



DIGITAL TRANSFORMATION OF HEALTHCARE SERVICES - RECENT INITIATIVES AND ADVANCEMENTS



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Background

Every single nation, irrespective of stage of development and might of wealth, has been shown a mirror by the unprecedented health emergency caused by Covid-19 Pandemic. It has revealed the blatant picture of healthcare facilities, gaps in infrastructure, inadequacy of care giving professionals, and state of readiness to handle such crises, despite experiencing earlier pandemics like Spanish Flu, Ebola, and Swine Flu. Mankind perhaps has finally understood that pandemic affects richer people faster like lifestyle diseases in large proportion than poor, when any amount of money cannot help arranging the needful treatment.

The present crisis has persuasively brought out three major learning points. The first one is that preventive measures would always reduce the burden of hospitalisation, intensive care, and treatment of patients in critical conditions. Quicker the response time, lesser would be the probability of the crisis developing into unmanageable dimensions. The third one is the need for working with principles of universal altruism for managing any such mass affecting disease. It would help developing a sense of collaboration and cooperation among all stakeholders, including a global multi-lateral agency that should take charge of timely coordination across all nations.

For effective handling of all these in a cost effective

manner the overriding requirement is collection, safe storage and efficient analyses of all relevant data in respect of citizens' health across all societal strata, service providers, manufacturers of medicines and equipment, results from their applications, etc. coupled with appropriate documentation under a prescribed set of guidelines. The need for standard policies, code of governance, and operating processes requires no overemphasis.

One would have not come to a different conclusion even if such a pandemic inflicted crisis is kept aside, and issues related to delivery of health care services is thought through in general. Any analytical introspection would have revealed many of these dangerous chasms of healthcare facilities in many countries, including India. Therefore, finding ways and means for solving such problems for humanity is the clarion call of the day.

Objective

The author in his earlier columns have written about certain initiatives of scientists since late 1990s for digital transformation of healthcare services. Readers might have noted how certain systems and processes have been fortified with digital tools for improving speed, quality, and effectiveness of healthcare services both in pre and post medical treatment stages. Major examples are use of AI and ML for augmenting speed and success factor of diagnoses, selection of medicine, robotic surgery, IOTs for detection, monitoring and controlling of diseases, blockchain platforms for healthcare service delivery, and so on.

In this column the author has made efforts to briefly narrate how digital transformation can help successful implementation of some of the recent policy decisions in India. Recent advancements in global arena for digital transformation of healthcare have also selectively been narrated. The author will relate his directional thoughts about what all solutions can further be thought through for startups to develop cost effective solutions and faster implementation.

Implementation of India's National Digital Health Blueprint

Niti Aayog has shared on July 15, 2020 in public domain India's National Digital Health Blueprint (NDHB)¹ with the objective to gather comments and views from all stakeholders in sequel to the National Health Policy, 2017. This Policy has laid down the key principles of ".....citizen-centricity, quality of care, better access, universal health coverage, and inclusiveness."

Paragraph 5.4 of the NDHB has outlined 'Methods & Instruments recommended by NDHB' for implementation, clearly reveals government's intent for applications of digital tools and platforms for end to end handling and delivery of healthcare services to citizens of India with the principle of inclusive happiness.

Digital Transformation for Attainment of Objectives

In the following paragraphs the author has attempted to ideate and identify possible applications of digital tools,

platforms, and solutions which can help attaining those objectives of NDHB and their further advancements. The paragraph headings, stated in italic fonts, have been excerpted from the said Blueprint.

- a. *'Establishing and managing the core digital health data and the infrastructure required for its seamless exchange.'* - A Blockchain Platform can provide solutions for end to end handling and recording of events and transactions right from expression of interest to settlement of payments. This platform would also be able to handle recording and management of citizens' identity and credentials, safe stacking of health data and secured storage of related documents in a digital library with abilities to retrieve and share.

This digital solution provides all required safety, immutability, transparency, and security. It would warrant that none can extract, modify, erase, breach privacy and exploit any such data and documents with ulterior motives. Yet at the same time all authorised participants would have seamless access for performing transactions from his / her computer node as facilitated by 'Distributed Ledger Technology' which Blockchain is synonymously known as. Such participants will be able to derive transactional data to the extent required for accounting, reporting, and analyses.

The proposed Platform would also ensure that participating citizens, business entities and other agencies do not live with a sense of 'Data Slavery for Life'. Because any participant would have rights to call back at any point of time his / her all personal, or their institutional data and documents from the Platform at their own volition even if the platform is run by a Government Agency.

- b. *"Promoting the adoption of open standards by all the actors in the National Digital Health Ecosystem, for developing several digital health systems that span across the sector from wellness to disease management.* - A Super Smart Contract, with duly linked specific Smart Contracts for each layer and sequence of transactions / events, can be incorporated in a Blockchain platform. Such contracts will ensure compliance of all standards and guidelines as laid down in the NHP, 2017 and NDHB. These Smart Contracts would be drafted by eminent lawyers and digitally embedded while coding the software with scopes for permitted flexibility to amend the contract(s) to the extent permitted.
- c. *"Creating a system of Personal Health Records, based on international standards, and easily accessible to the citizens and to the service providers, based on citizen-consent."* - As stated in point 'a' above this objective can be achieved by implementing an integrated digital document library.
- d. *"Following the best principles of cooperative federalism while working with the States and Union Territories for the realization of the Vision";* - The

author would like to envisage the same Nodal Structure that he has recommended for implementing the 'Kishan Blockchain Platform' in his 12th monthly column titled 'Digital Transformation of Agriculture – Seeds in the womb of time'². The solution designing team will have to meet the challenge of enabling scalability and interoperability by and between such District level Platforms that would be integrated to the State and then to the national level Blockchain Platforms.

- e. *"Promoting Health Data Analytics and Medical Research"*- Applications of digital tools for multidimensional and multipurpose data analytics will help conducting the intended medical research. For this all digitalised medical data, test reports, records of treatments provided, and surgical history, as appropriate, can be analysed using tools from the stable of 'Cognitive Intelligence' and 'Machine Learning'. Similar analyses can also be done for data related to service providers for insurance, pathological and radiological tests, hospitals, doctors, pharmaceutical companies, pharmacists, medical equipment, and appliance vendors, etc.

Results from such analytical studies would help perceiving trend patterns over a given period for patients of different age groups, gender, morbidity conditions, geographical segments, etc. Analyses can also be conducted to derive insightful inferences about various medical tests, results and effectiveness of treatment methodology adopted and drugs administered and by doctors.

All this information can be shared on a 'Need to Know Basis' through a stringent access control mechanism. Such astute of information would effectively contribute while introspecting and taking policy decisions, adopting standards, and initiating action steps for qualitative and quantitative improvements in delivery of healthcare services.

The aforesaid Blockchain Platform(s) operated with hierarchical nodal structure can seamlessly be integrated to ensure collection of data without any human intervention and maintaining one version of truth. The institutional service providers would also be able to apply RPA and Bots for channelizing data from internal systems through their nodal outlet of the Blockchain Platform. Doctors' hand-held and desktop medical appliances, and the IoTs / IoBs used by patients can also be integrated through push and pull mechanisms enabled by RPA and Bot for capturing patients' health conditions and treatment related data. This has more been explained subsequently in this paper.

- f. *"Enhancing the efficiency and effectiveness of Governance at all levels."* - Applications of the aforesaid digital platforms, tools and solutions would warrant the desired efficiency, effectiveness, and compliance of standard codes of governance as set out in the said Policy and Blueprint.

- g. *"Ensuring Quality of Healthcare."* - The combined effects and benefits derived from end to end digital transformation of systems and processes will result in qualitative improvement of services to ensure citizens' wellness and timely and cost-effective service deliveries to citizens.
- h. *"Leveraging the Information Systems already existing in the health sector."* - The above processes for digital transformation would not call for discarding all the existing IT Systems used at their end by stakeholders. Those can suitably be modified and integrated with the aforesaid solutions in a cohesive manner. For this software known as 'Application Programme Interface' can suitably be used to the extent considered desirable and required for cohesive orchestration.

Some of the transactions within the proposed Blockchain Platform would call for settlement by payment, e. g., for insurance premium, medicines, fees of doctors, charges for pathological and radiological tests, services by hospitals, etc. In the absence of any digital currency such payments are to be made by fiat currency, i. e., INR through any of the disjointed processes beyond the realms of the said Platform. Those could be credit cards, cheques, or payment gateways of FinTech service providers. If, there would have been a digital currency, bank could have been a direct participant in the Platform and the participants would have settled payments using the same.

The author reiterates his recommendation for introducing 'Central Bank Digital Currency' (CBDC) in India. This would obviate the need for any disjointed transaction to be handled beyond the realms of the proposed Blockchain Platform

The readers may be keen to know about what all are happening in digital transformation space for health care services across the world. The author would like the readers to refer a comment of Mariana Fernandez³ about the research paper of Frost and Sullivan titled Global Blockchain Technology Market in the Healthcare Industry, 2018–2022⁴. This report has examined, *"Key growth opportunities and highlights success factors and strategic imperatives for blockchain commercial deployment consideration in the healthcare space by assessing commercial partnerships. It also analyzes best-practice case studies for the identified growth opportunities."* This report remains to be studied in detail by the author.

Advancements in Digital Tools and Systems

Digital Stethoscope

The word stethoscope is a combination of two Greek words *stethos* meaning chest and *scopos* meaning examination / study. It is the oldest appliance that doctors even today use for listening to sounds of heart, chest, bowel, and blood flow noises of human bodies. French physician Rene Laennec attached a long-rolled paper tube to a funnel and thus the first stethoscope was born in 1818.

Innovative engineers have electronically enhanced the power of a stethoscope and made it a more versatile

performer. The new stethoscope can transfer through Bluetooth connection digital signals to hand-held smart phones and other computing devices of doctors. It has built in facilities for “... filtering, buffering, and amplification of the auscultated sounds, as well as conversion to a digital signal.

... These digital signals are then forwarded to the signal-processing module, which will package the information in a higher-order classification and cluster the data for a clinical diagnostic decision.⁵ The following picture delineates the transformation of a stethoscope.



Traditional Stethoscope

Digital Stethoscope

Smartphone and EKO Software Device

Source:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5757962/> and <https://shop.ekohealth.com/products/duo-ecg-digital-stethoscope>

Clinicians are thus more and better equipped to visualize, record, and save sounds for further diagnostic analysis. Advanced versions of such an electronic stethoscope can function as an ECG machine. All these evolutions have helped feeding such digitalised clinical records to a central system for further cognitive analysis. Such an electronic stethoscope is thus emerging as an IoT. The computing devices / facilities at the doctors’ end can be also made to serve as an Edge Computing facility.

Neuralink – The Fitbit for Head

Besides SpaceX, Elon Mask is passionate about his second project called ‘Neuralink’. It is a small coin sized Fitbit type device with fitted tiny wires which can be implanted underneath human skull by a bloodless surgery. It has all sensors that one can see in a smart watch and can capture thousand channels of information and has mega-bit wireless transmission capacity. The Link has a 6-axis inertial measurement unit, temperature and pressure gauges and in-built digital application that can relate to a Smart Phone. According a report by Forbes⁶ Elon Mask while speaking about Neuralink mentioned that any patient suffering from neuralgic and spinal disorders would look normal with its help. According to him world will increasingly have larger numbers of people affected by neuralgic disorders and spinal problems. This experiment has so far been shown to be tired on pigs and yet to be used for human beings.

IoTs and IOBs - Tiniest of The Amazing Trio

Three digital technologies are fast emerging to be the trio of heroes for industry sectors and christened as ‘The Amazing Trio’. Those are Blockchain, Artificial Intelligence

and Internet of Things (IoTs). Healthcare service space is no exception to that. These three technologies are increasingly being used to facilitate seamless digital transformation with a 360^o approach. Importance of Blockchain and AI need not anymore be emphasised. It will be appropriate to write more about ‘Internet of Body’ (IoB) which is an extension of IoTs and emerging to be the gamechanger technology for medical treatments.

IoTs make all things at our home, cars, cities, and industries smart by adding sensors and connectivity. Both doctors and patients are also now being powered by IoTs which facilitate two-way communication on a real time online basis. These, when connected through Bluetooth to smart phones and computing devices, help keeping digital records of patients’ health conditions and treatments related information. Days are not far when pillows will be fitted with a IoT which will inform the doctor about duration and intensity of sleep a patient had in previous night.

Asamanya Mohanty⁷ has aptly defined and introduced IOBs in these lines. “*Internet of Bodies (IoB) is an extension of the IoT and is the outcome of the Internet of Things (IoT) connecting with the human body. It is the inevitable development that’s taking the technology status quo by storm. Instead of devices, appliances and other items connected to the internet as in IoT, it’s human bodies which are now connected to a network, through devices that are ingested, embedded, implanted or connected to the body in some way. Once connected, data can be exchanged, and the body and device can be remotely monitored and controlled.*”

The following picture, albeit not much clear, gives an idea that IOBs that will soon be used for remedying sufferings related to almost every single ailing part of human body.



Prosthetic image source: www.popularmechanics.com

The proposed project of Elon Mask for Neuralink, as narrated above, is an example of IoB. Reading of research papers reveal more such probable use cases. Such IoBs are taken by patients like any other medicinal tablets. Upon getting positioned in stomach digital signals are emitted by those IoBs which render other radiological and scanning processes easy, less time consuming, and cost effective. Once the purpose is served those IoBs dissolves away without causing any harm to a human body.

Digital Health Passport for International Travelling

Days are not far when international travellers would carry another passport to cross sovereign boundaries other than the one issued by immigration authorities. This Health Passport will be digitally issued and managed end to end through a Blockchain Platform. International and even domestic travelling in the present pandemic period has caused enormous hassles for any traveller. Such Health Passport will enable smooth travelling with not only a certificate of good health condition but also with conviction of the traveller.

The present author is of the view that the Blockchain Platform(s), as ideated above for healthcare services, can be integrated with the Platform for issuing and surveillance of Digital Health Passport. If need be, this can also be integrated with Platforms like 'Arogya Setu' being used in India for tracking and monitoring spread of Covid-19 Pandemic as well as recovery of affected patients.

IBM has reported that⁸ "After months of COVID-19 lockdown, many areas in the U.S. continue to grapple with the pandemic response while other countries around the world are starting to lift restrictions (with mixed results). To reopen safely, businesses are envisioning digital health passports as a way to verify coronavirus testing or immunity status today and, in the future, vaccination."

Conclusion

Readers may feel that this article is abruptly coming to an end. More would have been better. So is the feeling of the author. More could have been written about many use cases of digital solutions which are being innovated by 'startupians' for the benefit of humanity. Shall look forward to writing more about digital transformation health care and animal care in course of time. **MA**

Note: The author acknowledges contributions of Ms. Rajashree Basu in writing this column.

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