staff, preventing stock outs and reducing waste.

Furthermore, by collecting vast amounts of information and analysing complex data, AI systems will be instrumental for governments in tracking disease more effectively and enabling them to predict or respond quickly to potential global health pandemics.

Yet the anticipation of what is possible with AI should not distract from the social, ethical, political and other issues raised by big data and machine learning. These issues include safety and trustworthiness of AI technologies, the critical importance of respect for the basic principles of equality and non-discrimination, and the need to ensure that current inequalities in relation to health care are eradicated, rather than exacerbated. The challenge of addressing inherent bias in the design of algorithms also needs to be considered, as do the power issues around data ownership, use, sharing and privacy.

Ethical issues are embedded from the design phase through to implementation and adoption of AI in health settings, including the impact of increasing precision in predicting health outcomes, where progress in diagnostics is not matched by improvements in access to treatment or medicines.

### **Governments need to be involved (but does AI need a rebrand?)**

1. Engaging with governments on how AI technologies can enhance health care systems, service delivery and personal care needs careful framing. There is a need to demystify the media hype (and scaremongering) that AI and machine learning inevitably attracts and instead talk about service delivery improvements leading to better and more affordable health care for communities and individuals. Having a range of use cases that demonstrate the effectiveness of the technology is important, as is supporting Ministries of Health and of ICT to collaborate and be empowered to drive the AI/health agenda in their country.
2. Linked with engaging governments is the importance of governance and the enabling systems that will foster effective integration of AI technologies into health service delivery and personal care. The importance of regulations and standards (for example relating to exchange of data during epidemic responses) are critical, and given the pace of technological change, innovative approaches to governance will be needed to keep pace. Some existing regulations may need to be changed and new ones almost certainly will need to be created. Achieving public trust without stifling innovation is a challenging task however, and governments will need to work closely with multi-disciplinary stakeholders, which in itself will often require new ways of working for all concerned.

### **World changing AI needs massive interdisciplinary collaboration (and it needs to be underpinned by ethical thinking)**

3. There are already a significant number of institutes and alliances forming to advance wider public understanding about AI and to share openly with each other the relevant issues and potential impact of AI on society. One challenge will be to ensure that there is a diversity of voices and experiences which are heard and factored into these discussions. Those who are furthest behind in terms of social and economic development are at the centre of the SDGs – they also need to be at the centre of design and application of AI technologies. Governments, academia, the private sector and civil society will therefore need to work together, respecting each other's accountability structures and breaking down traditional prejudices to build trust.
4. In order to prevent AI becoming a fragmented field both nationally and internationally (in the way that digital health has become), collaboration is also necessary between the donors and foundations. These entities need to rapidly pull themselves together and look at where to pool or co-invest resources that also align with country priorities. Donor coordination responsibility is not about wanting to close down innovation however – it is actually the opposite – responsibly funding experimentation without duplicating effort.

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5. The way learning is shared also needs to change and to be more collaborative. In mobile health (mHealth), organisations and donors have not always valued common goals or shared learning. Often in mobile or digital health, the focus was on 'being out of the gate first' with the newest technology; the term 'innovation' signalled an intense desire for organisations to differentiate their expertise, rather than collaborate. AI will require a more deliberate approach to collecting learning from communities and to share that learning across and between governments as well as between AI developers, researchers and social scientists.

### **Ethics needs to be embedded into the development of AI technologies to promote fairness, equity and access**

6. AI, machine learning, and other technologies powering big data will be instrumental in driving better health outcomes for populations. With these opportunities come policy and protection challenges, issues regarding the safety and trustworthiness of AI technologies and questions as to how policy and protection standards can be developed and maintained. In addition, there are concerns about the future alignment of AI to human values and the risk of inadvertent and harmful influences of AI. The Toronto Declaration (Protecting the rights to equality and non-discrimination in machine learning systems) emphasises the potential of AI technologies to intentionally or inadvertently discriminate against individuals or groups of people, stating that systems deploying machine learning technologies can vastly and rapidly change, or reinforce power structures or inequalities on an unprecedented scale.
7. There is an emerging AI and ethics literature and greater investment is needed to better understand the ethical implications of AI and machine learning, to consider what regulations and standards need to be in place to mitigate against discrimination and exclusion, and what the role is for non-state actors, such as corporations. Since research priorities and the investments made in research ultimately inform what policies are developed, there needs to be close attention on who is involved in the research and who pays.
8. Regarding the development of AI algorithms, how can the risk of bias be managed? There needs to be process architecture that is able both to identify and reduce bias (this is not just a technology problem) and potentially even a code of AI conduct. On a more positive note, new AI technologies can help reveal where there are endemic biases and mistakes in the current systems and provide information to help humans deal with their own inherent biases within the context of health service delivery.

### **Democratisation of AI in terms of access to data, transparency of data and sharing of data is critical**

9. Powerful analytics for decision support are dependent on the initial data used, and as there is a move to a more data driven landscape in global health, what the data is used for becomes a structural question. Issues include who can access and use the data, and should data be considered a public global good (and if so, who pays for it)?
10. A lot of the computational power and data sits within large corporations – what are the implications of this? For data to be more open, new business models will need to be developed. Arguably, one upside of data being more openly available means that its quality and the decisions made based on that data, can be assessed, potentially leading to greater public trust and confidence. However, the tension here is that public trust around 'data as a global good' is not there yet – not least given the media's attention on data leaks from high profile companies. If global health data is considered as a global good therefore, and analysis of the data becomes part of a global dialogue, it is not going to be just about the technology – it is also about systems and behaviour change.

“consider current and future potential human rights infringements, and how to address them with better thinking about harm to rights and regulatory and legal regimes”

“...who can access and use the data... should data be considered a public global good...and if so, who pays for it?”

“too often in LMIC countries data flows only one way – up – ... with the rapid increase of mobile health solutions and increasing use of algorithms ... create a feedback loop so health workers understand”



11. Collecting high quality data is expensive. In the context of health in LMICs, under what conditions could AI help health workers collect better data at the point of collection? A culture of collecting good data could be incentivised and fostered through focusing on the value of quality data. Too often in developing countries data flows only one way – up – and it’s hard for health workers to see the value of the information they are feeding into the system. With the rapid increase of mobile health solutions and increasing use of algorithms, this is an opportune moment to address that issue and create a feedback loop, so health workers understand and recognise the importance of the data they collect.

### **Research questions: what don’t we know?**

12. AI research must be robust, operate within secure restraints and be accountable to a broad range of stakeholders. More broadly, a culture of cooperation, trust and transparency should be fostered among researchers and developers of AI. Investment in research will be critical and should bring representatives together from multiple disciplines, who typically might otherwise be unlikely to collaborate.
13. Understanding what the key research questions for AI and global health in LMICs are is itself an area for discussion. One vehicle to help identify the research gaps is the Gartner Hype Cycle. One place to start might be to consider where AI sits on the Gartner continuum – from 1) Innovation trigger, through 2) Peak of inflated expectation; 3) Trough of disillusionment; 4) Slope of enlightenment, to 5) Plateau of productivity. It might be possible to create targeted research questions that will reveal what is needed at each stage of AI development and adoption to progress from one state in the cycle to the next, as well as what research questions need to be asked to explain AI and its potential value to decision-makers. Research questions could be about:
  - Health workforce development, such as what is the best way to educate health professionals to work alongside AI systems and robots?
  - The potential capabilities and benefits of AI to address health service inequities;
  - What structural requirements are needed to incorporate AI technologies into health service delivery?
  - What change management strategies need to be in place?
  - Governments, donors and others are interested in the potential capabilities and benefits of AI in low resource settings, and the evidence of economic impact of integrating AI into health solutions and service delivery.
14. More broadly, how AI research gets financed is itself an issue. The financing needed simply to develop the right research questions might require unlocking new forms of capital from investors that see the value of investing in new consumers from low income countries.

“The financing needed simply to develop the right research questions might require unlocking new forms of capital from investors”

### **Be grounded, be bold**

There are AI applications which could achieve significant health outcomes, by building on systems already being used and data already being collected.

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- Rural Medical Practitioners (RMPs) need skills training to better classify, and therefore prioritise, the health risks facing pregnant women. Using sophisticated (but easy to use) decision-making algorithms, the RMPs can quickly find out if a pregnant woman is at risk and refer her to a facility for care.
- regarding refresher training, AI could help through the use of chat bots responding to questions for information to improve decision-making.
- AI will also make it possible for the Minister of Health to analyse patterns of data to make better decision-making about who to target for services.
- in Bangladesh, routine disease surveillance data is not connected to district health offices; if it were, the data could be shared for better awareness of health and disease patterns.
- Finally, in this example, dermatology has been heavily researched leading to good image diagnosis; this could be used by the RMPs to identify whether patients need further testing or treatment.

“is the thinking sufficiently bold?”

15. AI can also add value by amplifying traditional medicine and also in personalising nutrition and health. However, in Tanzania, Senegal and other developing countries there are significant bottlenecks, such as lack of training in how to use AI technologies in health care (as well as more generally) and a lack of local people with computer science and other technical skills.

“should ... AI and health... be thought about in radically different ways?”

16. It will be hard for these countries to move ahead in AI technology if the universities are not equipped to offer the right programs and training for students. Furthermore, resources for research and development are typically very limited in many developing countries. There is therefore a clear need to address the ecosystem in terms of technical skills and tertiary level education as well as for investment in research and development.

17. Against this backdrop, is the thinking sufficiently bold? AI has the potential to disrupt the sector dramatically and to be transformative for health outcomes, not only to be an ‘enabler’ or to ‘augment’ health services. In the same way that Universal Basic Income is exciting interest and dialogue around financial inclusion, should the case be made that AI and health also needs to be thought about in radically different ways?

“Welcome to the most important conversation of our time” Max Tegmark, Life 3.0

### **Calls to action and next steps**

18. However, AI is defined, and irrespective of its pace of progress, there is a sense that the future impact of AI “is perhaps the most important issue the human race has ever faced”<sup>1</sup>. Robert Work, former USA deputy secretary for defense, called this a “Sputnik moment”, stating that “Once in a generation something comes along with the potential that AI has. The biggest challenge is to ensure that as a society, everyone benefits”.

“developing countries have perhaps the most to gain from AI, ... yet they may also have the most to lose”

19. Developing countries have perhaps the most to gain from AI, in terms of its potential to address systemic and wide-reaching inequalities, yet they may also have the most to lose. It will be critical to avoid deepening the digital divide and to ensure that the benefits of AI can be distributed equally and for UHC to become a reality. This cannot be done by one or even a few organisations. Global collaboration will be core to a future that respects the most vulnerable as well as the richest and that puts every patient, including those in the first mile, or hardest to reach areas, at the centre.

<sup>1</sup> Stuart Russell

20. Developed and developing economies, computer scientists and philosophers, civil society and lawyers, and many others need to join forces to drive the possibility of AI forward, ethically and responsibly.
21. There are processes and mechanisms that can support such partnerships. A number of proposals emerged from this discussion including a potential WHO Resolution on AI and Global Health, a Commission on AI, bringing together diverse global actors with the goal of launching a report and recommendations at UNGA in 2020 (leading potentially to a global plan for health AI) and a multi-disciplinary Center for AI based in India. The possibility of open data being elevated to a universal requirement was considered worth exploring further, as was a potential Universal Service Fund for AI that would require services to be available for LMICs.

## Summary and conclusions

Work in AI lies at human and technology frontiers; AI has the power to fundamentally transform the way that healthcare is provided in LMICs.

- AI will lead to more patient-centered approaches, which has significant implications for current healthcare provision.
- AI creates opportunities to bring expertise to hard-to-reach communities, but there are also risks that it may be done in a way that is not culturally sensitive or could widen the health divide.
- As AI is increasingly introduced into health systems and services, concerns about the safety and trustworthiness of AI technologies, and the fairness and transparency of AI systems need to be addressed.
- Developed and developing economies, multinationals and social entrepreneurs, technology companies and health professionals, universities and civil society need to join forces, and investment is required to help facilitate these global dialogues and ongoing research efforts.
- Donors and foundations supporting improved health outcomes and UHC in LMICs have a moral imperative to find ways to coordinate their efforts around AI and platforms for AI, as some are already starting to do, to avoid mistakes made by donor efforts in e-health and digital health, where billions of dollars have been wasted globally.
- There are key issues around trust in algorithms; there is a need for ethical frameworks to guide the development and implementation of AI as well to develop innovative approaches to governance for AI development. These will include tackling how to regulate/test apps (considering how new drugs need regulation) and issues of access and fairness (for all, not just those who can pay).
- In order to reap the benefits of AI, vast amounts of data are needed. In this respect, many developing countries are lagging far behind. A deepening of the digital divide needs to be avoided so the benefits of AI can be distributed equally.
- Development and implementation of AI health solutions in LMICs will need investment up front. New partnerships are likely to include philanthropists, health experts and IT companies and entrepreneurs.



AI technologies will, and in some cases already do, give innovators the tools and capacity to help solve some of the world's most pressing problems. As AI advances, it has the potential to represent a profound change for the health of populations across the globe. Whether progress takes place in step-wise increments, or in exponential leaps of possibility, there is a need to be vigilant so that the benefits can be reaped by all, not only the richest, most educated or simply the most advantaged because of where they live. Being bold, and at the same time ethically attuned, creating innovative and new market financing approaches, and being open to long lasting partnerships that bring the best minds together across multiple disciplines is an effort worth investing in.

### **Lesley-Anne Long**

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## **Annex**

### **Further reading and listening**

- Life 3.0: Being Human in the Age of Artificial Intelligence, Max Tegmark
- Superintelligence: Paths, Dangers, Strategies, Nick Bostrom
- WTF: What's the Future and Why It's Up To Us, Tim O'Reilly
- The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World, Pedros Domingos.
- Blog post: Benedict Evans Ways to think about machine learning June 22, 2018 In Machine Learning <https://www.ben-evans.com/benedictevans/2018/06/22/ways-to-think-about-machine-learning-8nefy>
- [Max Tegmark](#) podcast
- [Eliezer Yudkowsky](#) podcast
- [Kate Darling](#) podcast
- [Thinking on its own, AI in the NHS](#), Reform
- [Artificial intelligence \(AI\) in healthcare and research](#), Nuffield Council on Bioethics
- [Pre-Primary Care, An Untapped Global Health Opportunity](#), Your.MD
- [Ethical, Social, and Political Challenges of Artificial Intelligence in Health](#), Future Advocacy