Introduction to Smart Health Care in the Context of Big Data and AI

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August 16, 2020

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Abstract

Smart healthcare embeds unending amount of data which continuously grows at an alarming rate. The nature of such a data is not only huge but also complex .It takes different formats due to the fact that it comes from multiple diverse sources of the data. Big Data provides a wide spectrum of solutions to such datasets. By doing this it provides more meaningful and knowledgeable information that is well understood and can be implemented. To bring together such implementations and to find the relation among unstructured types of data is a challenging task. This may arise in healthcare immensely due to the fact that a majority of our population is illiterate and superstitious. To add to this there is lack of educated health care providers and infrastructure. Big data is the hope of the new future bringing successful insights from such zeta bytes of data using analytics as perfect solutions to ever increasing problems. This can take care of varied problems such as healthcare cost, patient safety, overtreatment and failure to adopt best practices for healthcare in resource-poor countries. As the population is dense and ever increasing, its need for health care is bound to grow. Health care providers are slowly declining in number and healthcare leaders looking towards advanced software's ie. AI for solutions to improve health service delivery. AI applications have evolved over time and have so far given us excellent solutions in the fields of healthcare and management. While a number of these applications have been used in economically sound countries, they have failed to perform in rural areas. However, a new hope of change is rising and serving health care problems. Many discussions have been conducted to reduce these problems but in vain. Big data systems along with artificial intelligence technology will increase the ability of doctors to analyze critical cases like detection and retraction of tumors and make fast and accurate diagnoses and treatments. Physicians are using alternate procedures to extract tissue samples while decreasing the cost of care giving. Despite many hurdles, AI still holds tremendous power to transform healthcare services in resource-poor settings into a complete smart health care system .A general overview of the way big data and AI can help bring smart health care systems into existence and make it a reality is addressed here. A case study about how handicapped women are neglected by the society and what problems they face in the real world and what statistical techniques can be used to know the numbers of such women and make an effort to provide better treatment to such patients is discussed here.

The main aim behind this case study is to introduce prediction models for Patients like handicapped women with Non Suicidal Self Harm (NSSH) and treating the patient with good diagnostic models for accurate diagnosis and providing cost effective solutions using Machine learning algorithms and AI systems in India. This case study also depicts the impact of resource poorness on the patients and the steps taken to eradicate such practices.

 Key Words: Artificial Intelligence, Big Data, Big data Analytics, Smart Healthcare systems

1. Introduction

1.1 Resource Poor Health care systems – Prevalence and Increasing

The existence of good health systems is of paramount importance to our people in the society today. But the healthcare scenario in the world is based on the demographic location of the people and the type of hospital setups installed in these locations .Irrespective of the architecture of the hospitals, they always deliver high tech medical care in mostly urban regions of the population .On the other hand are the less privileged rural regions where the hands of health care have been so short that it leaves most of the populations unattended and untreated .Despite various efforts made by the governments to establish health sub centers, the government has failed to meet the needs of the people .

The extent and mechanisms through which these barriers affect quality improvement interventions may be different in resource-poor settings [1]. Investments in health systems strengthening without continuous quality improvement are thought to be a useless effort and a waste of expensive resources [2]. Only focusing on quality improvement in a resource-poor context without engaging the broader health system for support is of limited value is of null effect [3]. Hence, tailoring feasible solutions to increase caring of patients and provide faster diagnosis must be the heart of every discussion.

In developing nations like India, an estimated 1,296,667,068 people with diverse cultures exist leading to enormous challenge in improving healthcare delivery system [4]. This brings into sharp focus the WHO theme of 2018, which calls for "Universal Health Coverage-Everyone, Everywhere." But such themes have failed due to new pandemics like corona virus creating more cases and extensive deaths in the whole world and the governments and WHO are failing to provide solutions to such pandemics.

Every year a multitude of immigrant's ie. Both internal and international increase the world's population and with it their needs are also increased bringing in serious public health implications. Such situations need immediate response. WHO Constitution of 1948 gave everyone the right to enjoy good standards of physical and mental health. But till now many refugees and migrants are devoid of proper access to health services as a result they pay out of their pockets for health services[5].

1.2 Challenges in Delivering Health care.

There exist various challenges while delivering healthcare to "everyone" .This list must include socially unaccepted, economically down, and the systemically marginalized people. But what keeps us from reaching the "everywhere," including rural areas. Here are some of the challenges faced:

1. **Awareness or the lack of it**: Illiteracy and superstitions add to lack of awareness in patients. They must ensure to get knowledge about health care facilities. Awareness must be raised among the younger generations to bring social and behavioral changes.

2. **Access or the lack of it**: rural areas must have access to information. Various barriers exist to access services in organizational domains despite being available. One can reach a patient within the physical reach of 5 km in rural areas. There are greater risks of disease, malnourishment, weakness, and premature death [6]. One can never know the quality of care that is provided even though it is available. Many of the primary health centers (PHCs) lack basic infrastructural facilities. Group discus-

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sions on such issues must be raised in social gatherings. Potential barriers must be identified to access healthcare facilities and get feasible solutions.

3. **Absence or the man power crisis in healthcare:** Every health professional wants to get accommodated in urban based corporate hospitals due to which man power is often lacking. Many of them are not trained. Most of the doctors never opt for working in government set ups and rural areas due to which there is lack of doctors attending to the needs of the patients. This brings the private sectors as a major player in healthcare service deliver. Medical insurance for major illnesses at their different coverage levels must be available to patient but still there is a flaw in such cases.

4. **Affordability/cost of healthcare**: The private sector always is leading in providing high quality healthcare. It affects a person who is sick but is scared to show himself in the hospitals because he cannot pay huge sum. The Government expenditure on health must urgently be scaled up, from <2% currently to at least 5%–6% of the gross domestic product in the short term [7]. This will boost health care services in the rural and marginalized areas. National health insurance must include people from all walks of life so they can be benefited.

5. **Accountability or the lack of it**: Being accountable has been defined as the procedures and processes through which a party takes responsibility for its activities and operations [8].

1.3 Smart Health Care - New Technologies Implementation for Resource Poor Health care Systems

Existence of such Health systems gives hope and increase the survival rate of the people. This results in increase in the life expectancy of the population along with feasible state of the art health services. A Constant improvisation and consistency on provision and availability of such health systems is of vital importance in the 21st century. Improvisation of such systems arises from actions that are taken and influenced by various factors. Health care data is voluminous and difficult to process. Healthcare data which is said to be unstructured or semi-structured is prevalent nowadays. The complexity and heterogeneity of such data [9-11] has made it difficult to extract useful information using different data analytical tools and techniques.

Big Data analytics is capable to address such type of data and convert it into a meaningful record of data that is useful for medical personnel to understand. It is also useful for the administrative staff that can use this data for the purpose of providing insurance to the patients in need. Patterns can be identified and improved in healthcare quality to reduce the costs and to enable timely decision-making [12-15]. Big Data technology can rapidly change the way people look and perceive the services provided by healthcare and will be ready to access these services with ease. Hidden knowledge can be uncovered using automated analysis of outcomes from using big data tools and methods [13]. Cloud computing has also been helpful in providing services to store huge volume of data for processing data by health services. Advanced techniques in cloud computing and demand in deployment of EMR's enables easy access to longitudinal patient data [14].

Big data sources have the potential to comprehensively understand the diseases at a considerably faster pace [15, 16]. The ability of Big Data analytics to identify disease heterogeneity makes quick and accurate diagnosis of diseases and assessment of various therapies [3, 17–19]. Big data transforms a continuous real-time data into valuable information for researchers and scientists. This is of major importance in emergency medical situations as it can mean the difference between life and death [10]. Some barriers are depicted in figure 1 below. This diagram shows how factors

such as political factors, demographic and socio-economic factors, and cultural, institution-al and social factors have a direct impact on the system .Simple access to resources promis-es health care facilities but it is not easily available. Quality of healthcare needs to be maintained thus increasing the likelihood of desired health outcomes.

Smart Health care systems are a need of the hour and both AI and Big data that form the new technologies from AI to big data and robotics could significantly improve outcomes for patients across the hospitals. But bringing those technologies into the health service also involves engaging with big tech companies and potentially sharing data about individuals and their conditions, which means that getting patients and doctors on board is one of the biggest challenges.
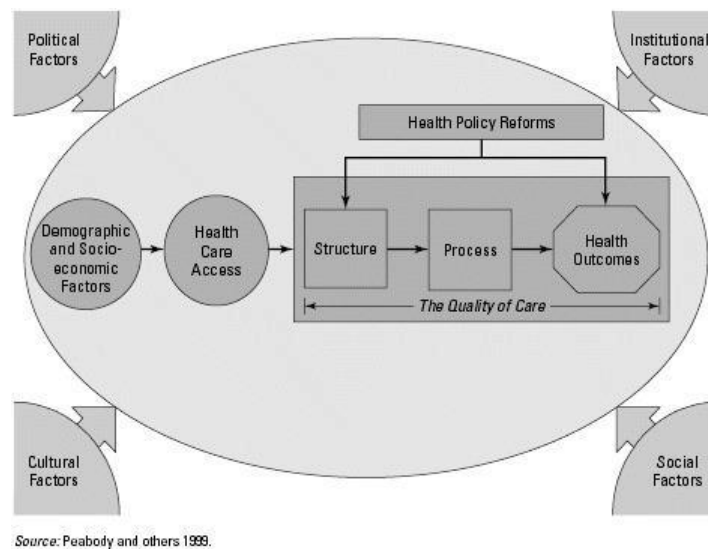

Source: Peabody and others 1999.

Fig 1.Quality-of-Care Framework

Researchers and Scientists across the world are implementing various methods to improve operations of healthcare industry. The process of optimization is helpful to improve care delivery by unlocking the potential of patient data.

2. Introduction to Big Data

Big data embodies operations like organizing, processing, and gathering insights from large datasets to carry on various operations on the data. While problem of working with data prevails, value was given to computing. Big data systems duty is to address voluminous da-ta. Hence, it encapsulates various methods that enable to operate on such data that are dif-ferently structured and stored.

Nature of Big Data

 The Six V's that define the nature of data in the databases are defined below:

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1. **Volume**: huge volumes of data produced from different sources. For eg. Most of the data is generated by humans through emails and messages.

2. **Velocity**: The speed of data flowing through networks and analysis of such data .

3. **Variety**: Diversity in data and its complex structure coming from different sources including data coming from geospatial and social media. Such variety of data is considered as the biggest of concern searching for solutions.

4. **Veracity**: There is very little security in ensuring the reliability and validity of data. This security can be guaranteed.

5. **Vulnerability**: Data like medical files are exposed for security issues and might also give access to hackers to make unauthorized use of that data.

6. **Value**: Data does not have any value when it is static but rather acquires value when extracted and used for a defined purpose.

The usage of the 6 V's in terms of medical applications using big healthcare data is as shown in the figure 2 below:
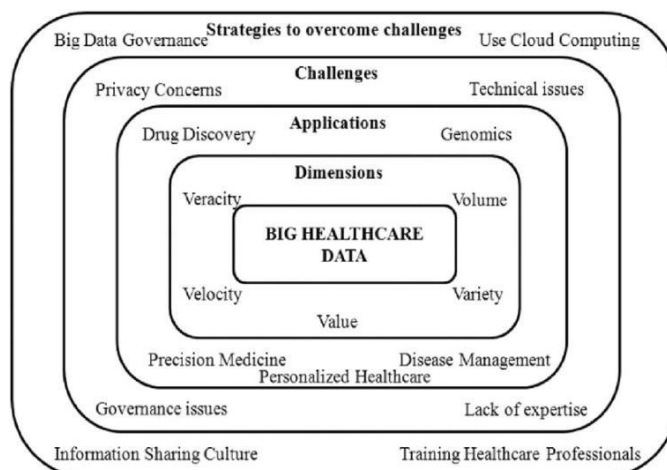

Figure 2: Big Data Framework using 6v's in medical Applications

Source: International journal of medical Informatics, Nishitha Mehta et. al.

2.1 Big data Framework in Resource Poor Healthcare

The Figure 2 summarizes various applications used in healthcare. This diagram clearly depicts identification of key elements that are interrelated in order to gain datasets from various fields so that compact solutions can be designed to solve major problems .This framework also covers both technical and non technical elements ie. IT, medical, legal and organizational issues.

2.1.1 Big Data in Healthcare-Definition

In healthcare, "Big Data includes heterogeneous, multi-spectral, incomplete and imprecise observations (e.g., diagnosis, demographics, treatment, prevention of disease, illness, injury, and physical and mental impairments) derived from different sources using incongruent sampling" [20]. Implementations can be depicted in the figure 3 as shown below:
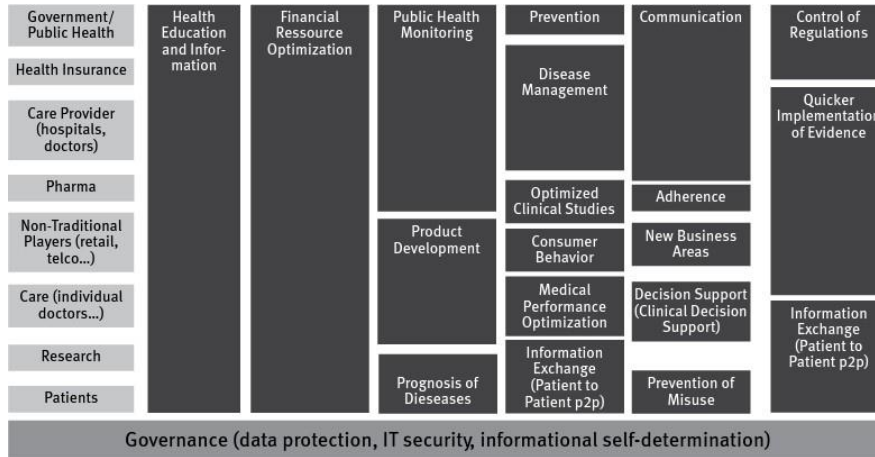

Fig 3: Big Data Components In Healthcare System

Source : Authors illustration

Explanation of the areas is as explained below:

1. **Information Governance:** talks about organizational and legal conditions– individual company or institution. Research data is also collected from different sources and processed.

2. **Health Education and Information generated** : It helps compiling and upgrading of data for different participants such as redesign of disease management programs

3. **The analysis of the inputs:** resources can be controlled and medical quality can be improved. Prediction of diseases using health analytics approach can also be implemented.

4. **Data integration and analysis:** enables prevention of threats like pandemics. It also handles the way to respond to such threats. Clinical trials can bring new fields of study and provide solutions to doctors and other staff and help them train themselves.

5. **Exchange of information from patient to patient:** patients can talk to one another who have similar symptoms and diagnosis .

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6. **Communication:** implementation of solutions to healthcare services.

7. **Adherence**: the intake of medications and maintaining of patient life style as per doctors suggestion.

2.2 Time for Big Data speed up

With the occurrence of new pandemics and the increase in the patient data and the cases, it has become very important to track various methods that can help us predict the disease and provide quick diagnosis to the patient's .Big data has to go beyond to provide such tools and softwares that will accomplish such tasks faster than ever before. It is time for the big data to take a leap forward and provide faster solutions to problems faced by many doctors. The following figure 3 given describes the potential of big data and explains how it needs to find solutions to medical problems with respect to time.
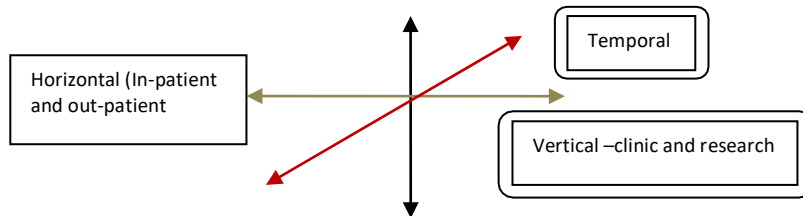

Fig 3: Time perspective

1. **Vertical: Clinic – Research:** Different databases can be integrated to find better connections with various domains in an organization.
2. **Horizontal**: Treatment of patients along with their data involving outpatient, in-patient and rehabilitative treatment.
3. **Temporal:** monitors business works. It converts the questions starting at "what happens" to "why something happens", helping in the prediction process done by tools of Big Data. This can be achieved by asking questions such as "What will happen?", "what risk profiles are there?" and "how does this permit earlier pre-ventive intervention".

3. Importance Of Big data Analytics implementation in Resource Poor Health care :

Big Data tools can check availability of resources more at the urban level rather than rural areas. People in rural areas are devoid of quality treatment and even if they need to get one they can't afford. This hinders a patient coming from rural areas from taking quality treat-ments from the corporate hospitals .With the advent of COVID-19, it poses threat to the whole world with no vaccinations available and lack of treatment methods.

As intensity of type of epidemics increases both rural and urban population are equally ef-fected. Diseases like corona can be handled through statistical prediction methods in terms of tracking the person sitting next to you to find out if he has the disease and taking measures to prevent such diseases from contracting .Various online Apps are into the mar-ket that are providing such services. This patient data can also help them to get the neces-sary insurance from the insurance companies if the patient is showing signs of this disease. But the real question is how to gather such huge information which is confidential .With

today's ever-improving technologies collecting such data is easy to gather. Using data-driven methods, it is easy to predict diseases and their treatments using big data analytical tools and machine learning algorithms. Tools like SaaS BI can be used for this purpose.

3.1 Big data Analytical tools for smart health care

Big Data analytical tools are well defined in table 1 below. These can be used very effectively in health care applications.

Table 1: Summary on the applications and methodologies

Application	Methodology
Prediction of inpatient violence incidents	Recurrent neural network; convolutional neural network; neural network; Naïve Bayes; support vector machine; decision tree
Prediction of type 2 diabetes and hypertension	density-based spatial clustering; synthetic minority over-sampling
Prediction of biochemical recurrences in patients treated by stereotactic body radiation therapy	prostate clinical outlook
Forecast of tuberculosis prevalence rate	Kruskal–Wallist test; regression model; Cuckoo search optimization algorithm; radial basis function neural networks
Investigation of the association between policy factors and healthcare system efficiency	Tobit model
Improvement on software reuse in smart healthcare	Systematic analysis
Investigation of the relationship between continuity of care in the multidisciplinary treatment of patients with diabetes and their clinical results	Statistical analysis
Optic disk localization	Statistical edge detection; circular hough transform
Classification of lung cancers	Deep convolutional neural network; support vector machine
Probability analysis of hypertension-related symptoms	XGBoost; clustering algorithm
Skin aging estimation	Scale-invariant feature transform; color histogram intersection; polynomial regression; support vector regression
Minimizing the number of physicians and nurses	Discrete event simulations
Classification of organ inflammation	Genetic algorithm; support vector machine

3.2 Challenges

1. Unauthorized use of data.
2. Lack of appropriate IT infrastructure.
3. Data processing in records instead of paper based..
4. Resistance to redesigning methods.
5. Huge finance requirement for usage of Big Data technology.
6. Lack of Knowledge for best tools.
7. Untrained doctors and medical personnel.
8. Patient privacy and confidentiality is attacked.

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Strategies to overcome the challenges

1. Implementing data governance at organization level.
2. Information sharing culture should be encouraged for predictive capabilities.
3. Checking the correctness of data security and continued confidentiality.
4. Medical personnel should be trained to implement Big Data tools.
5. Cloud computing tools should be integrated into organizations.

4. Big Data Adoption Model in Resource Poor Healthcare

The basic methodology that can be implemented on the addressing the problems faced in resource poor health care settings is first trying to know the key parameters that are required to know what problems arise in such systems. The first step is Collection of Data: Once the data is collected the next to be done is Sharing of Data: showing the possibility of sharing data among within or outside such systems .For this to happen once must be aware of the standards under which sharing of data is allowed. The third step is performing analytics on data to know where data is. It also helps us to know what is the percentage of medical employees that are available and to what extent they can help the patients? .We need to also find out whether resources are made available and if so then to what extent they are used . Once these questions are answered then the next thing is to decide which algorithms and modeling of data is required that can solve such problems.

Check lists of the data that needs to be gathered with respect to the hospitals or the clinics that are available in the rural areas are listed below as follows:

1. Hospitals /clinics present in the area or in the village?
2. Are the hospitals providing medical assistance to the patients?
3. Hospitals are ready to accept technology at the rural level?
4. Medical personnel are present in the hospital / clinic in the rural area?
5. How many Of them are available?

Researchers and scientists around the world agree that the main issue is not the availability of technology, but the presence of people/staff that are well trained to deal with healthcare in such resource poor settings.

4.1 Hurdles to Big data in Smart Healthcare

There are a few hurdles to implementing Big data in healthcare systems .Some of them are spread of data that are managed by organizations and managements. Using new online reporting software is important by collaborating with business intelligence strategy which can be accepted by people in the rural areas. Medical personnel must be trained to use these tools to gather information. Healthcare can opt regression-based methods using predictive analytics and machine learning to submit better outcomes.

4.2 Improving Quality in Healthcare Systems

Healthcare can be improved by implementing the following:

a) **Designing of a robust System with improved thought process**

In an environment that is dynamic and complex one needs to consider relationship between patients, clinical and non-clinical workers and to know the levels in the health system from tertiary to referral ones. We must also note down the resources availability that include medical personnel, training, supervisors and management trainees.

b) Participation of Medical Personnel in health systems

This involves understanding of health systems by doctors and other health care professionals, patients, researchers. Participation in such systems increases quality improvement efforts and enhances trials for improved services.

c) Accountability of organizations to the people

People involved in improving health systems such as government agencies should be accountable for treatments given to patients.

d) Validation –improving quality of care

Validation on how the quality of healthcare has improved where there is lack of resources.

e) Innovation on designs

As a part of research strategy determine quality improvement and in what circumstances they work in is studied in detail. Various research strategies in this are identified and applied. New softwares and technologies are to be introduced and medical personnel trained.

4.3 Applications

1) Predicting Existence Of Staffing when required

Predictions are made using big data analytic tools of the number of patients that are expected to arrive at each hospital. These tools help the doctors also to know the number of patients that are to arrive at the hospital at a certain period of time and day.

2) Electronic Health Records (EHRs): This is a very famous tool which has been used by most of the patients to know information like medical records, history of diagnosis, laboratory test results etc. This information can be shared via. Secure, authorized information systems with complete security in terms of data. Doctors can diagnose based on this information. It can also trigger warnings to the patient in critical conditions.

3) Alerting System

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Clinical Decision Support (CDS) provides doctors the advice on decision making to prescribe medications. It also helps doctors improve and modify delivery strategies.

4) Engaging smart devices

Patients are showing lot of interest in using smart devices that help to record daily routines. Potential health risks can be tracked and stored and the patient can directly monitor his health.

5) Preventing the use of Spurious Drugs : Scientists are working with fuzzy logic and analytics to identify risk factors of patients taking drugs or narcotics with accurate results .

6) Strategic Planning using Health data: Analysis of checkups in different demographic groups and finding out what makes patients to avoid medications.

7) Cancer Cure: Big data has made a big leap in curing cancer .Researchers take huge databases of patients suffering with cancer and analyze how different patients with cancer react with different treatments. They and also find ways to achieve better patient outcomes. But this gives rise to Incompatible data systems and patient data confidentiality

8) Predictive Analytics In Diagnosis of Patients: doctors can make decisions that are data driven at a much faster pace to provide diagnosis to patients. This is practical in chronic cases and emergency cases.

9) Reduce Fraud And Enhance Security: Patient databases are extremely valuable and profitable to most of the markets and security threats are immense in this field .Cyber attacks are frequent and must be stopped at any cost to improve confidentiality. The existence of firewall and anti-virus softwares provide more security in such cases.

10) Telemedicine: With the arrival of smart phones and wireless devices, it is easy to access doctors through telemedicine. Doctors can not only treat and diagnose the patients but also perform surgeries using robots and high speed real time data delivery to the same location where the patient is. This also helps in preventing hospitalization or re-admission of the patients .This reduces costs and improves the quality of the treatment**.**

11) Medical Imaging using Big Data : Lakhs of medical images can be read by analyzing specific patterns in those images which could help doctors diagnose the patient .Radiologists use such tools to make medical image look more clearer and specific .

12) Prevent unnecessary ER visits: A patient should be avoided from referring to different health clinics at the same time for the different diseases he or she carries which would end them in not obtaining proper treatment anywhere .This wastes not only money but also time and effort of the patient .Another major issue is if the medical tests have already been done in the previous hospital then the same tests need not be repeated if they approach another health clinic. A record of the earlier tests must be maintained and accepted to avoid wasting money and putting the patient through pain repeating the same tests again.

5. AI systems and its implementations in Smart Health care

5.1 Introduction

AI systems have engulfed majority of the population with their operations that has made everyone's life go easy and comfortable. There is no human that can survive longer without the help of AI systems. AI has penetrated into every area of our life and has successfully helped in running our everyday routines. Driverless cars and 'companion' robots caring for the elderly, handicapped and lonely people are already into the markets serving mankind. Machines can read retinal scans. In the field of medicine, medical care is best done when the doctors can feel the patients by physical examination and sensing the state of mind of the patients, their emotions and situations they are in. In terms of understanding and responding to human emotions many robots have failed to do so. It surely has the potential to replace doctors and nurses in providing comfort to the patients in need.

5.1.1 Definition of an AI system: Machines that represent the human mind to do intellectual task termed artificial intelligence.

5.2 Smart AI healthcare systems

Integrating AI into their healthcare is done by introducing various AI related tools. An analysis done on USA healthcare found that approximately $150 billion healthcare costs will be saved annually by 2026. Extensive opportunities have been created to improve the life of a human. The various applications that are used in Smart Health care Systems are listed in the table 2 below.

Table 2: Applications of AI healthcare

S No.	Applications	Usage
1	mHealth	Patients get information regarding their heath such as heart beat, pulse rate, weight and height of the person ,Body mass index etc.
2	Health informatics	Acquisition, storage and retrieval of healthcare information.
3	OpenMRS	It is an EMR platform to implement EMR system called Bora that helps improve mother and child health and HIV treatment in rural areas. It is used in 15 African countries.
4	DHIS2	is used for collection and validation of patient data apart from analyzing and presenting patient-based statistical data.
5	Cloud computing	A network of remote servers used to store, manage, access and process different data and to improve interactive voice response .
6	Mobile phones	Community Health Workers (CHWs) use mobiles to improve the provision of health services in the form of SMS to address barriers to vaccination and im-

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		prove immunization coverage. It has been thoroughly documented in countries like Kenya and the USA
7	Signal processing along with machine learning	prediction of birth asphyxia in new born

'Artificial Neural Networks' can be used for classification of patient records and to provide accurate information to scientists and researchers. Images of patients can be identified and the whole medical history of the patient can be displayed on the screen with the click of a button. The various types of diseases that are identified by AI are as shown in Figure 4.
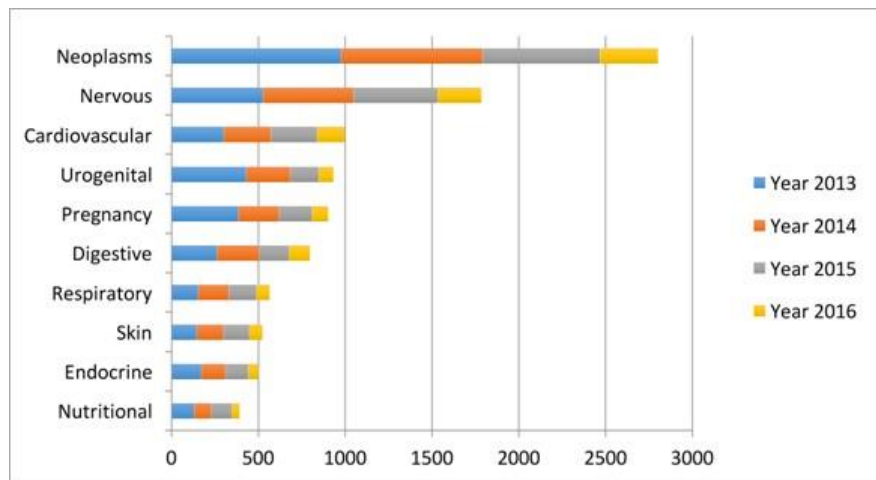

Fig 4: AI considered disease types according to (AI) literature.

Courtesy : AI literature on PubMed

Handling of Under-burdened and overburdened staff: Most of the rural areas and re-source poor countries continuously face lack of medical personnel and there is over burden of work on already available staff. To add to this most of the hospitals suffer from poor infrastructure. Automation of staff and their work routines can reduce the burden on the staff .Due to this senior staff can attend to critical cases and emergency cases.

Immunization using Machine Learning: It can help improve Immunization drives, supply chain for medicines, and referral services. The upper gastrointestinal cancers can be detect-ed at an early stage and treated without any expensive equipment.

All –in- one Diagnostic Station: WeDoctor uploads data automatically for online consultation and applications like AI-driven smart clinics help treat poor in rural areas.

5.2.1 Types of AI used in Smart Health care Systems

AI is of two types .The first one is **Artificial general intelligence** focuses on early AI research and representation of AI. **Artificial narrow intelligence**: A machine performs a **single task**. Health applications fall under artificial narrow intelligence.

5.2.2 AI devices

AI devices mainly fall into two major categories. The first category includes machine learning (ML) techniques that analyses structured data such as imaging, genetic and EP data. ML attempts to cluster patient's traits, or infer the probability of the disease outcomes. (NLP) is the second method that extracts unstructured data from medical records. It turns texts to machine-readable data and analyzed by ML techniques [21].

5.2.3 Areas of AI

1. Expert System: It is used to solve specific real time problems.

2. Fuzzy logic: The development of fuzzy logic is based on probability and uncertainty and can be very useful in applications such finding out the probability of patients who are going to need hospital admissions and patient inflows. Decision support applications with fuzzy logic can help better approximate the approach of human towards complex problems with uncertainty. This can include even providing smart health care to patients in need .They help predict pandemic outbreaks. For example, predictions of cholera outbreaks, predict birth asphyxia.

3. Machine learning: Machine learning is a method that identifies patterns in data and learn from the changes made to them. Patterns that are preexisting are found in data. Machine learning is gives good results in terms of patient diagnosis and patient-in and patient-out prediction, transmission of vector-borne tropical diseases based on weather and land-use patterns.

4.Natural language processing (NLP): helps identify key words and phrases .Handwritten texts can be interpreted by the algorithms and given to the machines to be used as medical data. Global Health Monitor detects and maps infectious disease outbreaks. NLP is also being used to analyze EMR's to support clinical decision making. The journey of converting clinical data into Natural language is as shown in figure 5 below.

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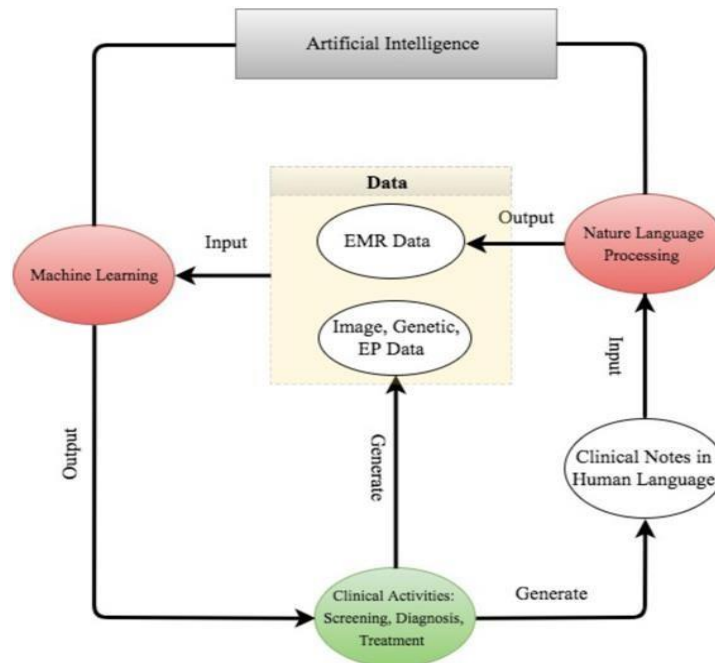Hyderabad, India

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Fig 5: The road map from clinical data generation to natural language processing .

5.3 The AI obstacles

AI systems lack proper standards to assess the safety of AI systems. Data exchange is very expensive and also involved the consent of the patients. Reimbursement of medical bills for treatment procedure and surgeries is also not provided by insurance companies. Some other obstacles are listed as below.

1. Patient Data is Unstructured: patient data is not organized or stored in a consistent manner but is scattered into different files. Most of the patient data is handwritten in local languages and poorly presented.

2. Internet Issues: Rural areas have no access to internet signals due to which they cant access smart healthcare services. Local governments must provide solutions so that it helps them access the resources.

3. Shortage of Trained medical Professionals: There is an extensive demand for medical professionals who are trained software tools .Medical personnel must receive training in these areas.

4. Providing Speedy Diagnosis: predictive analytics provides solutions for digitization of patient data, skill enhancement of health care workers, and re-deployment of resources.

6. Use Cases

6.1 Handicapped NSSH (Non-Suicidal Self Harm) Cases- Prediction and Evaluation

  Self -harm in India in handicapped females has increased over the years and is continuing to exist in both rural and urban areas of Telangana state. In spite of various efforts of the government to bring education to the rural areas it is still prevailing due to the social conditions in which the handicapped women are brought up and raised. Various hindrances such as social, economical, physical and psychological have lead women to take such a drastic step into doing self harm behind the closed doors of India. The problem of dowry system still prevails in India which has leaded the women of these regions to take a drastic step to end their lives because of the pressures laid by the in-laws. Most of the patients who self harm keep themselves away from hospitals due to fear ,shyness, lack of confidence and lack of sense of taking proper rational decisions .They are also scared that they will come under the attention of their peers if they do so. Self harm may arise due to several reasons apart from what is mentioned above ie .Rejection by family, friends, parents, unexplained diseases which causes them to feel uncomfortable to go to a doctor .So the only solution is they would keep it to themselves rather than share it with others.

An attempt is made to bring to light the statistics of how many handicapped women are facing this problem in the three regions of the state of Telangana ie. Bhadradri, Adilabad and Hyderabad. Datasets from the government of telangana was gathered from *http://www.data.telangana.gov.in/search/type/dataset* regarding the total population of women in telangana till 2017 in the regions of Adilabad, Bhadradri and Hyderabad .The data is separately collected consisting of handicapped women in these regions with a total of (n = 3459) (including both rural and urban) for the year 2018 and 2019. The rate of increase of such cases is studied in 2018 and 2019 combined. Random probability sampling is used on the population in households of Telangana. Prediction process involves collecting the sample data such as selection of addresses from postal codes address files which covered 97% of households. Data was also collected from working women's hostels ,mental asylums, orphanages and old age homes .Field work took place from January 2018 to September 2019 .We visited households having patients aged 16 years and above. Face to Face questioning was done by the interviewers by asking them questions .Some questions like experience of abuse, diseases that they were diagnosed and the feelings that they carried while taking a suicidal step were filled by the participant's .All their responses were recorded into a database for security reasons and privacy of information. Sample data was also collected from married and unmarried women who were affected by their family environments such as physical abuse or mental trauma received from their family members or their in laws and husbands. In our analysis we divided the participants into 5 groups ie : (16-24),(25-35),(36- 40),(40-55),(56-80).

6.2 Statistical Analysis

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R-Programming on Excel sheet was used as a statistical tool to perform analysis and is implemented on the datasets gathered .Multi-variable Regression is used for the analysis of the data. T-test is used to acquire confidence interval values for the independent age groups and values were independently acquired from respective regions of Telangana ie. Adilabad, Bhadhadri and Hyderabad. Analysis of parameters needed for prediction of appointment with doctors for NSSH (Non-suicidal self harm) patients was acquired in these three regions .Unadjusted odd ratios were calculated for service contact .Two models were taken into consideration. The first is the adjusted model which included District, Rural population%, Urban Population %, age groups (16-24),(25-35),(36-40),(40-55),(56-80), total disable people, unexplained feelings independently for the three regions .Participants were analyzed to known if self harm was attempted and if they tried to commit suicide and if so whether they visited a doctor for their respective problems .Missing data and data not reported was excluded from the analysis .

6.3 Results

The data for (n=3459) is analyzed for handicapped women participants in the age groups between (16-24),(25-35),(36-40),(40-55),(56-80) years of age in Telangana in Adilabad ,Bhadradri and Hyderabad for the year 2018-2019. The data is tabulated in the table 3 given below. It shows the overall prevalence of Disability in Handicapped women 2018-2019 (both physical and mental disability) in all three regions ie**.** Adilabad, Bhadradri and Hyderabad. Overall prevalence of disability in Telangana State estimated at 5.1% (121-263 95% CI), which does not vary significantly for females. Reported Limitations increases strongly with age from 11.5% to 18.4% for adults with 50+ age. Overall prevalence of clinical impairments and/or disabling health conditions in Telangana State estimated at 10.1% (95% CI (23.1-34.4) and reduces a bit at 9.4% of adults of 50+ age group .Most of the missing data were a result of the participants who did not provide information in both 2018 and 2019.These Participants were not necessarily old people but also included young participants who avoided answering to the questions possibly because it left a bad impact on their lives on which they did not feel to reflect back to answer to us.

Table 3: Overall prevalence of disability in handicapped women 2018-2019 (both physical and mental disability) of all three regions together

Description	n=3459		16-24 years		25-35 years		36-40 years		50+years	
	n	(95%) CI	n	(95%) CI	n	(95%) CI	n	(95%) CI	n	(95%) CI
Disability (physical and mental)	2542	5.1(121-263)	172	1.198 (25-44)	656	1.63 (17-36)	415	0.75 (14-31)	347	2.5 (11-27)
Self- Report ed Limitation s	285	8.1(4.4-12.9)	78	11.5 (4.4-12.9)	60	16.4 (3.4-9.9)	37	26.4 (1.8-6.3)	35	18.4 (0.6-7.1)
Modera te/severe impair- ment/ health condition	986	10.1 (23.1-34.4)	22	1.9 (16-29)	178	5.9(11-20)	227	4.9(9.4 -21.7)	247	9.4 (7.1-15.5)

The lifetime prevalence of NSSH rose from (5.1 % CI) to10.1% CI) in during the peri- od of 2018-2019).The overall prevalence of reported NSSH (at- tempted suicide) and self harm in terms of p value is as shown in table 2. It shows a rise in the self harm by p value of 1.531 in rural areas by using t-test than a low p value of 0.08232 (94-135% CI) in Urban areas where as the confidence interval in rural areas is 8.4054(61.0-83.9%CI) in Rural areas as opposed to 1.7976 (16-38 % CI) in urban areas. By using the chi-square test, the total confidence interval in urban areas is 42.43 as opposed to 0.1209 in both rural and urban areas combined. The self harm in rural areas using t-test has risen from 10.513 (44.7-56.2% CI) (attempted suicide) in rural areas to 15.044 (8.8-12% CI) in self harm. When linear regression is applied to the dataset then the overall re- ported NSSH with 95% CI is 1.931(urban) as compared to 0.999(rural areas)

.Whereas with 95% CI the attempted suicide cases in rural areas are 1.00(rural) as com- pared to 1.0375 (urban) areas. Self harm value has decreased to 0.5892 in both rural and urban combined together.

According to table 4, it shows the total number of people in the region of Adilabad that are affected and the number of people who self harm and attempt suicides. The highest rate of self harm is in the age groups of 16-24 and least in the ages <18.

Table 4: Overall estimate of the p values obtained using various methods of testing with 95% confidence interval for all three regions of Telangana combined statistics

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n = 3459 (2018-2019)				
Methods	Overall n(%)	Reported NSSH (95 % CI) Attempted Suicide	p-value	Self harm (95 % CI) Both Rural and Urban
T-Test Rural	88.4054(61.0 - 83.9%)	10.513(44.7- 56.2% CI)	1.531(Rural)	6.8(0.52- 0.6361%) to 15.044(8.8- 12% CI)
Urban	1.7976 (16-38%)	14.998(94-135 % CI)	0.08232 (Urban)	
Chi-squared Test	42.43 (Urban)	0.000532 (Rural and Urban)	0.1209 (Rural and Urban)	0.5746
Regression	1.931(Urban) 0.999(Rural)	1.0375(Urban) 1.00(Rural)	<0.4107 (Rural and Urban)	0.5892

In Fig.6, Demographic characteristics of analyzed sample to the age-region profile of population are shown.
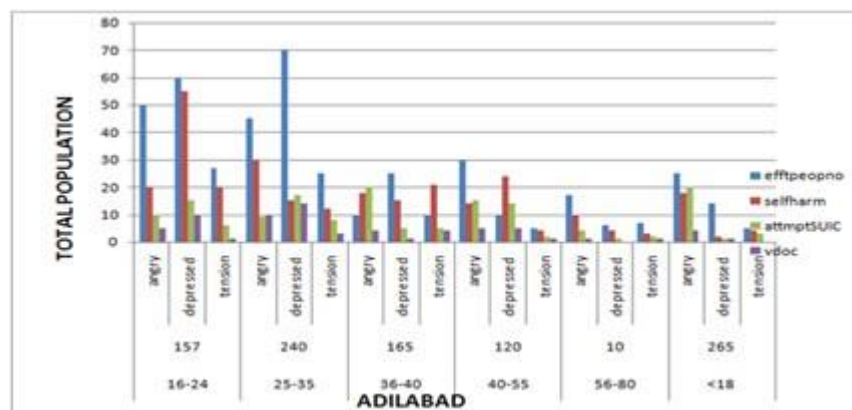

Fig 6 : Total number of people in the region of Adilabad that are affected and the number of people who self harm and attempt suicides

The ratio of the population reporting NSSH to relieve unpleasant feelings of anger ,tension, anxiety or depression roughly tripled in prevalence in women aged between (16-24). According to Figure 7, it shows a rise in self harm in the age groups of (36-40) in the region of Bhadradri.

In Figure 8, we can see for the region of Hyderabad that women between the age groups of (16-24) have more anger due to which they are depressed and that is leading them to attempt suicide.
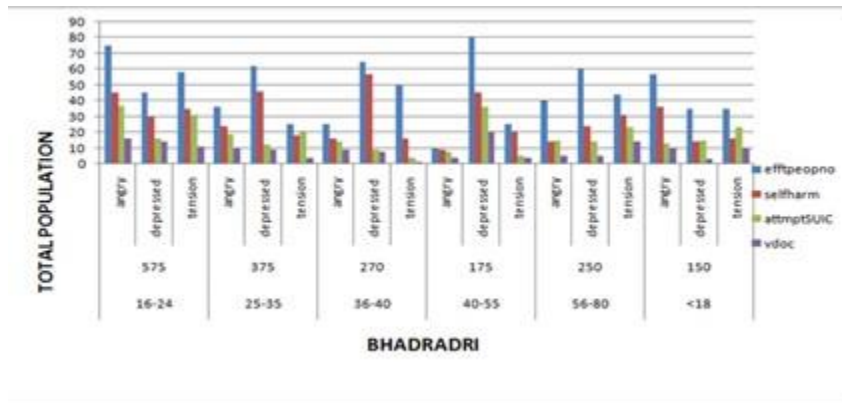
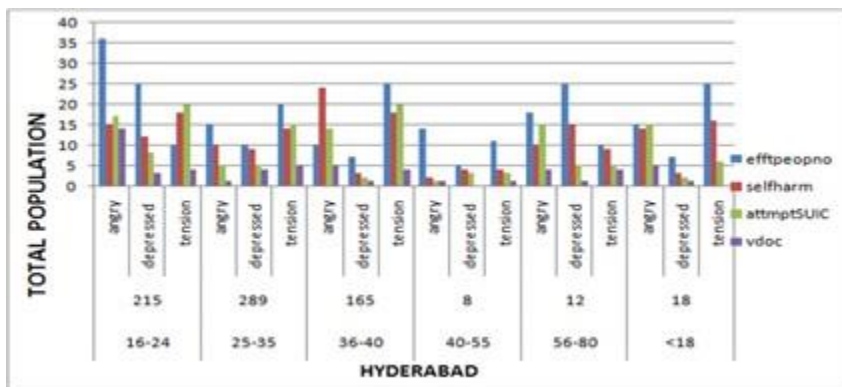**Fig 7: Rise in self harm in the age group of (36-40) years in Bhadradri**

Fig 8: Region of Hyderabad showing more effected people in the age group of (16-24) years and subsequently more suicides are attempted.

Prevalence of NSSH is found to increase in age groups of (16-24).This could have serious health implications .Young people may have increased risk for Self harm which may lead to suicide .Hence, young people must be counseled at regular intervals to bring the level of suicide rates down .Various coping methods must be introduced which might be helpful for more and more people to overcome the fatal feeling of NSSH. This analysis can be extended further using various decision trees to detect and predict early diagnosis of handicapped patients.

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7. Conclusion

 Big Data and AI hold can help transform healthcare services to a new dimension in re-source-poor settings. Big Data analytics is continuously improving the quality and out-comes and providing cost-effective care. Its ability to recognize patterns enables to achieve evidence-based medicine. The hurdles can be overcome by AI solutions. The use of smart AI devices provides an edge to improve public health. AI applications are actively in use and will be implemented more in coming years. It will change the way humans receive smart health care applications for their benefit instead of dwelling in the same old methods. Along with privacy, confidentiality and data security can also be maintained through own-ership permissions and informed consent.

8. Future Scope

 Big Data in healthcare can become more outcome-oriented when the following challenges can be addressed:

1. Initiation to set up centers to explore applications and increase the use of machine learning must be done by governments.
2. Big Data requires an interdisciplinary approach involving the various competencies in the field of healthcare.
3. Accelerate application of smart healthcare systems in rural areas.
4. New models need to be encouraged both by the governments as well as the IT indus-tries.

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