

Artificial intelligence enabled healthcare: A hype, hope or harm

ABSTRACT

In this paper, we have described the health care problem (maldistribution of doctors) in India. Later, we have introduced the concept of artificial intelligence and we have described this technology with various examples, how it is rapidly changing the health care scenario across the world. We have also described the various advantages of artificial intelligence technology. At the end of the paper, we have raised some serious concerns regarding complete replacement of human based health care technology with artificial intelligence technology. Lastly, we concluded that we have to use artificial intelligent technology to prevent human sufferings/health care problems with proper caution.

Keywords: Algorithm, artificial intelligence, doctors, healthcare, machine learning

The Existing Health Care Problem

Whether healthcare is to be provided in the government of private sector or in both, it is of utmost importance that availability of adequate number of doctors providing basic healthcare services in the under privileged areas is the key to improving health outcomes in our country. Some countries like India, the situation has changed. Now we have adequate doctors, the problem is maldistribution.^[1]

A new National Health Policy and the National Health Assurance Mission are already in the place. It is high time to critically analyse the options available to policy makers for resolving the current situation.^[1]

Nearly 69% of India's population resides in its villages, where only 26% (nearly) of its doctors serve, that too mostly in the private sector. This is very expensive and beyond the reach of common people. In India, more than 833 million people are dependent on 44,000 doctors.^[2]

Because of the maldistribution, on an average, each doctor serves 19,000 population. This situation is responsible for to ever-increasing out of pocket expenditures (OOP) on health. This in turn impoverishes 3.3% of India's population per year.^[3] This is about the quantity only. The issue of quality of care is also equally important. For positive health outcomes, there is a need of a healthy and viable health workforce which should be available to the populations 24×7 .

Rao *et al.* (2012) have highlighted the impact of the maldistribution of the doctors in the Indian public sector as a double burden – a threat to the health of the population as well as its economic well-being.^[4]

Artificial Intelligence-As Possible Solution

Among many options, we can think about introducing technology to tackle this crisis like other sectors, e.g. for reduction of bankers (manual) load use of IT enabled self-help kiosks. Both aviation and railway sectors have incorporated automation/technology in their operation to their advantage.^[5]

Now we are living in the era of Artificial Intelligence (AI). In simpler words, AI means- inherited intelligence of a computer machine, which the computer learns by repeated use of end users (humans). This is a non-human intelligence which can do wonders with 90-96% accuracy and reliability.^[5]

In the era of AI-based technologies, life has become easier, e.g., Alexa, is a virtual assistant developed by Amazon Lab126 used for domestic use. It is capable of performing modern day household activities like voice recognition, voice interaction, music playback, making to-do lists, providing real time information about the weather and traffic etc., Alexa can also control several smart devices like switching off TV or AC during non-use. Various extra skills (called apps) can be installed in Alexa which can increase its multiple capabilities.^[6]

Artificial Intelligence in Health Care

In reference to the healthcare industry, to solve geriatric care related problems, Japan has already introduced AI-based robots (personally programmed). These help geriatric persons, helping them in day to day activities, from taking the morning pills to adjusting the AC temperature while sleeping in the bed.^[7]

It is useful in the diagnosis of Glaucoma also. Glaucoma, an optic nerve disease, is considered as one of the major causes which can lead to blindness. Glaucoma is a Global Public Health

Problem. Progressive rise in intraocular pressure leads to pressure atrophy of atrophy, resulting in unilateral or bilateral vision loss. Differentiation of the texture of normal retinal image and glaucoma image is the key to diagnosis of glaucoma. In this work, 'Haralick' features have been used to differentiate the image of normal and damaged retina. AI features (image extraction and by training of the back propagation neural network) have been utilized for the diagnosis of Glaucoma with 96% accuracy.^[8]

Another example is UE Lifesciences and Niramai, who have adopted Artificial Intelligence to diagnose breast cancer accurately. In 2016, Niramai Health Analytics (Bangalore), developed a non-invasive, low-cost solution to screen early breast cancer based on mapping body heat embedded with artificial intelligence technique.^[9] 'Niramai' is an acronym for Non-Invasive Risk Assessment with Machine-learning and Artificial Intelligence. This 'Thermalytix' technology can detect tumours five years earlier than mammography or clinical exams. In this screening technique, no doctor or technician is required (i.e. no touch technique) while performing this screening test. The machine is portable and the costing is 1/10 (350-500 INR) of routine mammography (3500-5000 INR). Moreover, the skill set required for operating this machine is not very high. Nurses and paramedics can operate it very easily. This technology enables tele-radiology also for remote consultation, lowering full-time staffing costs for the hospitals. Now the company/technique is growing at a rapid pace. Till date, 12 hospitals have tied up with this company which stands for non-invasive risk assessment with machine learning. They have already screened nearly 4200 women and detected cancer early on in some of them.

In this test, the patient enters a room, and the instructions are given from outside. The test is carried out with complete privacy. Later, it was realised that the privacy component played a significant role, particularly for rural women. This resulted in easy and wider acceptance of this technology.^[9,10]

Nowadays, robot-assisted surgery is gaining popularity day by day. Surgical robots are capable of doing complex minimally invasive procedures with better visualization, increased precision, and enhanced dexterity compared to laparoscopy.^[11] These are the examples of successful use of AI technology in the healthcare. It is generally agreed from the above discussion that all scientific work in the future will be changed by machine learning complex algorithms, artificial intelligence and robotics.

Artificial Intelligence and Human Intelligence

There are two domains of human capabilities – cognitive and physical. In the past, humans retained authoritative role over the machines due to cognitive advantage and machines conquered with humans mainly in raw physical capabilities. Hence, most of the manual jobs in agriculture sector and industry sector were automated. As a result, “new” type of jobs have emerged which was based, so far, on mainly of cognitive skills, e.g. learning, analyzing, communication and understanding human emotions.^[12]

It is important to understand that the AI revolution is not just about high tech and super computers. It is now powered by breakthroughs in biological sciences as well.

The better we understand the biochemical mechanisms of human emotions, desires and choices, the better computers can become in analyzing and predicting human behaviours, and hence in replacing human drivers, bankers and lawyers.^[13]

To gain a much better insight of decision making by humans, a few decades ago, scientists hacked data of neurosciences and behavioral economics. The research findings highlighted that our all choices/decisions/desires (from eating food, wearing dress) resulted not from some enigmatic intuitions, but were due to the probabilities calculated by billions of neurons within a fraction of second. In reality, overhyped human intuition is just pattern/event recognition.^[14]

Good clinicians, surgeons, and nurses do not have magical powers about their patient's diagnosis. It is something like reconsidering recurring patterns/events. Usually, they identify the learned pattern/event in medical schools and try to avoid wrong things which may be wrong during the investigations, diagnosis, treatment or a wrong surgery. The study also revealed that the biochemical algorithms of the human brain are not absolutely perfect. According to the scientists, our neuronal biochemical algorithms are basically degenerated, short, outdated and adapted one.^[14]

That is why good surgeons, clinicians sometime make foolish mistakes. From the above discussion, it is now clear that AI-enabled doctors can outperform human doctors in the cognitive domain as well.

As already discussed, diagnosing a disease by a doctor is not dependent upon magical powers/intuitions. Rather, their brains spot biochemical patterns by evaluating signs and symptoms of the patients. If AI is equipped with the right sensors and software, it could treat patients far more accurately and reliably than a human doctor. This infotech and biotech revolution holds promise to fill the gap of human doctors in the resource poor areas.^[15]

What psychiatrists/neurologists are learning today about the basal ganglia, pons, cerebrum and the cerebellum might make it possible for computers to outperform human psychiatrists/neurologists in the future.

AI-enabled doctor may not only be able to hack humans and outperform them in their uniquely human skills, it may also have competitive advantage over unique non-human abilities. Thus, AI makes the difference between an AI enabled doctor and a human doctor who have mere owned a medical degree from medical schools. Among the non-human abilities that AI possesses, one practical advantage is of easy and quick connectivity and updateability.^[15]

If we have to update the medical knowledge of all human doctors, it will be quite a time-consuming exercise, as all humans

are individuals. It is not possible to connect them and update them in real time if any pandemic occurs.

In contrast, it is easy to integrate all AI-enabled doctors into a single flexible network. It means that we are not replacing millions of individual traditional doctors by millions of individual AI enabled doctors. Rather, an individual doctor is likely to be replaced by an integral network. Actually, we should compare the capabilities of a collection of human individuals to the abilities of an integrated network/AI-enabled doctors.^[15]

Similarly, if WHO identifies a new infection, or if a laboratory produces a new drug, it is not possible to update all the traditional doctors about these developments. In contrast, the same information can be shared/updated among 10 billion AI-enabled doctors within a fraction of a second. They can all also communicate to each other their feedback on the new infections or drugs via non-neural networks.^[15]

Some people might argue that by switching to AI-enabled doctors, we may lose the advantages of individual clinical judgement/creativity. As an example, if a traditional doctor makes a wrong diagnosis, he may kill that single patient. In contrast, if all AI-enabled doctors belong to a single system, and the system makes a mistake, the results might be devastating. In reality, an AI-enabled doctor can maximize the advantages the connectivity without the losing the benefits of individuality, the hallmark of AI.^[16]

When we run many alternative algorithms on the same network, the patient in a remote village can access hundreds of AI-enabled doctors whose relative performance is constantly monitored and compared. The particular patient, if not satisfied with the AI-enabled doctor, can easily contact the “Traditional Doctor” for a second opinion.^[16]

The future paybacks for human civilization are likely to be huge. AI enabled doctors could provide far better and cheaper healthcare for billions of under-served people. Thanks to machine learning and biometric sensors, a poor villager might get same healthcare via her/his smartphone as the richest person gets today from the modern urban health facility.^[16]

Few Concerns about Artificial Intelligence

In healthcare, we, as a doctor, concentrate almost exclusively on processing the medical information. Usually we collect medical data, analyze it and make a provisional diagnosis/final diagnosis. In contrast to doctors, nurses require good psychomotor and emotional skills also to give a painful injection to the newborn or replace a bandage to the injured. That is why it is easy to have an AI-enabled family doctor on our smartphone than a reliable nurse robot.

The healthcare industry which takes care of the sick, injured, disabled is likely to remain a human support for a long time.

Therefore it is difficult now to comment upon the complete replacement of emotional component of humans. However, missing of human touch may pose a problem, because at the end of the day, the most valuable and non-replaceable thing is human-human interaction.^[16]

The Conclusion

However, we cannot expect the rate of technology adoption in public health sector to be same as other sectors. Banking, tourism, and transport sectors usually adopt newer technologies at a higher speed than public health sector. This is because in every technological transaction, profit is involved. It is not the same for public health sector. Which is why we have to remain patient for some period to enjoy the fullest benefit of this technology.

Lastly, we cannot ignore the technological advancement. We have to use technology to prevent human sufferings with proper caution. Now it will be interesting to watch in the future that how much (in diagnosis/treatment/decision making) AI-enabled doctors can contribute to manage the “maldistribution” of doctors in India and address health problems of the community. It is high time to experiment with AI enabled doctors in other resource poor countries.

N.B. The opinion expressed in this article is that solely of the author and does not reflect the official position of any other affiliated institution or agency affiliated in past or present.

Acknowledgements

We do acknowledge all previous researchers who has been worked and still working on this topic (AI). We do also acknowledge Prof. Yuval Noah Harari, for inspiring us to write this article.

**Sudip Bhattacharya¹,
Keerti Bhusan Pradhan²,
Md Abu Bashar³, Shailesh Tripathi⁴,
Jayanti Semwal¹, Roy Rillera Marzo⁵,
Sandip Bhattacharya⁶,
Amarjeet Singh⁷**

¹Department of Community Medicine, HIMS, Dehradun, Uttarakhand, India, ²Department of Healthcare Management, Faculty Healthcare Management, Chitkara University, Punjab, India, ³Department of Community Medicine, MM Institute of Medical Sciences and Research, MMDU, Mullana, Haryana, ⁴Directorate of Health Services, Public Health Official, Uttar-Pradesh Health Department, Uttar Pradesh, Lucknow, India, ⁵Department of Community Medicine, Sub-dean, Asia Metropolitan University, Malaysia, ⁶HiSIM Research Center, Hiroshima University, Japan, ⁷Department of Community Medicine, PGIMER, Chandigarh, India

Address for correspondence: Dr. Sudip Bhattacharya,
Jolly Grant, Dehradun, Uttarakhand, India.
E-mail: drsudip81@gmail.com

References

- Deo MG. Doctor population ratio for India-The reality. *Indian J Med Res* 2013;137:632-5.
- Pages-RHS2017 [Internet]. Available from: <https://nrhm-mis.nic.in/Pages/RHS2017.aspx?RootFolder=%2FRURAL%20HEALTH%20STATISTICS%2F%28A%29RHS%20-%202017> and FolderCTID=0X01200057278FD1EC909F429B03E86C7A7C3F31&View=%7B9029EB52-8EA2-4991-9611-FDF53C824827%7D. [Cited 2019 Feb 15].
- Furtado KM, Kar A. Health resources in a 200,000 urban Indian population argues the need for a policy on private sector health services. *Indian J Community Med* 2014;39:98-102.
- Rao M, Rao KD, Kumar AKS, Chatterjee M, Sundararaman T. Human resources for health in India. *Lancet* 2011;377:587-98.
- Artificial Intelligence and its Role in Near Future [Internet]. GroundAI. Available from: <https://www.groundai.com/project/artificial-intelligence-and-its-role-in-near-future/>. [Cited 2019 Feb 15].
- Amazon Alexa. In: Wikipedia [Internet]. 2019. Available from: https://en.wikipedia.org/w/index.php?title=Amazon_Alexa&oldid=883093523. [Cited 2019 Feb 15].
- Japanese Automakers Look to Robots to Aid the Elderly-Scientific American [Internet]. Available from: <https://www.scientificamerican.com/article/japanese-automakers-look-to-robots-to-aid-the-elderly/>. [Cited 2019 Feb 15].
- Samanta S, Ahmed SS, Salem MA-MM, Nath SS, Dey N, Chowdhury SS. Haralick features based automated glaucoma classification using back propagation neural network. In: Satapathy SC, Biswal BN, Udgata SK, Mandal JK, editors. *Proceedings of the 3rd International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA) 2014*. Springer International Publishing; 2015. p. 351-8. (Advances in Intelligent Systems and Computing).
- Niramai - A Novel Breast Cancer Screening Solution [Internet]. Available from: <https://niramai.com/>. [Cited 2018 Nov 12].
- Thermalytix - Niramai [Internet]. Available from: <https://niramai.com/about/thermalytix/>. [Cited 2018 Oct 30].
- Adverse Events in Robotic Surgery: A Retrospective Study of 14 Years of FDA Data [Internet]. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0151470>. [Cited 2019 Feb 15].
- Woirol GR. *The Technological Unemployment and Structural Unemployment Debates*. Westport, Conn: Praeger; 1996. p. 224.
- Kahneman D. *Thinking, Fast and Slow*. 1st ed. New York: Farrar, Straus and Giroux; 2013. p. 499.
- Where machines could replace humans--and where they can't (yet) | McKinsey [Internet]. Available from: <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet>. [Cited 2019 Feb 15].
- Jiang F, Jiang Y, Zhi H, Dong Y, Li H, Ma S, *et al.* Artificial intelligence in healthcare: Past, present and future. *Stroke and Vascular Neurology* 2017;2:230.
- Harari YN. *21 Lessons for the 21st Century*. London: Jonathan Cape; 2018. p. 368.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Received: 23-02-2019

Revised: 25-02-2019

Accepted: 10-10-2019

Published: 15-11-2019

Access this article online

Quick Response Code:



Website:

www.jfmpc.com

DOI:

10.4103/jfmpc.jfmpc_155_19

How to cite this article: Bhattacharya S, Pradhan KB, Bashir MA, Tripathi S, Semwal J, Marzo RR, *et al.* Artificial intelligence enabled healthcare: A hype, hope or harm. *J Family Med Prim Care* 2019;8:3461-4.