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Scenario of Analytics in Indian Healthcare

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Abstract: *Information Technology (IT) with its Data Analytics domain has the potential to improve the quality, safety, and efficiency of healthcare in India. Though diffusion of IT in healthcare at present is low, however the long term benefits associated with it are really high. This paper provides a glimpse of healthcare industry in India and the role of IT in healthcare with a focus on analytics. It also highlights how the Government is emphasising on moving towards a digital platform through its Digital India initiative in the healthcare industry. Using this initiative as a first step, how analytics – Descriptive, Prescriptive and Predictive can be implemented to mitigate risks, reduce costs, improve service delivery and reduce inefficiencies. A few case studies of selected healthcare organizations are included here that illustrate how Analytics helped these organizations overcome some common challenges. Each of these success stories indicate how Analytics is directly linked to their outputs thus producing tangible and intangible benefits.*

Keywords: *Data Analytics; Healthcare; Predictive; Prescriptive; Descriptive; Electronic Health Records (EHR)*

I. Introduction to Indian Healthcare

The Healthcare Industry has witnessed to become one of India's largest sectors - both in terms of revenue and employment with an expected growth of USD 280 billion in size by 2020 and a doubled workforce of 7.4 million by 2022 [1].Increasing income levels, ageing population, growing health awareness and changing perception towards preventive healthcare is expected to boost healthcare services demand in future.

The Indian Healthcare Industry comprises of hospitals, pharmaceuticals, diagnostics, telemedicine, medical tourism, health insurance and medical equipment. Among these, the two categories that have huge emerging potential are telemedicine and medical tourism.

Telemedicine is a concept of providing remote healthcare treatment and diagnosis by the use of telecommunication technology. This market is expected to grow from USD 15 million currently to USD 32 million by 2020 [2].The major reason for this growth is the inaccessibility as well as the inadequate infrastructure of healthcare for a large part of rural population of India.

Medical tourism refers to the cross nation people coming over to our country for treatment. Medical tourism is on the rise due to the presence of a well-educated, English-speaking medical staff, as well as state-of-the art private hospitals and diagnostic facilities in Urban India**.** This industry is expected to reach USD 6 billion by 2018, with the number of people arriving in the country for medication set to double by 2021[1]. Other reason being country's history of yoga and alternate medical treatments that are not only cost competitive but also highly effective.

Indian healthcare delivery system majorly constitutes - public and private channels. The Government, i.e. public healthcare system comprises limited secondary and tertiary care institutions in major cities and focuses on providing basic healthcare facilities in the form of primary healthcare centre's (PHCs) in rural areas. The private sector provides majority of secondary, tertiary and quaternary care health center's with a major focus in metros, tier I and tier II cities.

Favorable government policies coupled with new initiatives also helped the industry to attract private equity, venture capitals and foreign players.

II. IT in Healthcare

The Healthcare IT market which was valued at USD 1 billion in 2014 was expected to grow 1.5 times by 2020. The Healthcare software market comprises a meagre 9% of the total Healthcare IT market in the country, however generated a revenue of USD 96.8 million in 2014 and is expected to grow at a CAGR of 11 % by 2019 [3].The healthcare software market can be segmented on the basis of patient centric technologies into the following categories on a broad level-Administration & Management Software, Mobile Apps, Healthcare Platforms, Health & Wellness Analytics and Wearables.

III. Analytics in Healthcare

With the current Government initiatives under the Digital India Programme (DIP) led by the Prime Minister of India, Mr. Narendra Modi – healthcare sector is in the process of undergoing a massive digital make-over. The e-

health initiative under this Programme allows integration of the patient's Electronic Health Records (EHR) in a 'digital locker', backed by Aadhaar which can be maintained over a lifetime and can be shared with doctors of both public and private establishments acting as issuers or requestors.

Figure 1 Ecosystem of DigiLocker [11]

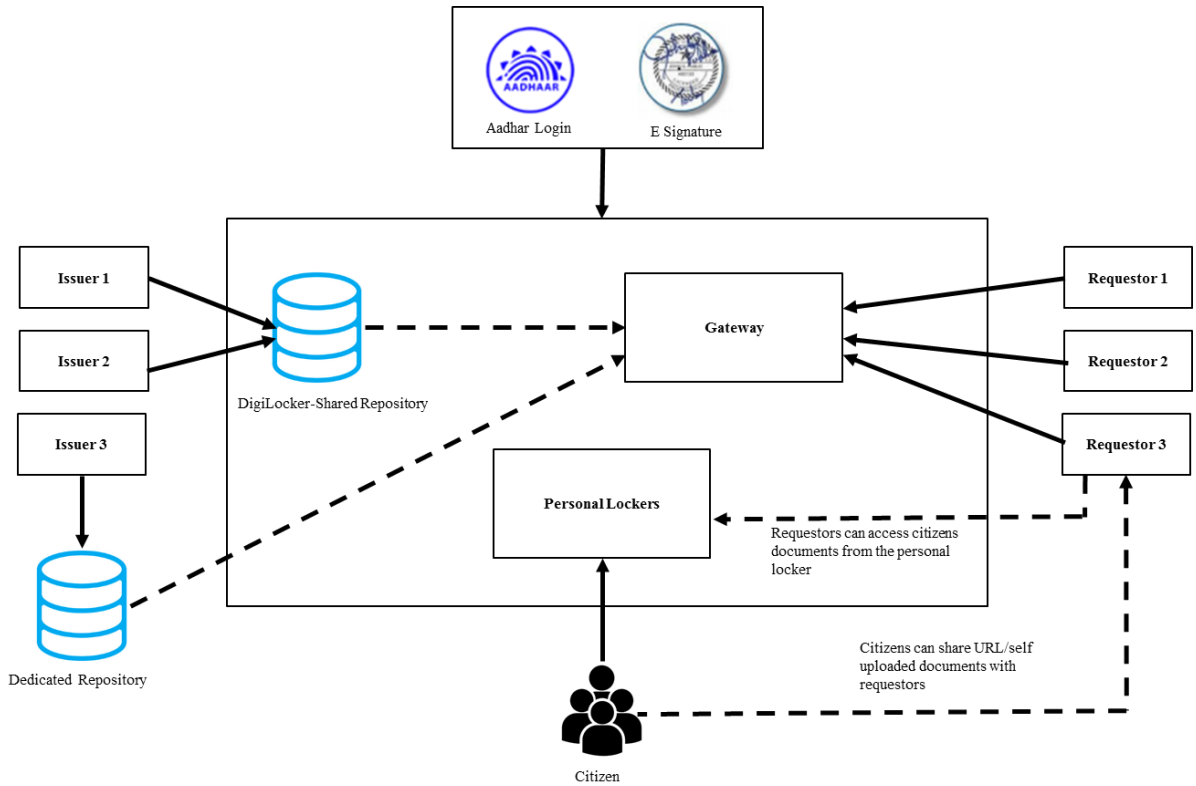


Figure I illustrates the idea of paperless governance by explaining the ecosystem of DigiLocker. DigiLocker serves as a platform for the issuance and verification of documents in a digital manner. Through this platform a dedicated cloud storage space can be accessed by the citizens which is linked to their Aadhaar number (Aadhaar is a 12 digit unique number, issued to the residents of India, by the Unique Identification Authority of India). Organizations that are registered with the Digital Locker can push electronic copies of the documents directly to the citizens Locker. Citizens can also upload scanned copies of their essential documents in the Personal Locker and undergo self-attestation by using the eSign facility.

The issuer in this case can be an e-document issuing authority like the Income Tax Department, Registrar Office while the requester can be Passport Office, University to name a few. This system thereby offers hassle free benefits like authenticity, accessibility and eSign (self-attestation) facility to its users to make maximum use of this service initiated by the Government of India.

Another part of the similar initiative allows patients to book appointments online and thereby to access their lab reports online through an online registration system. This involves a three step process:

- Choosing the concerned Hospital
- Verifying yourself by a Unique Health Identification Number (UHID)/ Hospital Registration Number – This UHID is generated while booking an online appointment at the concerned Hospital
- Viewing the Lab Report

These initiatives backed up by Aadhaar and Patient's UHID, might be integrated in future to facilitate EHR across the Hospitals.

Considering the growth of data from different sources and in different forms, such as: patient care records, prescriptions, diagnostic tests, insurance claims which is either sitting unused or retained mostly for regulatory purposes, limits the scope of utilizing data into actionable insights. In order to convert this structured and unstructured data into useful information, certain logic needs to be applied and this is where analytics comes into play.

Data Analytics is the systematic use of data and other informative business insights developed through applied analytical applications (e.g. statistical, quantitative, predictive, cognitive, other models) to drive fact-based decisions for planning, management, measurement, validation and learning.

Analytics in India was evolved in the late 1990s, however the role though significant has still not been fully utilized in the healthcare domain.

IV. Evolution of Analytics in India

Figure II Evolution of Analytics [9]

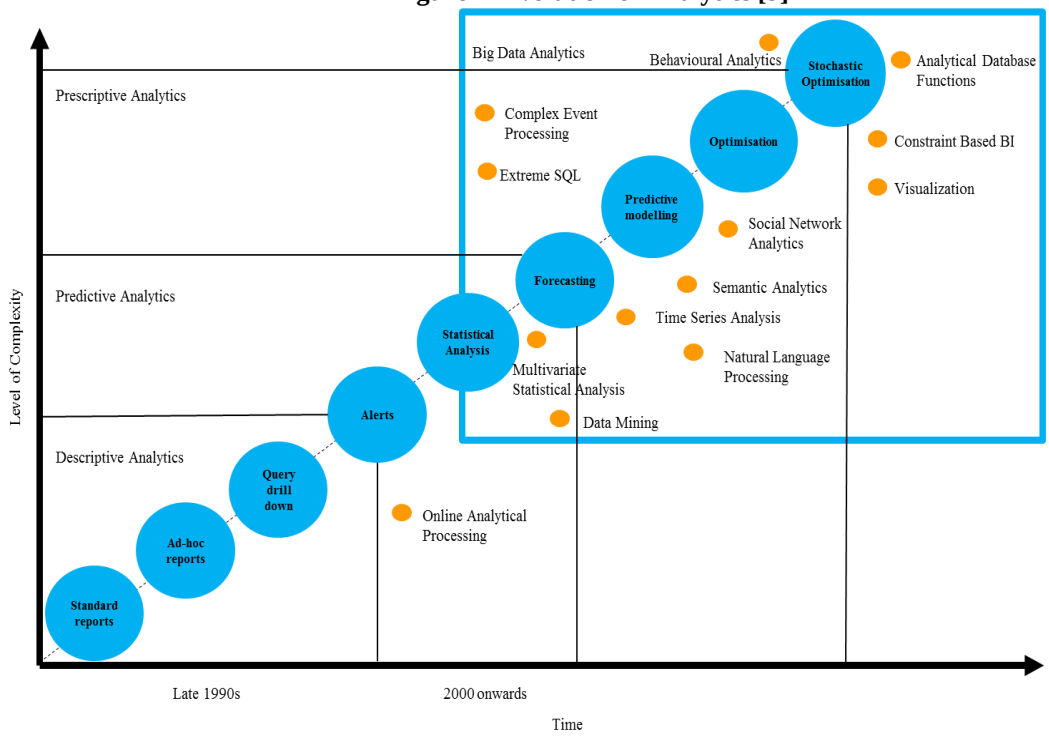


Figure II represents the evolution of Analytics, with Analytics in Healthcare broadly classified into descriptive, predictive and prescriptive. When advanced analytics are applied to big data sets then Big Data Analytics comes into play.

1. **Descriptive Analytics:** Data aggregation and mining techniques are used to throw some light in to the past and reflect "What has happened?". This can help with population health management tasks such as identifying diabetic patients, benchmark outcomes against government expectations, or identify areas for improvement on clinical areas or other aspects of care [4].

   While data analytics and big data are still in the nascent stage of adoption in the healthcare domain, the wheels are definitely turning. Healthcare providers have shifted from the paper documentation prevalent in the Hospitals to the EHRs giving way to data insights (by deploying analytics).This in turn will improve care and lower costs. One such deployment of descriptive analytics at a leading healthcare organization is stated below.

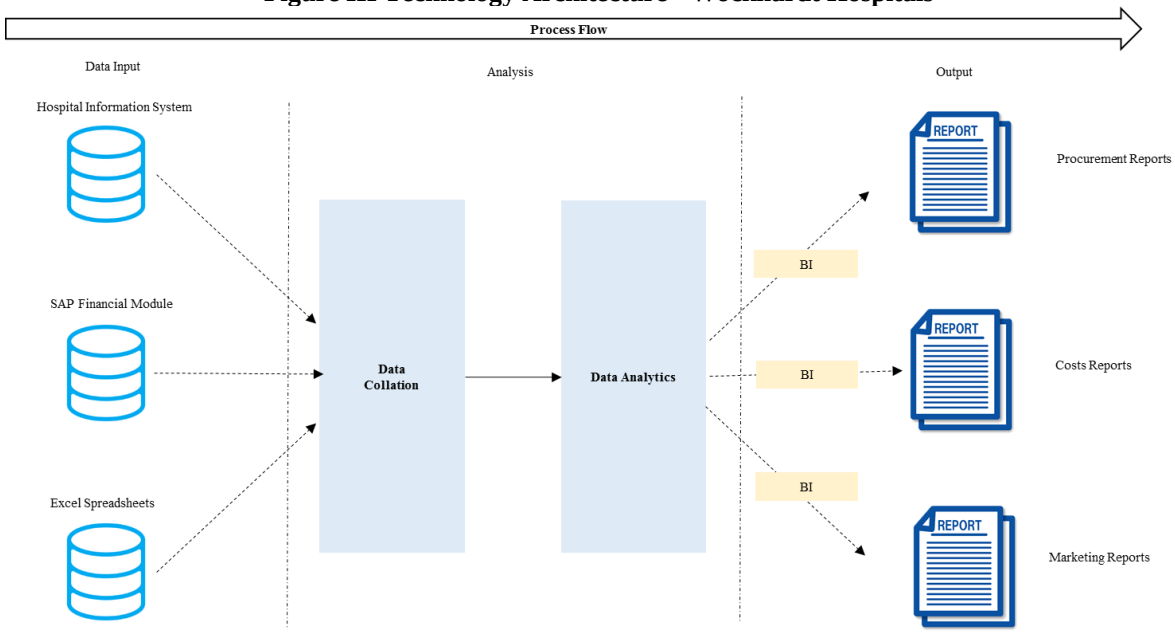
   1.1 Use case:

   1.1.a. User: Wockhardt Hospitals Ltd., Mumbai.

   1.1.b. Business Case: To leverage on additional benefits from the pool of disconnected data available in the Hospital and make more meaningful decisions from the same dataset by culling different viewpoints from it.

   1.1.c. Solution: Wockhardt Hospitals Ltd decided on the company wide adoption of data analytics and hence on-boarded Business Intelligence and Data Analytics Company, Qlik. The Business Intelligence and Analytics company, partnered with Exponentia Data Labs to assess how the data was disconnected and came from diverse sources – 1) the existing Hospital Information System (HIS), 2) SAP financial module and 3) large volumes of data also flowed in from excel spreadsheets.

Figure III Technology Architecture - Wockhardt Hospitals



1.1.d. Result: Post six months since Wockhardt Hospitals Ltd have implemented BI and Analytics solutions, the results were observed across three main areas:

- **Procurement and supply**: Qlik's integrated analytics solutions helped in meeting procurement challenges, improved operational efficiency and reduced costs by ensuring timely procurement
- **Cost of service:** Identified and analyzed the full cost of every service provided by the healthcare company
- **Marketing**: A lot of data is being created around the digital space and analytics offered a holistic view. Allowed to gauge areas that have had maximum impact and where more resources could be required for a better marketing experience

2. **Predictive Analytics:** Predictive analytics uses forecast techniques and statistical methods to search through massive amounts of information, analyzing it to predict outcomes for individual patients and thereby answer "What could happen?". That information can include data from past treatment outcomes as well as the latest medical research published in peer-reviewed journals and databases. [5]

2.1 Use case:

2.1.a. User: L V Prasad Eye Institute, Hyderabad.

2.1.b. Business Case: To predict the final surgical outcome of eye surgery patients and provide insights into how blindness spreads across the country, helping health officials develop strategies to fight the issue.

2.1.c. Solution (to be deployed): Microsoft India and LV Prasad Eye Institute launched Microsoft Intelligent Network for Eye care (MINE) - a global consortium of research and academic institutions (Flaum Eye Institute - University of Rochester, Bascom Palmer - University of Miami, Federal University of Sao Paulo and Brien Holden Vision Institute) will use artificial intelligence to help eliminate avoidable blindness and also to deliver eye care services nationwide. Microsoft will deploy its prime cloud platform technology — Cortana Intelligence Suite - for advanced analytics and to build Artificial Intelligence models on eye care. The Institute will use Azure Machine Learning and Power BI as a predictive model to gather insights on the database created by these research and academic institutions.

2.1.d. Results (to be achieved/expected):

- **Timely prediction of ailment:** This would help to predict regression rates for eye operations, allowing doctors to pinpoint the procedures needed to prevent and treat visual impairments
- **Risk Identification:** Doctors would be able to better understand the risks involved for a patient, which will lead to more effective treatment while reducing costs

3. **Prescriptive Analytics:** Analytics that uses optimization and simulation techniques to advice on possible results and bring forth the answer: "What should we do or how can we make it happen?", so that actions be taken to avoid or mitigate a risk [6].

3.1 Use case:

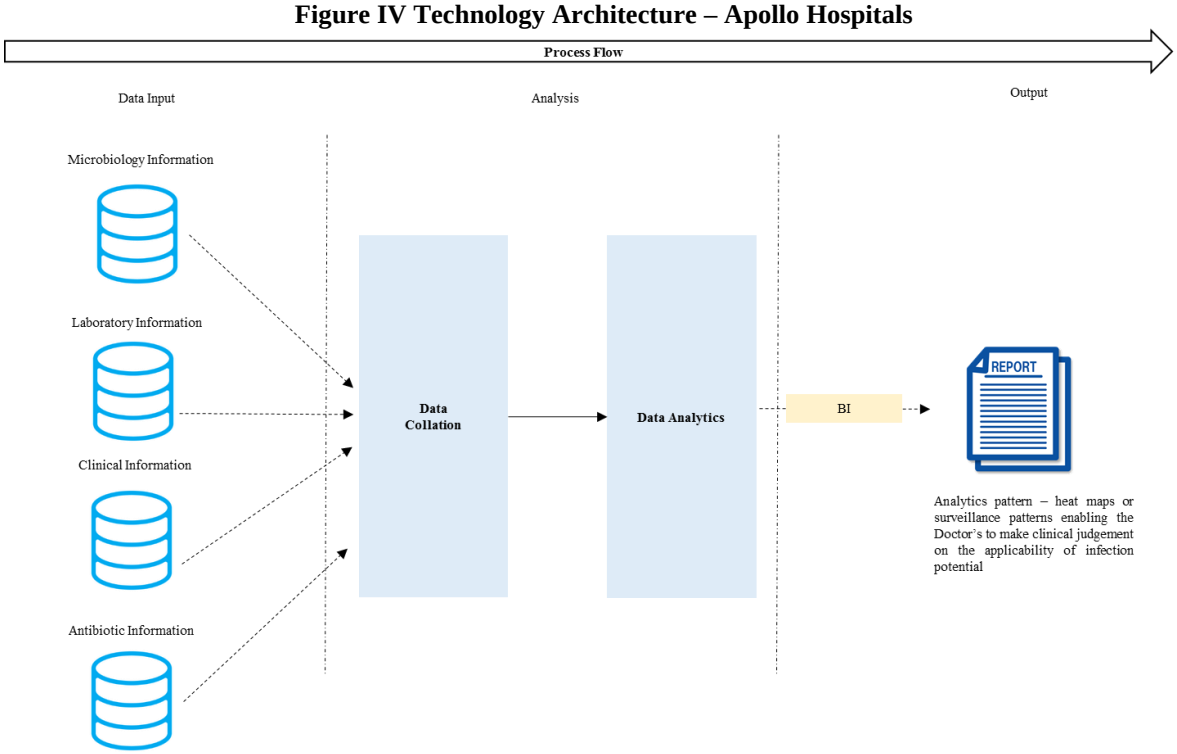
3.1.a. User: Apollo Hospital, Chennai.

3.1.b. Business Case: To immunize the Hospital against Hospital Acquired Infections (HAI). Most of the patients coming to the hospital, have low immunity. HAI is a disease contracted by a patient while under medical care and poses as one of the biggest challenges faced by hospitals, especially in critical care. Once a patient is infected, treatment becomes difficult because infection often mutates in a hospital environment and become multi-drug resistant. HAI directly or indirectly leads to the deterioration of health of a patient requiring him to stay admitted in the hospital and bear financial burden.

3.1.c. Solution: The IT team at the Apollo Hospital seeked technological solution to overcome HAI, by understanding the various infection patterns that affect an inpatient. Since this was a multi-clinical disciplinary activity, such a project entailed the involvement of the microbiologists, lab teams, doctors from various clinical specialties and pharmacologist. Hence, the teams were provisioned with powerful big data analytics to enhance their ability to define both preventive and prescriptive treatment patterns and ensure that the patient's well-being is maintained.

Considering the importance of technology and Analytics, Apollo Hospitals selected the solutions of RxAnalytics. The company supported them to understand the process and the patterns by collaboration of microbiology information, the laboratory information, and the antibiotic information. To ensure a visual usability of the information received, the multi-disciplinary team at Apollo used Office 365 tools inclusive of Power Pivots and Power BI for the graphical features.

Figure IV Technology Architecture – Apollo Hospitals



3.1.d. Result: Apollo Hospitals post adoption of this solution has immensely benefitted across the following parameters:

- **Reduction in Analysis Time:** The HAI analysis which was earlier performed manually took several days and weeks but now this has been reduced to few hours
- **Scalability:** The platform is now available at all big Apollo Hospitals, plan of scaling it to newer specialties is also in the mind-set of the management

- **Standardized Approach:** Adoption of the standardized approach to the entire infection control process keeps the hospital well informed and plan in advance for the infectious disease control. Besides, secondary complications and adverse clinical outcome can be completely reduced.
- **Improved Quality of Healthcare:** The doctor utilizes the information to make better judgements on the treatment of the patient thereby refining the overall healthcare outcome

Lastly, by adopting analytics Apollo Hospital has been able to ensure that HAI can be kept to the minimum level and the length of hospital stay is thereby reduced. This helps reduce the cost to the patient and the entire healthcare process.

V. Conclusion

Analytics in Healthcare in India is still at a very nascent stage, however the application of well-defined and well-integrated analytics throughout the healthcare value chain can be transformative. To bring in this change, efforts and wise usage of the health data is required so that new and ground breaking insights can be generated. Hence, consolidation of the existing data (structured and unstructured) in both public and private healthcare organizations serves to be a great starting point for implementation of analytics in the Indian Healthcare scenario. Though a few players in the private sector have moved a step ahead and adopted analytics over their health records.

The consolidation of data can be further backed by the Government by releasing a mandate for the implementation of EHR practice in all the healthcare centre's (hospitals, clinics, diagnostic labs, pharmacies etc.).Though a step in this regards has already been made by the Ministry of Health and Family Welfare, by revising the EHR standards, 2016.The objective being introduction of a uniform system for creation and maintenance of EHRs by the healthcare providers.

Once the EHRs are being maintained by the healthcare providers, this can further be followed with the adoption of analytics (descriptive, predictive or prescriptive) to tackle the health issues identified.

Needless to say, analytics has a long way to go in the future with the following advantages in its bucket - new treatments and technologies to support healthcare professionals, assist consumers to become more accountable for their own health, mitigate health risks, reduce healthcare costs and predict individuals' future healthcare needs to name a few. However, a few challenges in the roadblock are yet to be overcome such as high cost of analytic solutions, dearth of experienced and skilled professionals and concern about data security and privacy.

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