



“The Digital Transformation of Healthcare Industry”

Dr. Dayasagar Saloki

Assistant Professor, Department of Management, Government Women's First Grade College, Jewargi Colony, Kalaburagi

Corresponding Author- Dr. Dayasagar Saloki

Email: dayamba@gmail.com

Abstract

The convergence of science and technology in our vibrant digital era has resulted in the growth of innovative digital health devices that allow easy and accurate characterization in health and disease. Information and Communication Technology (ICT) is revolutionizing many sectors but health sector is lagging in adopting ICT. In the manual system, much of the data is difficult to access and is not available in real time. There is lack of coordination between clinical service providers (doctor, nurse, patient and management) and other services such as pharmacy, procurement, laboratory and radiology. Digitization of hospital is vital in providing quality and cost-effective services to patients and improving support services. Although Health IT (HIT) has tremendous potential for improving quality and reducing cost in healthcare, significant challenges need to be overcome to fully realize this potential. In this commentary, we survey the landscape of existing studies on HIT to provide an overview of the current status of HIT research. Health care sector grows tremendously in last few decades. The health care sector has generated huge amounts of data that has huge volume, enormous velocity and vast variety. Also it comes from a variety of new sources as hospitals are now tend to implemented electronic health record (EHR) systems. These sources have strained the existing capabilities of existing conventional relational database management systems. In such scenario, Big data solutions offer to harness these massive, heterogeneous and complex data sets to obtain more meaningful and knowledgeable information. This paper attempts to provide a framework for digitization of hospital operations and services.

Key Words: Big data, Healthcare, digitalization, apps, etc

Introduction

Within these early years of the 21st century, we have witnessed remarkable technological progress with the developments of powerful and portable computing devices. Simultaneously, a global connection resulting from broadband and satellite technologies has resulted in an increasing number of 'connected users' for information sharing. The emergence of new mobile health (mHealth) technologies has resulted from the temporal intersection of several coincidental movements: (i) an urgent need to address the rising burden of chronic diseases; (ii) Moore's law—the exponential increase in computing power resulting in the development of smaller and cheaper mobile electronics; and (iii) shifting healthcare model to an increasingly patient-centric designs. mHealth is defined by the practice of

medicine supported by portable diagnostic devices. Use of these devices at the point-of-care is resulting in a change in the method of healthcare delivery from one that was health-systems generated to one that is remote and patient generated. The culmination of these factors presents unparalleled opportunities to increase patient engagement, to reduce healthcare costs, and to improve outcomes.

To reach the transformative potential of mHealth, a great deal of validation of the technical capabilities and accuracy, as well as the clinical impact of these technologies, is needed before we know they are effective. The real-world practice of medicine is complex and raises important questions on how we can generate clinically meaningful digital health data. Clinicians are beginning to enquire whether more devices necessarily

mean more information and if some information may be redundant or even unnecessary. As mHealth devices become increasingly available, three important questions arise: who should be the first digital health adopter: the patient, the provider, or the healthcare system? What factors of mHealth are most effective? And what is the evidence supporting the clinical utilization of such devices? As we aim to determine the effectiveness of these technologies, what are the outcomes—morbidity and mortality—or are patient-generated outcomes such as quality of life equally important? Are patients prepared to understand mHealth findings particularly elderly patients or those with complex disease states? Do patients modify their behaviour? Will user-generated data lead to patients seeking out therapies for digital data rather than true disease states? We present these questions as they relate across the digital device, the digital patient, and the digital clinic, and discuss the literature evaluating mHealth towards their answers. More Americans than ever before are receiving regular healthcare. But managing this onrush of literally millions of new patients has forced the industry to confront significant challenges. Providers and payers are having to transition to more scalable business models designed to handle higher volumes of consumers. These systems must be designed to help companies mitigate risk and enable new strategies for business and data management. Digital transformation enables the continual build-out and extension of services and data, while coordinating services across the care continuum to support population health. Population health strategies are the ways in which companies achieve positive health outcomes for a group of individuals, including the distribution of these outcomes within the group. Digitization has the potential to affect every aspect of care delivery and operations, enabling smarter choices and better utilization of time and resources and allowing people to spend more time on patient interaction at the point of care.

Information and Communication Technology (ICT) is revolutionizing many sectors but health sector is still lagging behind. Due to shortage of healthcare facilities, people are not able to reach the medical facility in the early stage of disease; also processes in the hospital are more

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complex in nature. In the manual system, much of the data is very difficult to access in real time. There is lack of coordination between doctor, nurse, patient and management. Digitization of hospital is now the buzzword in healthcare sector for providing better, low-cost, and efficient services to patients and other stakeholders. The healthcare market has grown by leaps and bounds to a whopping US\$100 billion and is expected to further grow at an estimated CAGR of 23 percent by 2020 reaching around worth of US\$ 280 billion.

Need for Digitization and Its Advantages

To do the digitization of hospital services and operations, first is a needs assessment and gap analysis of present processes for what is and what needs. How much time the staff, patient and providers take in current system and how much time it saves after digitization needs to be assessed. There is a need for customization and optimization of the digitization process and assessment of how much time it will be required for a functional system to be monitored. Detailed workflow analysis of what needs to be digitized and what are the expected outcomes has to be studied. For operational perspective, what are the processes that need to be digitized, i.e., human resource, finance, hospital services, procurement, logistics, and patient records? We should keep in mind what patient records will be saved/ stored in the hospital and what the patient will have to generate on their visit. For user perspective, what the clinical care providers in the hospital by doctors, nurses, lab reports, what information patient and relative can be accessed, how patient and relatives will be integral part of information sharing during the patient care in the hospital? If there is need for an outside hospital consultant, then what information and how the outside healthcare providers will be integrated with the hospital? Internet of Things (IoT) is going to revolutionize healthcare.⁵ According to the author, technology can reduce errors during delivery of care. IoT can also help the people at their home, in rural and urban areas and extend the scope of healthcare to where the people are. Digitization of hospital services and operations requires involving all stakeholders for their inputs and capacity building of all stakeholders for implementation of digitization. Before

digitization, we would have to decide what quality of care digitization could provide to the current system.

Big Data: Background and its Sources

Big data is a term that is used to describe large volume of data. Data may in form of structured or unstructured. The analytics of Big data leads to any organization towards better decision making and strategic steps. Giant companies in sectors like retail, manufacture and

government agencies are using Big data to meet their business and strategic objectives. The Big data analytics also plays a vital role for small and medium size industries to capitalize their business. Industry analyst Doug Laney originally coined the concept of Big data while referring to the challenge of data management. According to that, there are three important dimensions of the Big data concept illustrated below.

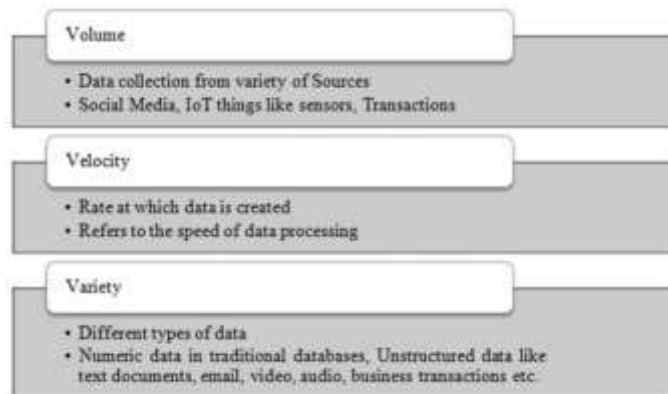


Figure 1. Three Vs of Big Data

Health Care and Big Data

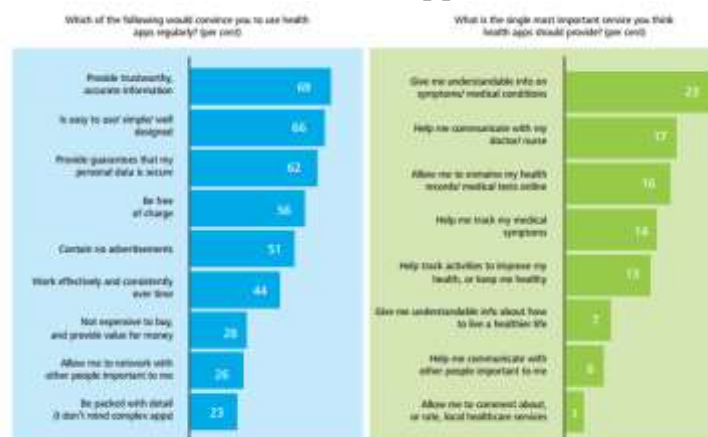
An information and communications technology (ICT) is playing a vital role in improving health care for individuals and communities. It helps to improve health system efficiencies and prevent medical errors. With an invent of new and efficient mechanisms for storing and accessing information, ICT helps to serve a society in a better way. ICT powered health mechanisms are often known as eHealth.

One of the characteristic that health care sector possesses is its data richness. With the development in diagnostic and treatment, health care sector evolved so quickly in last few decades. There are many sources in this sector from where the data is generated. These data is undoubtedly in the

form of Big Data. The data came from many sources and categorized as follows:

1. Web and social media data: Data captured from Facebook, Twitter, LinkedIn, blogs, and the like. It can also include health plan websites, smartphone apps etc.
2. Machine-to-machine (M2M) device generated data: readings from remote sensors, meters, and other devices.
3. Biometric data: Data may in form of retinal scans, x-ray images, finger prints, genetics, handwriting, other medical images, blood pressure and other similar types of data .
4. Human-generated data: In the form of unstructured and semi-structured data. Some of the examples are EMRs, Doctor's notes and paper documents.

What do patients and carers want from health apps?



Information to be Digitized and Its Uses

For effective and real-time monitoring of hospital services and operations, a dashboard should be created according to the roles and responsibilities of different users. Reports in digitized system should be interactive, easy to read, and real time. Who will enter the data and who will access data according to their roles and responsibilities should be clearly defined. Patient prescription and referral system and patient feedback system must be digitized. Patients can give their valuable suggestions to improve the services and quality of operation. Radio-frequency identification (RFID) tag can be used for patient localization, supply chain management, Inventory control, etc. In order to avoid misuse of the digitized system, confidentiality and privacy should be maintained.

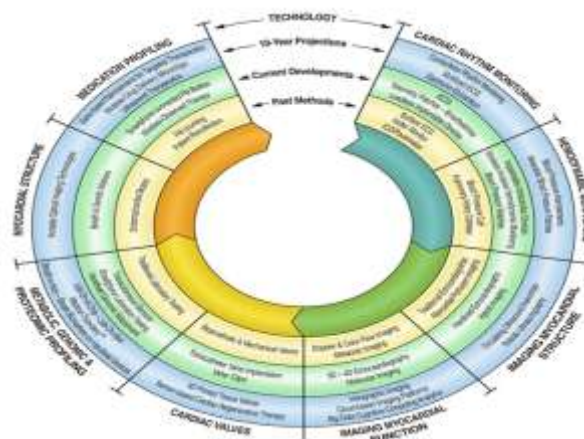
Considerations for Software and Hardware

1. User friendly
2. Open-source software platform for long-term access
3. Standardization and interoperability for different formats and data transfer
4. Internet speed
5. Storage of data internally or cloud based
6. Security

7. Backup and disaster recovery plan
8. IT support
9. Online as well as offline operation
10. Flexibility in data access, reports
11. Helpdesk for IT support

Healthcare's digital future

Within the next decade, we predict the development of new technologies across several areas in diagnostics, imaging, and therapeutics. Similar to clinical practice, the reality of mHealth is becoming increasingly complex. Our analysis of the current state of the field provides three main paths for translating mHealth to the real world: to identify new methods for patient engagement that results in beneficial and measurable behavioural changes, to develop the necessary tools to streamline clinical integration and data analytics, and to outline the regulatory factors that promote the most effective and robust technologies for clinical use. To achieve all three, we are collectively required to create an evidence base that assesses the impact of mHealth on healthcare quality, cost, and outcomes. In doing so, this interplay of digital devices, digital patients, and digital doctors holds exceptional promise for the future developments in medicine.



Conclusion

We may consider Big data as a latest evolution in the field of decision support data management systems. On the other side, the digitalization in health care sector is in peak. As we discussed in the paper, there are several opportunities for Big data in health care sector. Meanwhile, the technological advancement is rapidly going on towards the implementation of Big data analytics. In near future, there will be widespread implementation of big data analytics across the health care organization and the

healthcare industry. The Big data solutions could definitely save millions of life and improve patient services.

Notably, in the projects analysed as well as the existing reports on the digitalisation of healthcare (WHO 2016), little was discussed about how these developments would challenge existing structures, processes or work practices in the organisations that would implement them. As one analysed project sensibly and clearly posited: 'Telemedicine is 'trendy' but it is rarely implemented in practice because it

requires a thorough reorganization of the way doctors and nurses work, both in town and in hospital. The consequences of these changes need to be carefully assessed in terms of feasibility, safety and also from a medical and economic point of view if these new ways of medical practice are to be implemented more broadly. Notably, in the projects analysed as well as the existing reports on the digitalisation of healthcare (WHO 2016), little was discussed about how these developments would challenge existing structures, processes or work practices in the organisations that would implement them. As one analysed project sensibly and clearly posited: ‘Telemedicine is ‘trendy’ but it is rarely implemented in practice because it requires a thorough reorganization of the way doctors and nurses work, both in town and in hospital. The consequences of these changes need to be carefully assessed in terms of feasibility, safety and also from a medical and economic point of view if these new ways of medical practice are to be implemented more broadly. Notably, in the projects analysed as well as the existing reports on the digitalisation of healthcare (WHO 2016), little was discussed about how these developments would challenge existing structures, processes or work practices in the organisations that would implement them. As one analysed project sensibly and clearly posited: ‘Telemedicine is ‘trendy’ but it is rarely implemented in practice because it requires a thorough reorganization of the way doctors and nurses work, both in town and in hospital. The consequences of these changes need to be carefully assessed in terms of feasibility, safety and also from a medical and economic point of view if these new ways of medical practice are to be implemented more broadly. The framework presented in this paper helps us to understand the implication of digitization system and related issues over the manual operation of the hospital. This framework is divided into four parts which is useful to identify the requirements, issues and stakeholders so that correct information will get in right time at right location. In the future, we will investigate the feasibility of framework to digitized the hospital operations and services

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