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A study of 'Impact of Technology in Healthcare: Big Challenge'

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Abstract: This research is on the study of technology in medical field, its effect on the lives of people and the changes in the method of healthcare. Healthcare changes dramatically because of technological developments, from anesthetics and antibiotics to magnetic resonance imaging scanners and radiotherapy. The study analyses the influence of information and technology in the delivery of healthcare service. This study is focused on the impact of technology in transforming the field of healthcare, planning for human resources, continuing medical education, facility registration, and telemedicine initiatives. The topic is relevant, and shows the prevalence of technology in the medical field which includes advance technologies such as Telemedicine, Electronic Medical Records, Hospital Management System, e-Health, availability of information and Big Data. The main purpose of this research is to study about the challenges faced during the implementation of technology in healthcare. One of the biggest challenges is lack of manpower and required training. The main objective of our study is to bring awareness about technology implication in healthcare.

Keywords: Telemedicine, Electronic Medical Records, e-Health, Big Data, IT: Information Technology, HMRI: Health Management Research Institute, EMRI: Emergency Management Research Institute, AI: Artificial Intelligence, 3D-Printing.

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Introduction:

The role of technology in healthcare is significant and can play a transformative role. It has the ability to revolutionize healthcare. Technology can bring services closer to the community. Technology can expand the capacity of the health system to provide care. IT has come a long way in making hospitals paperless and filmless entities. It has provided enormous benefits such as faster patient throughput, faster diagnosis, reduced manpower requirement, recording patient history at one place, and referring them for overseas medical treatment.

In modern times, the use of new information technology (IT) has provided remarkable opportunities to decrease medical errors, support healthcare

specialist and has increased the efficiency and even the quality of patient's care and safety (Rajkumari N (2014). ***Impact of Technology in Better Dispersal of Health Care Methods and Improving Health Care Systems. Occup Med Health Aff 2:162. doi: 10.4172/2329-6879.1000162, pp.1-3, ISSN: 2329-6879, an open access journal, accessed on -07-09-2017***) There are a number of good examples where technology has played an important role in improving healthcare access, in driving accountability, in increasing efficiency, and in reducing out of pocket expenditure for the poorest of the poor. Two organizations, the Health Management Research Institute (HMRI) and the Emergency Management Research Institute (EMRI), have implemented large scale technology-based services in several states across India, often in partnership with the government. These services are based on an integrated technology platform that interconnects patients, referral services, the emergency response system, and, in some cases, telemedicine and outreach services by community workers.

Technology is rapidly changing.There have been many visible ways in terms of technology impacting healthcare. From microscopes and stethoscopes invented hundreds of years ago, to MRI machines today, technology is making sweeping changes in healthcare and undoubtedly India will be a big beneficiary.

How Technology is Revolutionizing Healthcare: Healthcare is traditionally a very conservative and slow moving industry, while IT technology that can potentially benefit this industry is growing at a faster speed than ever before. Digital technology is disrupting healthcare and shifting its structure.

The main drivers, today and in the future, are smartphones, always-on connectivity, big data and artificial intelligence (AI). Today, wearable health trackers can monitor heart rates and the number of steps taken during exercise. It can also send blood sugar readings from a glucometer and more. Monitoring technologies synced to a smartphone can automatically notify family or healthcare workers know when something is wrong or send an alert for help, regardless of where a person is located. In India, a person living where there isn't a nearby access to doctors or healthcare professionals has a greater opportunity than ever before to access some form of professional health advice or medical information through these drivers.

These technologies are immediately valuable and tangible for an individual, but analysing information across many people is where we can spot important trends that can help a large number of people in India and beyond. Because we can now track everything; from location, to vital signs, to disease and drug outcomes across millions of people. A vast amount of data is being generated. This is where the application of artificial intelligence techniques such as machine learning will help us understand big data sets and help us make the right healthcare decisions.

Quality, Access to Government Hospitals are Hurdles: A country-wise survey on healthcare access reveals that the proportion of people using private healthcare facilities is increasing even though public healthcare facilities are less expensive.

The primary reason, the study goes on to prove, is the absence of doctors and a dissatisfaction with quality standards at state-run,or public hospitals. However, the data shows that between 85% and 90% of the patients are willing to shift from private hospitals if the situation improved in the public healthcare facilities.

The study was conducted by IMS institute for healthcare informatics, in over 14,000 households across 12 states (including urban and rural areas). (***Ramaya Kannan (30 july 2013)."more people are opting for private healthcare". Chennai, India: TheHindu.retrieved 31 july 2013, updated on June 08,2016 06:14 IST, Accessed on :14-09-2017***)

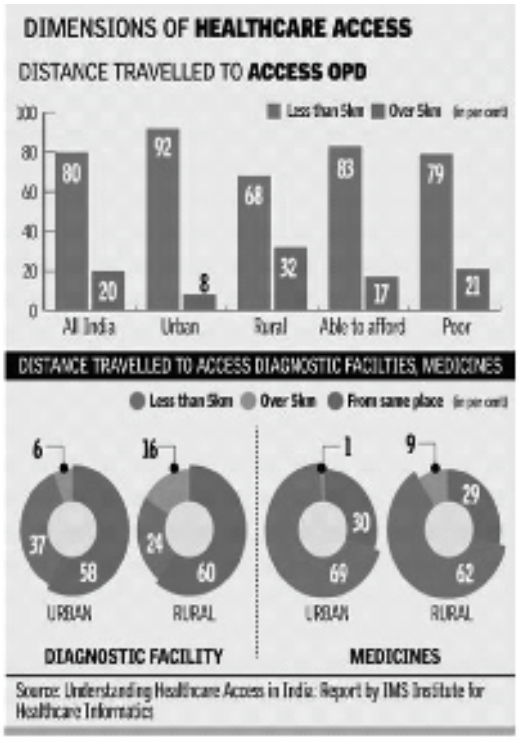


Fig. 1

Some of the challenges faced in implementation of technology:

- Inaccessibility of healthcare information to citizens and patients is one of the major challenges
- Apart from low doctor-to-patient ratio, several other issues are faced by the healthcare and pharmaceutical sector that limit quality healthcare from reaching the citizens, especially in the rural communities
- Absence of an effective and transparent grievance redressal system further creates gaps in the Indian healthcare scenario
- Another issue of traditional healthcare is posed by paper-based record keeping system which delays in access to records, leads to delay in diagnosis, impacting the quality of healthcare services provided to patients

The major issues that Indian healthcare industry faces is the lack of basic infrastructure. Primary healthcare provision, unfortunately, does not seem to be a governmental concern. The private sector in the healthcare industry is, without a doubt, a better provider of quality medical help. It is also expensive and more often than not, restricted to the urban areas.

Some of the technologies being implemented in Healthcare:

e-Health: e-health refers to the use of information and communications technologies in healthcare.

The Journal of Medical Internet Research defines ***e-Health, "In a broader sense the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve healthcare locally regionally, and worldwide by using information and communication technology" (https://www. rishabhsoft.com/blog/how-healthcare-mobile-apps-can-help-doctors-and-their-patients, accessed on 11.09.2017).***

Electronic Health Records: It includes components like appointment management, document management, lab integration and billing insurance.

M-health and Mobile Apps: The mobile platforms have completely redefined the healthcare industry. Mobile health is a term used for the practise of medicine and public health supported by mobile devices. 25% of the physicians use mobile technology for the patient's care. The major benefits of mobile apps are to secure communication, appointment scheduling, easy to share results, single repository and recorded consultation *(https://www. rishabhsoft.com/blog/how-healthcare-mobile-apps-can-help-doctors-and-their-patients, accessed on 11.09.2017).*

Big data: Big data in healthcare is used for reducing cost overhead, curing diseases, improving profits, predicting epidemics and enhancing the quality of human life by preventing deaths. Some of the examples of application of big data are electronic health records, telemedicine, real time alerting and predictive analytics in healthcare.

Telemedicine/Telehealth: Telemedicine has provided a platform for delivering remote clinical services using technologies.

Some future technologies of healthcare:

The future of healthcare is even more exciting than we could ever have imagined. We will be forever young, cancer may get cured, and surgeries will become way more successful.

Genetic Engineering: Genetic engineering plays significant role in production of medicines. It is concerned with the study of inheritance pattern of diseases in man and collection of human genes.

3D Printer:

- **Printing Skin:** It is used in developing skin to help burn victims and skin disease patients.
- **Blood Vessels and Heart Tissue:** Organovo is a company that has already successfully printed blood vessels and sheets of cardiac tissue that actually beats just like a real heart.
- **Replacing Cartilage and Bone:** 3D printers have also helped scientists and doctors create stem cells that could eventually develop into both bone and cartilage in the long-term.
- **Replacement Organs:** It is helpful in printing new part for organs or an entire organ.

Nanomedicine: Nanomedicine is simply the application of nanotechnologies in healthcare that are used globally to improve the treatments and lives of patients suffering from a range of disorders including: ovarian and breast cancer, kidney disease, fungal infections, elevated cholesterol, menopausal symptoms, multiple sclerosis, chronic pain, asthma and emphysema.

Objectives of the study:

- To study and understand in detail, how health information and technologies facilitate or hinder communication between patients and doctors.

- Ultimate goal of finding out how we can optimise the use of these technologies in order to support effective cost and better services.
- To bring awareness and analyse the impact of technology used in healthcare upon people.

Hypothesis of the study:

The hypothesis of the study concerns the basic assumptions or beliefs upon which the entire study is based which would be verified by the study. The hypothesis of our research is as follows:

- Whether patients are aware of the new technology.
- Whether new technology in medical field are affordable to patients.
- Whether advance technology is being implemented in rural areas as well as urban areas.
- Whether new advanced technology is making an impact in healthcare.

Methodology and Tools used:

Area of study: A survey was conducted in three different hospitals of Patna, they are AIIMS, Phulwarisharif, Patna; Kurji Holi Family, Kurji, Patna; and PARAS HMRI Hospital, Raja Bazar, Bailey Road.

Sample size: Data was collected through personal interviews and questionnaire from. Nearly 100 people including, patients and doctors took part.

Methods of data analysis: Data received was analysed using MS-Excel and described through charts. The contents of our research and findings were modified in the form of a research paper.

Tools and techniques for the data collection: Data was collected through various sources such as: Interview schedule, Questionnaire, Observation, Field Survey or Data Collection, exploratory method and Analysis of Data and website references.

Major Findings of the study:

According to our survey which took place in three different hospitals, we came across several facts about the implementation of technologies in healthcare. A total of 100 respondents were taken into consideration in our study. Following are the highlights of our study:

1. Are you aware of the technology being used in healthcare?

a. Yes b. No

One of the main objectives of the study was to find out the awareness among the people regarding the technology being used in healthcare and how much it is beneficial for health. In our observation we found that 80% of people are aware of the technology in healthcare and 20% are unaware of it. Our survey was done on middle aged 35 people. Some of them were not comfortable using advance technology.

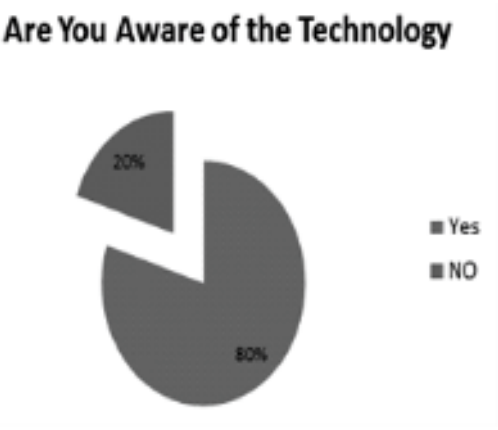


Fig. 2

Table 1.

Total	Yes	No
100	80	20

2. Is the technology usage cost-effective?

a. Yes b. No

From our study we came to know whether the use of technology is affordable to every patient or not. We observed that 68% people think that it is cost-effective and affordable to them. 32% people showed their disagreement when asked about cost-effectiveness of technology.

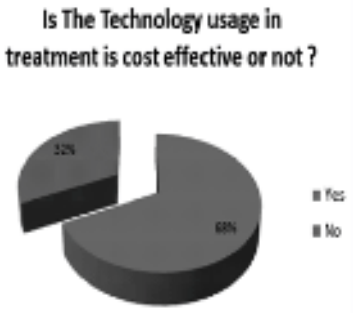


Fig. 3

Table 2.

Total	Yes	No
100	68	32

3. Do you know about any mobile apps related to healthcare?

a. Yes b. No

According to our study, 32% people know about the healthcare mobile apps, but 68% people are still unaware of mobile apps usage.

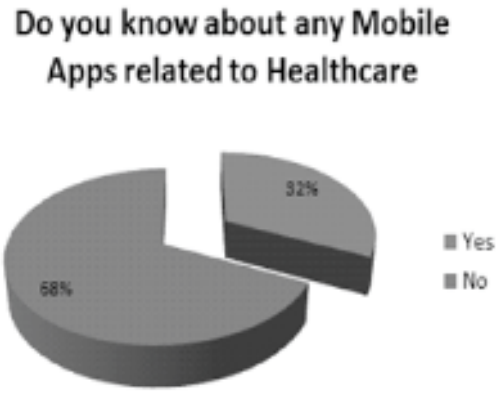


Fig. 4

Table 3.

Total	Yes	No
100	32	68

4. Do you see any changes in the way diseases are being treated in these days than earlier?

a. Yes b. No

In our research project we tried to find out people's views on major changes taking place in the treatment due to advancement of technology. 96% of people think that the scenario of healthcare has changed drastically but 4% still feel that there is no such changes in healthcare. They think so because mostly they were from villages and outskirts of Patna district where there is no facility of technology for treatment of diseases.

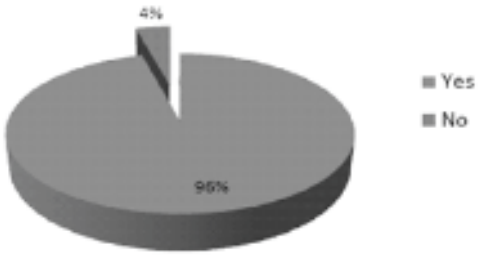


Fig. 5.

Table 4.

Total	Yes	No
100	96	04

5. Is technology available in hospitals in rural areas ?

a. Yes b. No

In this study, it was important to find out how much implementation of technology is achieved in rural areas. Through the questionnaire, we were curious to know about the implementation of technology in hospitals in rural areas. The areas of study of our research work were three hospitals in Patna. When we visited these hospitals there were different groups of patients as they belong to different rural as well as urban areas. So when the above mentioned questions were asked, we came to the conclusion that 40% of the patients agreed that the availability of technologies has been initiated in their home district or villages, but 60% of the patients said that there is still no implementation of new technologies in rural areas' hospitals due to lack of manpower and resources.

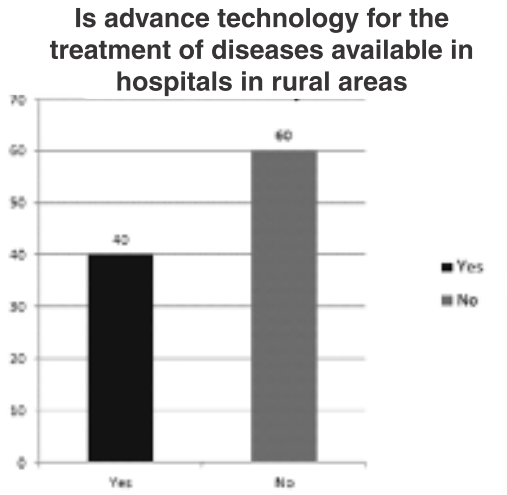


Fig. 6.

Table 5.

Total	Yes	No
100	40	60

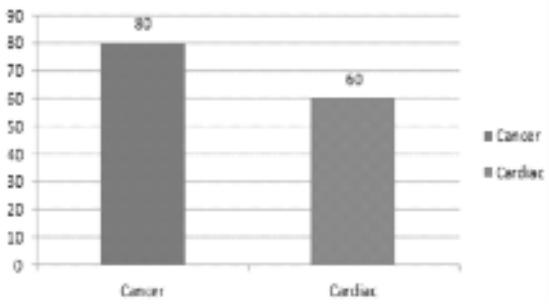
6. Observation of implementation of technology in three different hospitals of Patna:

As we surveyed the three different hospitals, we observed that some specific technologies were implemented in some departments such as oncology, cardiac, telemedicine, etc.

The following graph shows the specific implementation of technology in:

(a) PARAS HMRI, PATNA:

Implementation of technology in PARAS HMRI, PATNA



ig. 7

In Paras hospital, we observed that the two departments were using the technology in Oncology like PET-CT (for diagnosis), Gamma Camera, Linac, Brachy Suite(internal therapy) and in Cardiac like Angiography (for diagnosis), Angioplasty(for treatment) and Cath-Lab, C-arm (machine used for angioplasty).

PET-CT

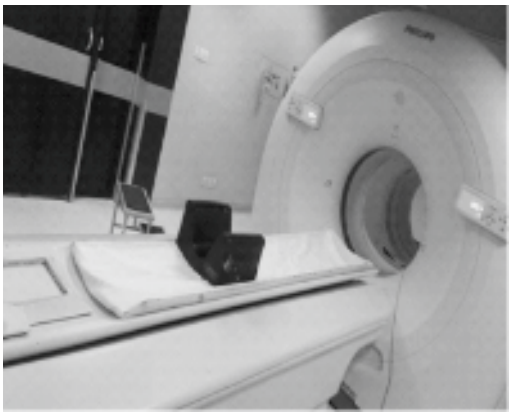


Fig. 8

Gamma Camera

Fig. 9

Cath-Lab

Fig. 10

Fig. 11

(b) AIIMS, Phulwarisharif, Patna

In AIIMS, we visited two departments Telemedicine and Physical Medical Rehabilitation(PMR) which were equipped with technology. According to them and from our study we found that AIIMS is the only place where telemedicine is being implemented for the past 4 years. They took initiatives of starting the telemedicine centres in various districts of Bihar and served around 54,000 people providing healthcare service. They have organised 63 free pre-healthcare campaigns.

They have another scheme named **"SHRAVAN KUMAR"**. Under this scheme they have created 96 Shravan Kumars (Care Givers to old citizens) and the purpose of the **"SHRAVAN KUMAR"** scheme is to provide healthcare services to senior citizens who are not with their families. In this scheme the Care Givers give the services like checking blood pressure, checking blood sugar, providing basic medical aid such as how to apply a bandage, administer an injection to old citizens.

Implementation of technology in AIIMS, PATNA

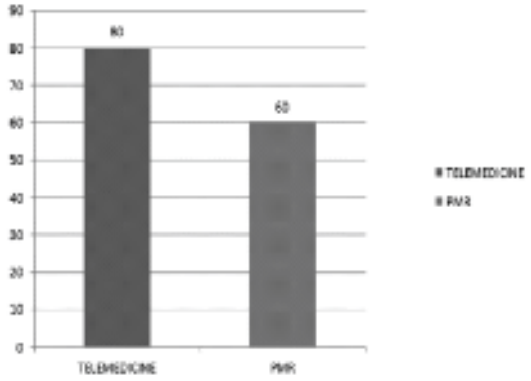


Fig. 12

Fig. 13

(c) Kurji Holy Family Hospital, Kurji, Patna

When we visited Kurji hospital for survey, we found that there is no such specific advance technology available to cure and diagnose diseases. Most of the diseases were treated using common techniques except EMR.

7. Availability of technology in three different hospitals of Patna :

When we surveyed three different hospitals of Patna regarding the implementation of healthcare technology, we observed that PARAS and AIIMS were technologically upgraded but in the Kurji Holy Family hospital only EMR and Big Data were available.

The following graph shows the availability of specific technologies in three different hospitals of Patna.

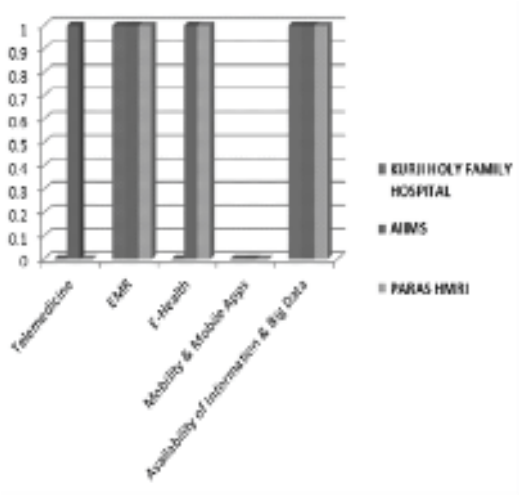


Fig. 14

8. Through our study we observed some barriers that come during the implementation of clinical tools as well as in decision-making. So the following graph shows the level of difficulty faced by medical practitioner.

Barriers in using tools for clinical decision-making

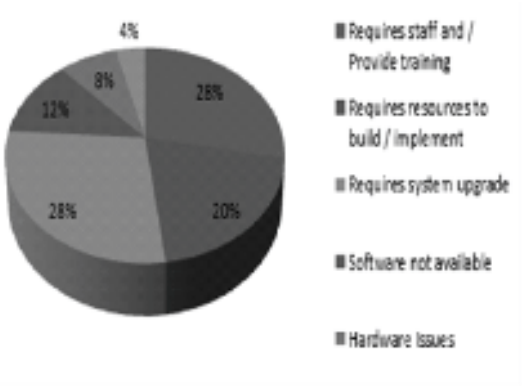


Fig. 15

Work flow system of some Advanced technologies based on our findings

PET-CT and Gamma camera are the two most effective tools for cancer treatment:

PET-CT stands for "**positron emission tomography-computed tomography**" is a nuclear medicine technique which scans measure metabolic activity and molecular function by using a radioactive glucose injection. The F-18 FDG is injected into the patient. The PET scanner detects the radiation emitted from the patient, and the computer generates three-dimensional images of tissue function or cell activity in the tissues of the patient's body. These functional

images can detect disease earlier than the anatomic information gained from CT alone. There are no side effects from this injection and procedure. However,cancer cells grow faster than normal healthy cells and they use glucose at much higher rate than normal cells. This is the basis of imaging with F-18 FDG for cancer detection in PET scan.

Gamma camera is an imaging technique used to carry out functional scans of the brain, thyroid, gallbladder, kidneys and skeleton. A sodium iodide crystal gives a tiny flash when a gamma photon hits it. This flash is picked up by photomultipliers which convert the flash into an electrical signal. The electrical signals from the photomultipliers are analyzed by a computer to construct an image. The gamma camera is positioned in such a way as to ensure that it selects the gamma photon being emitted by the organ under diagnosis.

Cath-lab(Angiography, Angioplasty)in Cardiology: Angiography or arteriography is a medical imaging technique used to visualize the inside,or lumen,of blood vessel and organs of the body with particular interest in arteries veins and the heart chambers .

3D-Organ Printing: The printer works with a liquid mixture of different cells called “bio-ink.” This liquid is pressed through an extruder and fused together on the printer bed using blue light. The most common technology used for 3D printing medical devices is called powder bed fusion. Powder bed fusion is commonly used because it works with a variety of materials used in medical devices, such as titanium and nylon. The powder bed fusion process builds a 3-dimensional product from very fine metal or plastic powder, which is poured onto a platform and levelled carefully. A laser or electron beam then moves across the powder layer and melts the material it touches. melted material fuses to the layer below it and to the powder around it to create a solid. Once a layer is completed, the platform moves down to one or more layers carefully.

Telemedicine: Telemedicine has provided a platform for delivering remote clinical services using technologies. Following are the ways to use it:

Live video: It is also known as synchronous Telemedicine, which is a live two-way interaction between a patient, or caregiver and a doctor. This is performed by using HIPAA compliant video communication technology. Live video telemedicine can be used for both consultative and diagnostic and treatment services.

Remote patient monitoring: This involves the collection and transfer of health and medical data that is collected from an internet enabled medical device. These devices can collect a wide range of health data from the point of care, such as vital signs, weight, blood pressure, blood sugar, blood oxygen levels, heart rate, and electrocardiograms. Doctors, medical assistants, and other health professionals then monitor these patients remotely and act on the information received as part of the treatment plan.

Future scope:

From our observation, we came to the point that there is very less implementation of technology in healthcare in Patna. There are so many technologies which have been introduced in healthcare worldwide but in India very limited technology is used. When we analyse the current environment of health in Bihar in comparison to other metro cities then we reach to this point that there is immense need of implementation of technology in Bihar. In Bihar, the obstacle to implement advance technology is lack of awareness, lack of resources, medical training, etc. Therefore the scenario of healthcare in Bihar could be transformed by taking some initiatives by the government as well as by the medical professionals.

Suggestions:

To implement the technology in healthcare the following points should be taken into consideration**:**

- To make significant progress, a major implementation of information and technology in healthcare delivery system is needed. So to improve technological implementation government must provide internet facility at an affordable cost.
- In the future, only with an upgraded technology in healthcare in Bihar, doctors can be enabled to take quality care of the patients. It would also be cost-effective.
- There must be a proper system to support technological implementation in healthcare sector.
- To reduce non-availability of diagnostic tools and increasing reluctance of qualified and experienced healthcare professionals to practice in rural, under-equipped and

financially less productive rural areas is becoming a big challenge.

So, to overcome these problems some initiatives should be taken by the government regulation to ensure quality of care.

- However, the pace has been slow and implementation is a challenge, because there is no single authority who is responsible for quality assurance. So, to improve the quality care services all the responsible authorities should work in coordination and must deliver their services on time.

Conclusion :

From our overall observation, we have come to the conclusion that in developing a new healthcare technology it is important to recognise its potential impact. As there is only one doctor per 1,700 citizens in India; the **World Health Organisation (WHO)** stipulates a minimum ratio of 1:1000.While the Union Health Ministry figures claim that there are about 6-6.5 lakh doctors available, India would need about four lakh more doctors by 2020 (https://www.quora.com/ What-is-the-future-of-healthcare-in-India, accessed on: 11.09.2017).

- By seeing this we can say that shortage of doctors can be minimized with the help of technology
- If telemedicine is implemented widely in Bihar then it would be helpful for improving communication gap between remote patients and doctors. Also it would be helpful to reduce the physical limitations of patients to reach medical professionals with less effort.

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Ms. Taru (HR Manager,PARAS HMRI,Patna)

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Dr. Anil Kumar Sinha (Head of the Telemedicine dept., AIIMS, Patna)

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