Artificial Intelligence the Itinerary of Sustainable Health Care

Simren Bhatia[1], Anmol Mathur[1*] and Aditi Mathur[2]

[1]*Department of Public Health Dentistry. Dr D.Y Patil Vidyapeeth, Pune India.*
[2]*Department of Pedodontics and Preventive Dentistry, Dr D.Y Patil Vidyapeeth, Pune, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Review Article

ABSTRACT

The Global Strategy for health for all by the year 2020 was launched by WHO in the year 1979 but still the goal has not been achieved; crisis of health care personnel is a major reason behind it. To achieve a more stable future, health care sector needs Artificial Intelligence (AI) will be a curtain raiser towards sustainability in the field of health care.
Sustainable health care can be achieved by fulfilling the targets set out by Sustainable Development Goals, AI can provide promising alternatives to match the goals and aim the sustainable health care for the generations to come. The current paper would like to propose AI as a solution to these issues. AI is already in the front line for diagnosis and medical imaging but there is still lot of scopefor utilization.

1. INTRODUCTION

In the year 1979 during the World Health Assembly the Global Strategy for health for all by the year 2020 was launched, various member states of WHO formulated national policies, strategies and plan of action to attain the goal at individual level or regional level but till date, four

_____

Corresponding author: E-mail: dranmolmathur@gmail.com, anmol.mathur@dpu.edu.in;

hundred million human beings lack entry to basic health services and 5 billion human beings are deprived of safe, low-priced surgical and anaesthetic care in the most critical situations [1]. Challenges confronted by the Healthcare sector are numerous, from growing demand and rising costs, affordability and accessibility. Crisis in the world healthcare staff in recent years has gained attention. There is a world wide disparity of human resources for health and specifically, a scarcity of healthcare workers in developing countries [2]. The crisis of healthcare team of workers is due to at least three critical reasons: health practitioner deficiency at a global level, the increasing age and burnout of doctors and an ever-increasing demand for continual care. An efficient health care system relies upon the availability, accessibility and acceptability of its health workers [3]. It is found that there is a shortage of 17.4 million healthcare people worldwide and the experience workforce is an added assignment [4]. In India, the available ratio of doctors to population can be calculated at 1:1596 as per the Central Bureau of Health Intelligence [5]. Government spending on healthcare is one of the lowest in the world with only 1.4% of India's GDP in 2016-17 [6]. According to the National Sample Survey Office, 2014, 79% urban and 72% rural households depend on private health facilities. Furthermore, 30% of the total health expenditure is borne by the public sector while the remaining expense is by the patient, which is 70% [7].

This disparity is only going to worsen, there is a major requirement of health support system throughout the world [8]. To achieve a more stable future, health care sector needs new workforce models that make health service more accessible, capable and affordable in order to meet the rising demand. To an extent the workforce has already expanded by incorporating home caregivers, social workers, teachers, and others outside the medical profession [9]. This still will not be enough and the current paper would like to propose the solution to this situation.

Technology will have to play a major role in providing support to fill the gap. In particular, there should be an increase in use of Artificial Intelligence (AI) and robotics towards health care delivery or assistance in its delivery [10]. AI is the branch of computer science that deals with the simulation of intelligent behaviour in computers. To summarize it means to act intelligently.

Artificial Intelligence term was formally given in 1956 by a group of researchers for a fundamental approach towards medical care [11]. Globally the Artificial Intelligence (AI) domain has started to raise the technological growth in the health care industry. Universal Health initiatives have started exploring its ways to grasp AI as opportunities to investigate and alleviate public health care standards. AI tools can help optimize delivery of healthcare in the absence of health care workers at inaccessible community level situations, thus allowing limited resources to possess greater impact [12].

The use of AI will be a curtain raiser towards sustainability in the field of health care sector. The Global AI in healthcare market was estimated at 2.5 billion USD and it is expected to show a growth of 41.5% by the year 2025 [13]. It has been estimated that India's AI expenditure will grow at a Compound Annual Growth Rate (CAGR) of 30.8% to touch 880.5 million USD in 202 [14]. By definition, sustainability has many meanings, the most recognized version is "meet present needs without compromising the ability of future generations to meet their needs".

Sustainable health care can be achieved by fulfilling the targets set out by Sustainable Development Goals [15]. AI can provide promising alternatives to match the goals and aim the sustainable health care for the generations to come.

Sustainability in health care aims to promote viable, healthy and equitable care in communities. It is one that is low-cost to residents alongside with authorities and is dedicated toward reaching the continuous fitness and delight of consumers [11]. A clinical perspective allocating assets accurately (both human and material) and considering the health and wellness of team of workers – arguably the single most vital entity in the sustainable delivery of healthcare [16].

There are various AI models that will help us improve sustainability in health care. Few of them are discussed below [17].

2. ROLE OF AI IN ACCOMPLISHING SUSTAINABLE HEALTHCARE ADMINISTRATION

The Brookings Institution estimates that 40% of the tasks which are carried out by health workers and 33% of the tasks by healthcare practitioners

have the potential to be automated.By undertaking the duties of doctors such as information entry of patients, laboratory statistics and imaging conclusions, can even carry spare time for the overloaded clinicians to grant more time towards management of patients [18]. Linking machine learning data to electronic fitness management can assist administrators to gather correct and context personal details of the patients [19].

AI has been of great help with its Electronic health records (EHR) which has improved the quality of health care, patient outcome through improved management and reduce manual errors in the health record systems.

AI in the area of statistics strategies have recognized as amongst the most creative proposition to guide health system and its administration by using augmenting scientific growth and reducing administrative needs for health care [19]. In a research it has been observed that the use of AI technology will result in saving $150 billion in healthcare annually by 2026 in USA alone [11].

2.1 Clinical Selection Support

Clinical choice support structures can assist to limit clinical drawbacks and enlarge consistency and efficiency of healthcare system to get scientific excellence. Texas has developed AI software program that can examine mammograms and analyse pathology and give reviews to diagnose breast cancer with 99% accuracy that too 30 times faster than a doctor could [20].

Thus an AI based diagnosis increases detection possibilities and accuracy for diagnosing rare and difficult conditions. In University of Alberta, researchers have developed nano-machines that use artificial DNA motors to discover most cancers or different sickness markers before and deliver tablets precisely, with decreased side effects [20]. Google, for example, is collaborating with health care networks to build prediction fashions from big records to warn clinicians of high-risk conditions, such as sepsis and coronary heart failure. The support in drug dosage and drug delivery effectiveness, drug designing are going to be revolutionary in pharmaceutical science.

2.2 Patient Monitoring

Digital records and monitoring patients can be excelled by the adaptation of smartphones with digital fitness monitoring systems. It is the adjunct to AI units to come alive, and thus improve the clinical decision and judgements of a clinician. Digitalization is becoming extremely helpful in patient education and selective training through smartphones. This will reduce the time allocation for health education and precise topic selection for every patient. Monitoring the drug response and creating the data base towards drug interactions will be extremely useful for new drug designing and making diseases cured.

2.3 Healthcare Interventions

Machine learning packages built-in with digital fitness files can analyse biometric and other scientific information of man or woman who suffer with a specific disease and advise plan to cure the disease based totally on cutting-edge clinical guidelines. Interventions such as drug repurposing, quantitative structure active relationship modelling, structure based virtual screening and de novo drug designing towards pharmaceutical industry can lead to innovation in new drug design. This will eradicate the urban rural discrimination and disparities of health care delivery to a great extent.

3. CONTRIBUTION OF AI IN IMPOVERISHED REGIONS

The AI is not just entitled for developed countries its use has been reported from the under developed countries also. This section will highlight the immense thrust of AI model being utilized for health care sector. The giant scenario of facts has created immense possibilities in making a better health care system for any population across the globe. Open Medical Record System (Open MRS) is an electronic medical record (EMR) platform that is becoming popular in African countries. Kenya started the use of Open MRS to construct and put in force an EMR device referred to as Bora to make an effective maternal health and enhanced HIV therapy in impoverished areas.

For presenting patient based statistical data the District Health Information Software (DHIS) is an open source of EMR platform that is being widely used, it is now used in more than 40 countries of

Africa, Asia, and Latin America [16]. In resource poor settings, mobile telephones have been used by health employees to improve the provision of health care facilities. In regions like Tanzania, records of pregnant ladies and health care records of young children are given by a non-governmental corporation through a mobile phone-based device [17]. The effect and the efficiency of the device is currently on a process of assessment still mobile phones are found to be of extreme use in providing data related to health system to patients in a face-to-face interaction which was not possible in low resource regions till date [16].

AI develops into a super intelligent systems for health care delivery especially in conditions like prediction of epidemic, the COVID pandemic has well documented the need of such smart platform for consultation, drug dispersion, disease statistics all this in special conditions of COVID 19.

The versatility of AI has added opportunity to the Health Care settings to maximise its incorporation in to more and more models, the future belongs to AI if we are looking forward to deliver sustainable health care to the generations to come through Sustainable Developmental Goals.

4. CHALLENGES REGARDING AI

Challenges will be faced by resource poor settings while adopting AI. The high cost of this disruptive technology could serve as a setback for the underdeveloped countries trying to improve their health care. There is additional concern on its effect on human jobs e.g., AI researchers predict that AI-powered applied sciences will replace surgical operations from doctors by 2053 [18]. In the coming 20-30 years, more than 50% jobs would be old fashioned and not wished anymore and even the healthcare industry would be impacted by it [19]. The authors stand is that AI cannot exchange medical service professional, but the ones refusing to embrace the incorporation of AI in to health will definitely face the issues [20]. Because of the complexity and other state-of-the-art process of decision making in coming to a diagnosis, clinician verification should definitely be the gold standard in decision making but the scrutinising capability and speed of AI can never be overlooked.

AI is definitely the future of sustainable health care; this could be the pass towards attainment of health for all and can help us achieve the goal. With deep penetration of tele communication in country like India it will be really wise to invest in AI. Government agencies in India have already started with The District Health Information Software (DHIS2) in order to maintain health care still tele medicine is the field to capture. Areas of remote origin and zero existence of health care facility need to be prioritised in attainment of AI based tele medicine support in order to achieve an e-health for all strata.

Appropriate funding is required to advance the technology and creation that in the end will run down the amount of care and raise first-class and consumer happiness. The assignment is to arrange the budget specially for healthcare improvements that might not have a short-term return on investment.

5. DISCUSSION

Artificial Intelligence can be utilized in the healthcare sector with its own benefits and challenges. As already discussed, AI is being used globally in order to help make healthcare affordable and accessible to the public and at the same time ease the burden off the shoulders of healthcare workers. The main aspect of the present article is to enlighten sustainability aspect of AI especially in the field of health sciences, In order to incorporate sustainable health care using AI, Alami H et al. [21] have proposed five building blocks for the sustainable utilisation of AI specially in low resource regions. These are: training and retention of local expertise, a robust monitoring system, a systems based approach to implementation and a responsible local leadership inclusive of all stakeholders [21].

Based on application of AI, the market may be bifurcated into Eye Care, Oncology, Radiology, Cardiovascular, Pathology and others. In the eye care segment, AI is increasingly being used for the diagnosis of diabetic retinopathy. Several solutions are available in the market that use AI that analyses images of the retina for signs of diabetic retinopathy, a complication of diabetes caused by high sugar levels.

On the basis of Diagnostic tool, the Global AI-based Medical Diagnostic Tools Market has been

segmented into Medical Imaging Tools, Automated Detection Systems, and Others. Medical Imaging Tools accounted for the largest market share in 2018. AI-based medical imaging tools rely on an enormous supply of medical data to derive its algorithms to discover patterns in images and detection of specific anatomical markers.

On the basis of regional analysis, the Global AI-based Medical Diagnostic Tools Market is classified into North America, Europe, Asia Pacific and Rest of the world. North America is expected to hold the largest market share followed by Europe. The healthcare authorities in North America are commenting themselves to the power of Artificial Intelligence in order to raise the level of acute care in hospitals with experts [22].

Analytics Insight also predicts that owing to its extensive deployment for data analysis that automates analytical model building, Machine Learning with a share of 44% is leading the Artificial Intelligence market during the forecast period 2019-2023. AI market led by Machine Learning is expected to grow from US$18.8 billion in 2019 to US$80.3 billion at a CAGR of 33.6% in 2023.

Moreover, Deep Learning stands second in the row to drive AI's futuristic market with an 18% market share. Computer Vision is projected to grow at a CAGR of 24.0% from US$6.3 billion in 2019 to US$18.3 billion in 2023. Further, thriving ahead with the linguistic innovations, NLP is expected to flourish at a CAGR of 28.5% with 13% market share, rising from US$5.8 billion in 2019 to US$20.2 billion in 2023. And others are predicted to grow at a CAGR 12.8% from US$4.2 billion to US$7.8 billion during the forecast period [23].

Machine learning and deep learning algorithms have been implemented in several drug discovery processes.

This knowledge of the growth which is expected to be seen in the various areas of AI can be put to use to help make it more sustainable for the healthcare sector globally, with a focus on the low and middle income regions. Several advances have taken place in the past decades in AI and these advances continue into the future.

6. CONCLUSION

The latest health care opportune lies in Artificial Intelligence which promises to change the health care services in extreme resource lacking regions. Health care delivery system in current scenario is getting more dependent towards AI technology. The digital technology such as smart phones has immense potential towards use of AI applications to enhance the public health outcomes. Its role in drug/ vaccine invention will change the scenario of mankind. Several samples of utilizing AI are already applied with the purpose to uplift health outcomes in less resourced regions, there are various other AI implementations which will come into practice in the coming years.

It has become one of the finest tools which will help in reaching greater targets to set out in the SDGs, particularly related to ensure global health coverage for the generations to come.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Cometto G, Boerma T, Campbell J, Dare L, Evans T. The Third Global Forum: framing the health workforce agenda for universal health coverage. The Lancet Global Health. 2013;1(6):e324-e325.
2. Pruitt SD, Epping-Jordan JE. Preparing the 21st century global healthcare workforce.BMJ. 2005;330(7492):637-639.
3. Behera D, Praveen D, Behera MR. Protecting Indian health workforce during the COVID-19 pandemic. Journal of Family Medicine and Primary Care. 2020; 9(9):4541.
4. Nicol E. Sustainability in healthcare: efficiency, effectiveness, -economics and

the environment. Future Health J. 2018; 5(2):81.

5. Central Bureau of Health Intelligence. National Health Profile 2018, Ministry of Health and Family Welfare. Chapter 1; 2018.

6. Rao N. Who is paying for India's healthcare? The Wire; 14 April 2018.

7. National Sample Survey Office. Health in India: NSS 71st round. Government of India. January-June; 2014.

8. Wenke H, Jongwha C, Michelle L, Harold P. Effects of Integrated Delivery System on Cost and Quality. Am J Manag Care. 2013; 19(5):e175-e184.

9. Hadley TD, Pettit RW, Malik T, Khoei AA, Salihu HM. Artificial Intelligence in Global Health —A Framework and Strategy for Adoption and Sustainability. Int J MCH AIDS. 2020;9(1):121-127.

10. Ahuja AS. The impact of artificial intelligence in medicine on the future role of the physician. Peer J. 2019;7:e7702.

11. Haenlein M, Kaplan A. A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. California Management Review. 2019;61(4):5-14.

12. Hadley TD, Pettit RW, Malik T, Khoei AA, Salihu HM. Artificial Intelligence in Global Health -A Framework and Strategy for Adoption and Sustainability. Int J MCH AIDS. 2020;9(1):121-7.

13. Artificial Intelligence in Healthcare market size, share and trends analysis report by component (Hardware, software, services) by application, by region, competitive insights and segment forecasts, 2019-2025. October 2019.

14. Beniwal V. Artificial Intelligence is India's solution to fix data gaps. Bloomberg Quint. Jan 2021. https://www.bloombergquint.com/economy -finance/artificial-intelligence-is-india-s-solution-to-fix-data-gaps

15. Shahid N, Rappon T, Berta W. Applications of artificial neural networks in health care organizational decision-making: A scoping review. Plos One. 2019; 14(2). 0212356

16. Weber JS, Toyama K. Remembering the Past for Meaningful AI-D. :6.

17. Gryfe CI. Physician resistance to new information technology. CMAJ. 2007; 176(5):659.

18. Alexander, David. Disaster and Emergency Planning for Preparedness, Response, and Recovery. Oxford Research Encyclopedia of Natural Hazard Science; 2015. Oxford University Press. Date of access 19 Feb. 2021

19. Meskó B, Hetényi G, Győrffy Z. Will artificial intelligence solve the human resource crisis in healthcare? BMC Health Serv Res. 2018;18(1):545.

20. 20.Centers for Disease Control and Prevention. MMWR 2011;60(22): 1-4. Available:https://www.cdc.gov/mmwr/previ ew/mmwrhtml/mm6022a3.htm

21. Alami H, Rivard L, Lehoux P, Hoffman SJ, Cadeddu SB, Savoldelli M, Samri MA, Ahmed MA, Fleet R, Fortin JP. Artificial Intelligence in healthcare: laying the foundation for responsible, sustainable and inclusive innovation in low and middle income countries. Globalization and Health. 2020;16(1):1-6.

22. AI-based Medical Diagnostic Tools Market Size By Application (Eye Care, Oncology, Radiology, Cardiovascular, Pathology, and Others), By Diagnostic tool (Medical Imaging Tools, Automated Detection Systems, and Others), By Geographic Scope And Forecast. Verified Market Research; 2020.

23. Analytics Insight. Analytics Insight predicts artificial intelligence market at US $53.2 billion in 2020, North America to lead; 2020.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/72119