

Artificial Intelligence in Public Health: Opportunities and Challenges

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Science informs, technology enables and innovation creates. This trio has the potential to carry our societies through an era of rapid technological progress in the years to come. Every technology with a computing base is advancing on an exponential curve- including sensors, artificial intelligence, robotics, synthetic biology and 3D printing. Digital revolution, of late, is slowly taking over lives, every part of society and in fact each waking moment of the day. In a world driven by technology, we are just commencing the greatest shift that society has seen since the dawn of humankind. But it would be apt to add that public health in comparison to other scientific disciplines, has been behind the curve in terms of using advanced technologies (1). But with the advent of Artificial Intelligence (AI), substantial success has been made in deep learning, producing systems able to learn without having to be explicitly programmed. AI, is defined as "the science and engineering of making intelligent machines, especially intelligent computer programs". It is related to the task of using computers to understand human intelligence, but AI doesn't have to confine itself to methods that are biologically observable (2).

AI may be gainfully deployed in healthcare to improve medical care especially the big data, exponential computing power and ever- increasing demand on health care systems due to burgeoning ageing populations. The ubiquitous nature of technology in every aspect of modern living implies that it is now easier for physicians to cater large number of patients with the aid of AI. Among the areas where AI can be the most beneficial include improving diagnosis from free text, radiological images and combinations of laboratory results. AI can also help to predict complications and hospital readmissions, be applied to operational research to reduce waiting time and discover methods to improve patient satisfaction. Another big advantage envisaged by use of AI in healthcare is that it can help where there is scarcity of

human resources especially in rural areas.

In context of potential benefits due to use of AI in the field of healthcare, following reasons have been aptly put forward for time being ripe for its enhanced integration in healthcare sector:

- 1) A sense of frustration with the existing medical systems both among the health professionals as well as patients
- 2) Ubiquity of networked smart devices in the society
- 3) Easy access of services at home like those provided by technology companies
- 4) The world of big data is so huge that AI would be needed to keep track of it.

Opportunities: Current and Future

1. *Medical record mining*- Google Deepmind Health Project is being used to mine the date of medical records in order to provide better and faster health services

2. *Designing Treatment plans*- IBM Watson for oncology has an advanced ability to analyse the meaning and context of structured and unstructured data in clinical notes and reports that may be critical to selecting a treatment pathway. A device designed in India by Sig Tuple creates a digital image of every blood slide submitted and analyses it.

3. *Forecasting health events*- Researchers in Singapore have developed an AI agent to forecast dengue incidence up to four months ahead by learning the seasonal patterns of dengue cases over the last decade. Manipal Academy of Higher Education in Karnataka is set to have a centre for data analysis, to eventually build AI models that can be used in healthcare.

4. *Assisting Repetitive jobs*- IBM launched medical sieve- also known as cognitive health assistant-which is qualified to assist in clinical decision making in radiology and cardiology. It is able to analyse radiology images to spot and detect problems faster and more reliably.

5. *Online Consultations*- Babylon launched an app

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which offers medical AI consultation based on personal medical history and common medical knowledge. They increase efficiency in diagnosing patients many times along with decreasing wasting time in front of doctor's examining rooms.

6. *Medication management*- Aicure app confirms if the patients are adhering to their prescriptions. Useful for those with serious medical conditions, who tend to go against the doctor's advice and for participants in clinical trials.

7. *Precision medicine*- Human longevity, a venture by Craig Venter, offers complete genome sequencing coupled with full body scans and very detailed medical check-up which enables to spot cancer or vascular diseases in their very early stage.

8. *Drug creation*- Atom wise uses supercomputers to root for therapies from a database of molecular structures and found two drugs using AI technology which may significantly reduce Ebola infectivity. Berg Health is a Boston based biopharma which mines data to find out why some people survive diseases and thus improves current treatment or creates new therapies.

9. *Healthier choices and decisions*- Open AI Ecosystem refers to the idea that with an unprecedented amount of data available, combined with advances in natural language processing and social awareness algorithms, application of AI will become increasingly more useful to consumers. It could provide information about how to design healthcare based on needs and habits of patients.

10. *Using AI to solve public health problems*- Using AI and machine learning to review vast sets of real time data, health experts can identify at risk populations for any number of diseases ranging from Diabetes mellitus to Heart diseases. In Indiana (USA), use of the hc 1 opioid dashboard- allows officials to identify potential hot spots of abuse early on while measuring the impact of programs aimed at prevention and treatment.

However, these solutions will only revolutionise medicine and health care if they are available to average, mainstream users and not to richest medical institutions and to a handful of experts.

Challenges: The challenge for AI in healthcare is that it represents a paradigm shift in the practice of medicine that needs doctors to learn how AI recommendations are derived before they can rely on such systems for day

to day decisions. Translating technical success to meaningful clinical impact is the next great challenge. The year 2017 saw two setbacks: i) IBM Watson's project with MD Anderson Cancer Centre was halted after four years of development ii) Google deepmind's partnership with Royal Free London NHS Foundation trust came under fire for inappropriate sharing of confidential patient data. So, there are real challenges of the ethical and legal framework for data sharing, inoperability of systems and legal framework for clinical responsibility when errors occur using these systems.

As per Neill DB(3), three main challenges for next decade of disease surveillance research are:

- i) Making disease surveillance system more interactive, enabling users to make sense of the mass of available data
- ii) Exploiting the richness of complexity of novel data sources at the societal scale
- iii) Creating new methods which can scale up massive quantities of data and can integrate information from large number of data sources.

The key is to ensure that techniques we are building have the potential to benefit everyone equally, balance risks and rewards and minimise the dependence that technologies create. The fear is that AI will become so sophisticated that it will work better than the human brain and after a while, it will aim to take control over our lives. As per Rubens M et al (4), AI can best serve the goals of public health only with cross-disciplinary expansions and collaborations which entails not only the development of computer science but also incorporating advancements from field like epidemiology, biology, modern medicine and public health policy.

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