EDITORIAL

Digital Healthcare –Paving the Road to "One World, One Health"

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Our world today is not defined as 7 continents, 5 oceans and 193 countries; it is rather a global village. A unified population, connected extensively thanks to the existing and forever evolving technology.

To keep at pace with this evolving nature of society, healthcare sectors must evolve too. Digital healthcare (DH) is the pacemaker of our new world.

A recent event which unified all the members of society and diluted all borders of the world as we know it, is the much talked about COVID-19 pandemic. The pandemic has been a teacher to all of us, explaining by example how important preparedness for any event is for the healthcare sector and how the concept of "One world, one health" rises above all.

With knowledge comes power. Awareness and information are tools of primary importance in any novel challenge that a nation faces. The pandemic was no different. Communicating the right information about the pandemic in terms of its spread, the course of the disease, outcomes of the patients and preventing & testing strategies were the most sensitive and critical steps in handling the response of the citizens.

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From the very first diagnosed case to the current status of the disease in the population, our nation handled the COVID-19 situation with great maturity. The first step was to spread awareness without creating chaos. Contact tracing was a major challenge which has been well tackled with a phone app, Aarogya Setu which has now transformed into a national health app allowing citizens access to not only COVID-19 contact tracing, testing, vaccinations, and updates, but also to other digital health services. The application has been downloaded by roughly 217 million users and is a nationally and internationally lauded effort towards the pandemic.

Numerous government and private laboratories were rapidly set up for COVID testing during the pandemic and over approximately 90 Cr samples have been tested till date. All the reports were centralized under the Indian Council of Medical Research (ICMR) to maintain a database to assess disease patterns, contact tracing and patient follow ups.

A National Covid Registry has been established for real-time hospital data. It involves 50 centers under 14 COVID-19 clinical registration sites, which finally fall under the ICMR and Ministry of Health and Family Welfare (MoHFW). The registry aims to collect data regarding clinical and laboratory features, treatments, follow up and outcomes of

hospitalized COVID-19 patients in India. The details recorded by the registry will also aid in studying the natural course of the disease, its spectrum, prognostic factors, outcomes data, medications, health systems and context specific questions such as COVID-19 in tuberculosis, malnutrition.

Anytime a person tests positive for COVID and is assessed to be stable enough for home isolation, home isolation monitoring kits and medications are provided to patients. Regular telephonic follow up and online consultations are given to ensure that any danger sign or symptom is promptly identified, and the patient is advised a hospital visit. Special care is offered to elderly patients or to those who do not have an adequate care giver during isolation.

India also has a very robust and successful vaccination drive and since its inception, approximately 70% of India's population has been fully vaccinated. The vaccination details, certificates and records are stringently and systematically maintained with easy access and user interface for citizens.

Universal healthcare by 2030 is a pivotal commitment for India because it will promise digitized healthcare making it accessible, equitable and affordable.

The principles of the National Health Policy 2017 include universality, citizen-centricity, quality of care and accountability of performance. The core of the policy lies in the paradigm shift towards digital health to realize the dream of Universal healthcare. The National Digital Health Mission (NDHM) now rechristened as the Ayushman Bharat Digital Health Mission (ABDM) was initially launched as a pilot project in 6 union territories in 2020 and then expanded nation-wide in September 2021 focusing on initiatives like Ayushman Bharat Health Account (ABHA) No., Health Facility Registry, ABHA App, Healthcare Professionals Registry and Unified Health Interface (UHI). As of September 2022, an impressive 24 crore plus ABHA numbers have been created with 1,44,371 health facilities and 69,312 health professionals have been registered. The mobile application has been downloaded with over 7 lakh health records. The ABDM uses the approach – "Think Big, Start Small, Scale Fast" and aims to develop the backbone necessary to support the integrated digital health infrastructure of the country.

During the lockdown period, the adoption of virtual health care was accelerated throughout the nation, including teleconsultation, teleradiology, telepathology and e-pharmacy. Since 2010, the telemedicine market size has seen a gradual increase and is expected to grow at a compound annual growth rate (CAGR) of 31% from 2020 to 2025. Over 5 Crore Indians accessed healthcare online in March-May 2020. The national telemedicine service, e-Sanjeevani, completed more than 1,50,000 teleconsultations in August 2020.

A recent effort which is ongoing to enhance accessibility, is a QR Code-based OPD registration service which allows patients to scan QR codes with their mobile phones and register for OPD appointments. It helped over 2200 patients at 2 major government hospitals within 15 days to avoid long queues at the registration counters.

While the numbers look promising, and 24 crore ABHA numbers constitute one-sixth of India's population, a large part of the healthcare value chain remains outside of the ABDM-initiative. According to the National Health Profile 2019, an alarming 65% of rural India still has no internet access and only 65% of primary health centers in rural India have computers. This poses a challenge for the wide spread of the digital mission, but as our nation has proven time and again, no dream is too big to achieve.

The World Health Organization (WHO) defines public health surveillance as, "the continuous, systematic collection, analysis, and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice". Advancements in information technology and information sharing is giving rise to a new field of *infodemiology*. Infodemiology is defined as, "the science of distribution and determinants of information in an electronic medium, specifically the internet, with the ultimate aim to inform public health and public policy". Online surveillance-mapping tools like the Surveillance and Outbreak Response Management and Analysis System (SORMAS), as well as HealthMap, have the potential to improve the early detection of infectious diseases in comparison to traditional epidemiological tools. SORMAS and HealthMap have also been in use for COVID-19 surveillance.

Healthcare systems have experienced a proliferation of innovations aimed at enhancing life expectancy, quality of life, diagnostic and treatment options, as well as the efficiency and cost effectiveness of the healthcare system. Taking inspiration from the National Health Mission, various states have made efforts towards advanced health care. 'Making a Difference: Good Replicable and Innovative Practices' (GRIP) is a compilation of 85 innovations across the states and 8 central government initiatives from different areas of the health systems.

The government of Madhya Pradesh started an integrated referral transport system including mobile medical units and Janani express vehicles which are operated through district level call centers. An Emergency Medical Ambulance Service popularly known as "108 Ambulance Service" has a daunting fleet of 554 Basic Life Support (BLS) ambulances and 50 Advanced Life Support (ALS) ambulances. Supported and deployed by a centralized call center which receives more than 25000 calls per day and handling 1800 emergencies a day. Such a system of organized healthcare transport provision has been monumental in improving outcomes of patients living in remote areas in our developing country.

In Rajashthan, a free supply of generic medicines is given under the Mukhyamantri Nishulk Dava Yojana. Not only does the programme aid less privileged patients in getting access to quality medications but also aids in the strengthening of supply chain management. Right from the procurement of drugs to their distribution to various institutions via District Drug Warehouses (DDW), a complete supply chain tracking mechanism has been deployed using e-Aushadhi which is a software for inventory management. The software covers – online demand, rate contract desk, online PO generation, supplier interface, stock ledger, inter-DDW transfer, lab interface, quality control, supplier performance detail report, NA hit report and expiry drugs detail.

An additional advantage of the e-Aushadhi software, under the Mukhyamantri Nishulk Janch Yojana, is the daily online reporting of investigations and for information to non-reporting institutions via SMS message.

ASHA workers form an essential part of rural healthcare and since they are volunteering for the betterment of their respective villages, it is important to keep their motivation alive. Delays and lack of transparency in payment of ASHA incentives are a deterrent in motivating these activists. In Jharkhand, a fixed day was decided to make payments to ASHA workers through NEFT transfers directly from the block. The key components of this model were to establish a robust system of claim submission, collection, verification, and authentication leading to timely payments under the Public Financial Management System (PFMS). The PFMS system provides both online and offline data entry options for ASHA payment. Another effort directed towards the encouragement of ASHA workers by transparent access for them to incentives is ASHA Soft which is a web-based software which was launched on December 26th 2014.

The state of Gujarat implemented the Mobile Mamta Diwas scheme which was a platform for creating health related awareness targeted for the far-flung and poorly accessible areas of the state. Information generated by the software has influenced policy decisions and nearly 2 lac newborn admissions, discharges, deaths and follow up visits have been captured by the software.

The Mother and Child Tracking System (MTCS) is an initiative of the MoHFW for ensuring delivery of full spectrum of healthcare and immunization services to pregnant women and children up to 5 years of age. It is an innovative, web-based application to facilitate and monitor service delivery as well as to establish a two-way communication between the health service provider and beneficiary. Near real time data uploading ensures real time work plans and goals for ANMs, and timely delivery of services to all pregnant women and children.

When we examine some of these successful technological trends and developments in healthcare in India over the past decade, the accomplishment report card is an impressive one. So too is the roadmap for what lies ahead. Yes, challenges remain, but the elements are in place for an enduring transformation.

On a global scale, health care has witnessed two macro trends driving the change impacting the healthcare industry. The first is the acceleration of healthcare systems to work towards value-based care models. Such models shift the focus away from treatment to

prevention and early intervention. This dynamic can in some ways be a shift from a thing — a product or a pill — to a process for solving health issues. It's less about reacting to disease and more about helping manage the disease, or better yet, developing predictive structures to help optimize wellness and health. The other dramatic shift that's taken place in healthcare is simply physical location, or point-of-care. Digital technology's capability to keep us connected, despite physical distance, has been one of the main stories in the world's response to the COVID-19 pandemic. Digital health enables healthcare providers to engage directly with their patients, regardless of the actual location. Sensors, trackers, remote patient monitoring (RPM) technologies and other elements of digital healthcare make the point-of-care the patient themselves. As such, it simultaneously closes the distance between the patient and healthcare provider while also opening up opportunities for how, when and where these interactions take place. Consideration of both these trends provides a broader framing for more specific insights into the exciting opportunities in healthcare today.

Future concepts now seem very achievable. Artificial Intelligence (AI) on its own one of the most potent accelerators of innovation and emergent capability in healthcare. The analysis provided by AI and machine learning can be purposed to enable a highly personalized healthcare where specific courses of action are recommended or automatically taken based on ongoing monitoring of patient status and compliance with, for instance, a digital twin or via engagement with a digital health monitoring platform. More than three-quarters of digital healthcare solution providers say they are either seriously considering options or already working with advanced technologies for delivering personalized medicine and precision healthcare solutions.

Another opportunity for explosive innovation by healthcare manufacturing companies is through delivery of additive manufacturing — sometimes referred to as 3D printing. In just the last few years, additive manufacturing has become essentially a medical technology, enabling extraordinary benefits within a variety of niches, for example in the orthopedics market. Corrosion-resistant and biocompatible structures 3D printed from both polymers and metals and incorporating complex and precise geometries unattainable by traditional machining and manufacturing process are revolutionizing the work being done with patients suffering orthopedic trauma or other health-compromising conditions. Quick design turns with minimal waste and maximum strength make additive manufacturing printed implants ideal for next-generation applications with capabilities for customization to a patient's specific anatomy.

Modular design architectures addressing the "non-therapy" portion of a medical device may be the optimal approach for minimizing the complexity of regulatory approvals and improving speed to market. In the pharma space, digital technologies can be leveraged to optimize clinical trials performance by improving adherence and compliance to study protocols, and lowering costs, all in support of accelerating the right candidates to market.

A lab-on-a-chip is a miniaturized device that integrates into a single chip one or several analyses, which are usually done in a laboratory; analyses such as DNA sequencing or biochemical detection. Research on lab-on-a-chip focuses on several applications including human diagnostics, DNA analysis and, to a lesser extent, the synthesis of chemicals. The miniaturization of biochemical operations normally handled in a laboratory has numerous advantages such as cost efficiency, parallelization, ergonomics, diagnostic speed and sensitivity. The emergence of the lab-on-a-chip field mainly relies on two core technologies: microfluidics and molecular biology.

The basis of the lab-on-a-chip dream is to integrate onto a single chip thousands of biochemical operations that could be done by splitting a single drop of blood collected from the patient in order to get a precise diagnosis of potential diseases. As we will see, we are currently quite far from this, but current technologies are already able to do several single tests with specialized lab-on-a-chip such as HIV or glucose detection, bringing us closer to the realization of this dream. In the following decades, lab-on-a-chip advancements will change diagnostic practices.

The word "transformation" is often used when describing the impact of digital technologies on the industry. What were once considered barriers are now opportunities? Digital healthcare's progress now tracks an

unmistakably upward sloping trend, but as impressive as that graph is, COVID-19's impact on healthcare delivery and legacy healthcare workflows is to a whole other degree.

The COVID-19 pandemic has catalysed a massive shift toward a more aggressive leverage of digital technologies in healthcare. Telehealth, virtual care and remote patient monitoring are helping to protect people's lives — and for medical staff, their livelihoods. The entire ecosystem is evolving to address limited resources: the people, places and things which make up our healthcare system. Direct access to our physicians and medical centres has changed. We are being triaged and treated differently. If something can be done remotely, or through a sensor with digital connectivity, it's being embraced to deliver us safely, and with more cost efficiency, through the bottlenecks.