TELERADIOLOGY: ENROUTE TO FUTURE GROWTH OF INDIA

Dr. Chidambra Makker[1], Dr. Divey Kapoor[2], Dr. Surbhi Chaturvedi[3]

ABSTRACT

BACKGROUND/INTRODUCTION: India is seventh largest country in the world having $2.84 trillion economy with 1.4% of GDP been contributed on the healthcare sector. There are approximately 14 million doctors in India out of which 80% doctors live in urban India and 66.46% of citizens live in rural India. WHO has prescribed 1:1000 doctor patient ratio, but in India the ratio is about 1:2000. India requires 20,000 radiologists to cover every corner of India; however, at present there are 10,000 radiologists. There is also lack of amenities such as high-quality MRI (Magnetic Resonance Imaging) machines and CT (Computerized Tomography) machines in India. There are 600 MRI and 50,000- 55,000 CT machines present. This shortage of radiologists and proper equipment in rural areas, has led to considerable travel expenditures of rural patients, hence, increase in their out-of-pocket expenditure. Teleradiology offers solutions to address these shortcomings in the existing healthcare system.

Teleradiology is digital sharing of patient's radiological reports among different organizations for the primary interpretation of data, expert consultation, or/and clinical review by digital transmission. It was primarily started in USA, but now the use of teleradiology is seen across the world.

Providers upload and download Digital Imaging and Communications in Medicine (DICOM) and HL7 images which are displayed on the desktop. These are then compressed, encrypted, and sent to the virtual clouds from where these reports are delivered to radiologist who interpret these reports and send it back to the provider.

OBJECTIVE: To review the benefits of teleradiology for creating a facility bridge for rural population from urban facility resources and to provide recommendation to grow in the field of teleradiology for future development in the healthcare sector.

METHODOLOGY: Literature review of status and future perspective of teleradiology in India.

RESULTS: The government has taken several initiatives for implementation of teleradiology. It is seen that teleradiology was introduced in Pauri district hospital and 12 districts of Dehradun; in Karnataka, it was introduced in Narayana Hrudayalaya hospital in collaboration with Indian Space Research Organization; however, they faced many challenges.

PACS (Picture Archiving and Communication System) software such as K-PACS, Conquest or Osirix, and Very Small Aperture Terminal (VSAT) equipment which is a satellite transmission system was provided for free by the government in Ramakrishna Mission Hospital. This hospital is situated in mountainous and relatively inaccessible area of Arunachal Pradesh and is an only referral hospital in the entire state which cover rural population over 1 million; therefore, with the help of government, they successfully collaborated with TRS (Teleradiology Solutions), Bangalore for teleradiology.

RECOMMENDATION: The scope of public private partnership could be explored. Free PACS software and broadband internet service might help in improving the healthcare sector.

It is seen that access to broadband internet connectivity in rural areas is steadily increasing and the adoption of internet utilization has shown tremendous growth this could help in providing teleservices to the rural areas with ease.

KEYWORDS*: Technology, Telemedicine, Teleradiology, Health, PACS, RIS, DICOM.*

INTRODUCTION

With the beginning of this new era, India has grown tremendously in the field of science and technology, which has led to the development in the branches of telecommunication and Information technology. This development has led to the emergence of telehealth which has helped in improving the healthcare sector of India; however, as per world healthcare ranking (which was done in 2016 on basis of disabilities, life expectancy, speed of service, protection of privacy, financial contribution, and quality of amenities) India ranked 145 out of 191 countries which lay behind many poor and conflict ridden countries like Sudan having 136 rank, Equatorial Guinea at 129, Botswana at 122, Namibia at 137 and Yemen at 140 [1].

As per a report of March 2015, it was noted that there is extreme shortfall of workforce seen in the rural areas especially in community health centres (CHC) and the primary healthcare centres (PHC). More than 8% of 25,300 PHC were without a physician and 38 % without a laboratory technician. Also, as noticed in CHC, there are lack of surgeons and physicians by 83 % [2].

In 2013, WHO mentioned that there is approximately 9 percent availability of diagnostics in low-income country as compared to 92 percent availability in high- income countries hence it highlights that, there is limited access to the diagnostic tools in India [3]. At present, there are 10,000 radiologists in our country resulting in one radiologist per 1,00,000 population although, we need 20,000 radiologists to fulfil the requirement of skilled radiologist in every part of our country. Due to lack of radiologist and amenities, people tend to travel, loose their daily wage, and suffers from delay in their diagnosis; therefore, leading to ignorance of their health status with increase in the disease burden, hence, increase in their out-of-pocket expenditure. They also lose their chances of getting early detection of their illness.
Introduction of teleradiology service in rural and remote areas of the country might help to bridge these gaps [4].

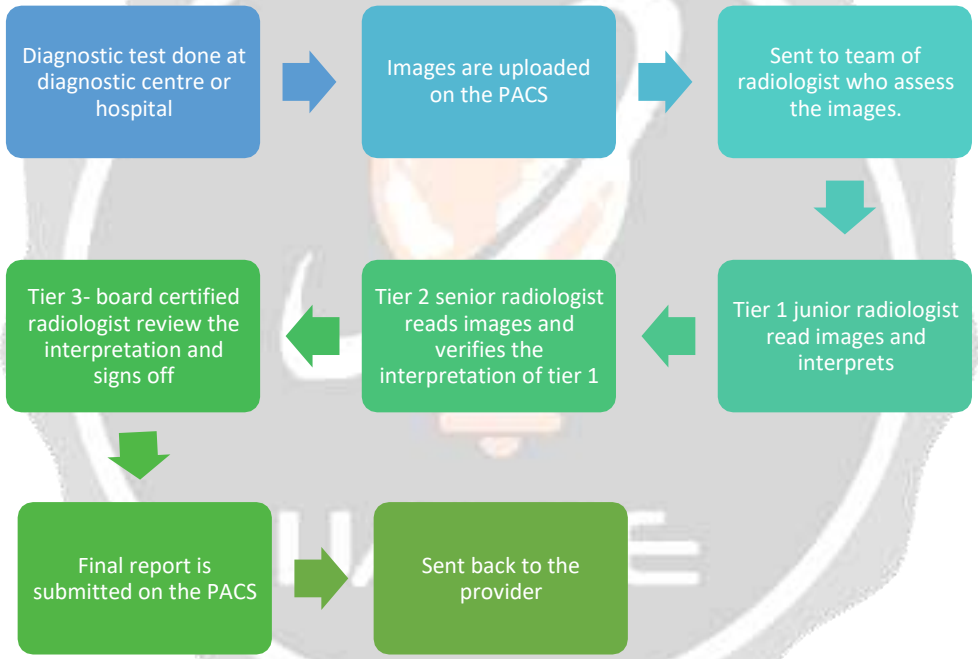
Teleradiology is the digital transmission of patient's radiological images such as CTs, MRIs, ultrasound, and x-rays from one place to another for primary interpretation, consultation and /or clinical review. Teleradiology is currently the most common form of telemedicine which results in better patient care and utilization of the resources. It utilizes technologies such as internet, telephone lines, local area network (LAN), wide area network, and computer clouds. It provides services to those areas where there is lack of radiologist to locations where radiologists are available. Special softwares like PACS (Picture Archiving and communicating system), RIS (radiology information system) and DICOM (Digital Imaging and Communications in Medicine) are used to store and transmit radiological images for effective analysis [4]. PACS is a computer network which collects, stores and distributes medical images to physicians having PACS system with them. This technology replaces the traditional way of storing radiological images. On PAC system, no manipulation of imagesis

possible; however, fixing of the contrasting issues of the radiological images can be done, hence reducing repetitive capturing of patient's images [5].

Radiological information system (RIS) is generally used in integration with PACS. This is a network software system which is used for managing medical images and associated data. RIS allows staff to make appointments as well [6].

Another technology which is required with PACS is DICOM on which the images are compressed, encrypted, and sent to the virtual clouds from where these reports are delivered to the radiologist present in any part of the world who interpret these reports and send it back to the provider [7,8].

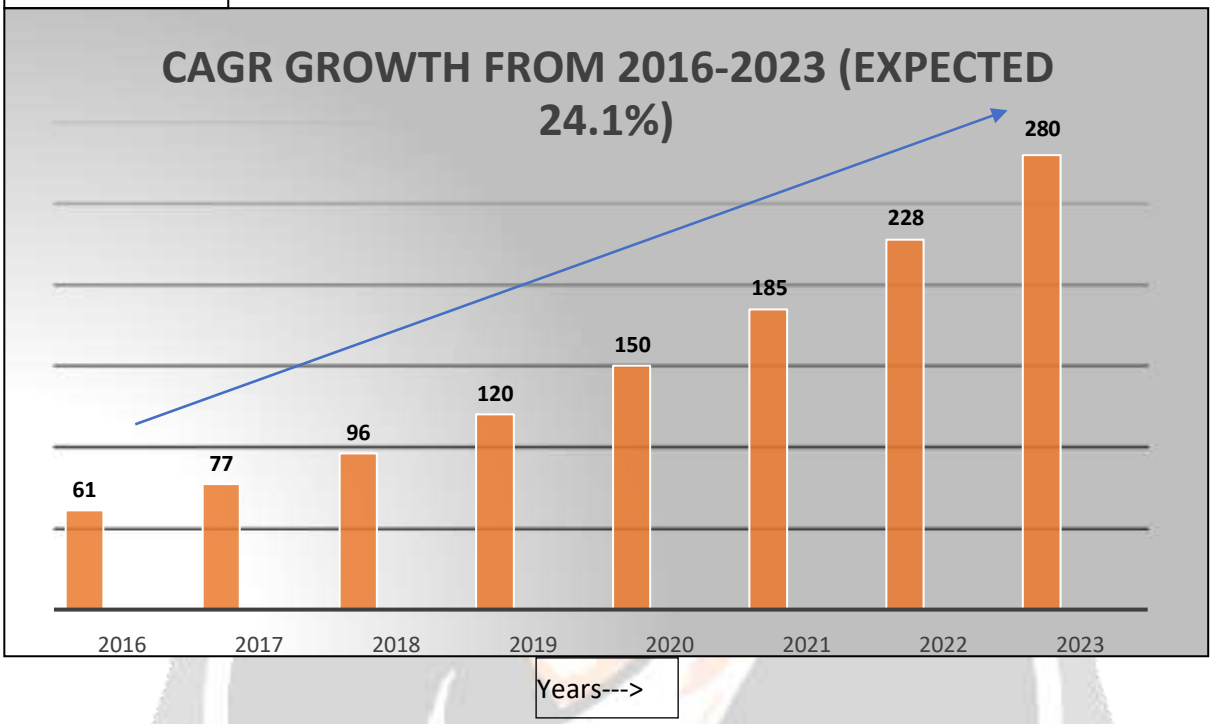
FIG. 1.1 THE PROCESS OF TELERADIOLOGY



The global teleradiology market in 2016 accounts for about $2,143 million with Compound Annual Growth Rate (CAGR) as 19.06% and the market is expected to reach around $7345 million by 2023. This growth can be seen due to advancement in the digital technology which will help in rapid interpretation of the images especially in the emergency situation and with outreaching of the technology to the remote areas of the country; however, low speed of internet connectivity or lack of skilled professionals contains the market growth [9].

Increase in the number of providers, the expansion of the IT sector and government initiatives might help in the market growth which will help in improving the healthcare of the society [9].

FIGURE 1.2



OBJECTIVE

To review the benefits of teleradiology for creating a facility bridge for rural population from urban facility resources and to provide recommendation to grow in the field of teleradiology for future development in the healthcare sector.

METHODOLOGY

Literature review of 10-15 research papers and 25-28 articles from year 2013 to 2018 and some important articles prior to 2013 reviewed with respect to current status and future perspective of teleradiology in India.

RESULTS

Teleradiology was initially started in USA and since then this field has grown rapidly [8]. In India, it was introduced in 1996 by Jankharia Imaging, Mumbai which is a privately-owned imaging centre who initially started with video-capture cards and Windows 95 dial-up protocol [10].

The first non-hospital-based healthcare organization to introduce teleradiology was Teleradiology Solutions (TRS), Bangalore by Dr. Arjun Kalyanpur and Dr. Sunita Maheswari who were Yale trained physicians which addressed the lack of adequate staff in India. This company initially provided services in hospitals of USA; however, later to improve the health quality of the rural and underserved areas, TRS opened Telerad foundation (Non- profit trust) in 2007.They are also providing services to US,Canada and countries in middle east [20]. They cover over 150 hospitals in 21 countries globally [11,20]. First RIS was prepared by Telerad in 2006 and was sold to Ricky Bedi who named RIS as RadSPA after which the use of RIS came into existence in India [19].

TRS in collaboration with government provided teleradiology services in Ramakrishna Mission Hospital

which is situated in mountainous regions ofArunachal Pradesh which is relatively inaccessible. Being the only referral hospital in the entire state, the hospital always experienced overcrowding by more than 1 million population. There was large amount of workload with presence of only one radiologist. They had one CT scan machine and had no help for interpreting radiological reports especially of CT scans which were done at very high rate; therefore, teleradiology was requested by the radiologist of Ramakrishna Mission Hospital. Teleradiology project started in August 2007 in which PACS and VSAT (Very Small Aperture Terminal) were provided for free by the government; although they experienced many challenges due to VSAT being unreliable in the rural areas. Two subspecialised CT technicians (qualified radiographers) were trained to use RIS. The hospital connected to the FTP server through internet and sent the images as compressed ZIP files at a speed 256 Kbit. /s. In the first year of the project, 19% of the total reports failed transmission initially; henceforth, they resent the reports successfully. The average TAT (turnaround time) was 60 minutes and foremergency cases TAT reported was less than 30 minutes. This teleradiology implementation proved successful in the end which infers that it is possible to provide services in the rural areas [12].

In Uttarakhand, the state government launched teleradiology in Pauri district hospital of Garhwal and 12 more state-run hospitals on November 10, 2017, in collaboration with private sector as there were total 33 radiologists in the state; although, the requirement of the state is 135 [13].

In Assam, the government equipped many regional diagnostic centres with CT machines and X-ray but, due to lack of radiologists in the state, these equipments were not utilised properly which lead to the introduction of teleradiology in the state which was introduced in collaboration with National Rural Health Mission (NRHM), the Department of Health and Family Welfare, and Government of Assam in 2012 who joined hands with privately owned HealthFore Technologies Limited [14].As the success of this project was noted within a month after the introduction, the state government planned to link all the civil hospitals of the state [24]. As per recent information (received on November 27,2018), total 1,85,710 CT scan has been reported out of which 68.94% of the reports were submitted within the given TAT i.e., 8 hours for normal cases and 1 hour for emergency cases [23].

In Karnataka, Narayana Hrudayalaya hospital in collaboration with Indian Space Research Organization started providing teleradiological services to Chamarajanagar and Vivekananda Memorial Hospital, Saragur in 2002, where 52,000 patients were treated through teleradiology till in the year 2008. Narayana Hrudayalaya hospital initially faced several challenges. [15, 26].

Some privately owned hospitals have introduced teleradiology. These are Apollo, Arvind eye hospital, Columbia Asia, and Manipal group of hospitals [9].

In India, there is high amount of inaccessibility to the services and as per Dr Arjun Kalyanpur, and it requires more than eight years to teach radiologists because their role is critical; therefore, teleradiology can be a solution to these issues which also reduces time for commuting. Not only this, teleradiology provides approximately 40% cost reduction, providing around 98% accuracy and TAT as 15-30 minutes for emergency cases and finally reduces workload [20, 21].

It was noted in the year 2012 that, the most frequently submitted radiological images were panoramic radiographs of oral cavity of the patients [25].

DISCUSSION

In the United States, almost 70% radiological practices are done using teleradiology and the utilization of teleradiology has tripled from the year 2003 to 2007. At present, US Army Medical Department Telehealth Network encompasses 50 countries and 19 territories across the time zones. Policies like HIPPA are strictly followed [22].

It is seen that, in Japan, teleradiology services has increased by 69% from the year 2006 to 2012[14]. The teleradiology was initially introduced for military purposes in Europe. The radiology images were sent to hospitals for diagnosis and further patient management, and as per 2011 survey, there are 61% of radiologist present for teleradiology in Europe [16,17].

In India, the teleradiology is moving at a very slow speed as compared to these countries. In 2011, there were only 2 hospitals using PACS. Till now, 3.6 million scans are reported. There is lack of special policies

in India which supports teleradiology [18].

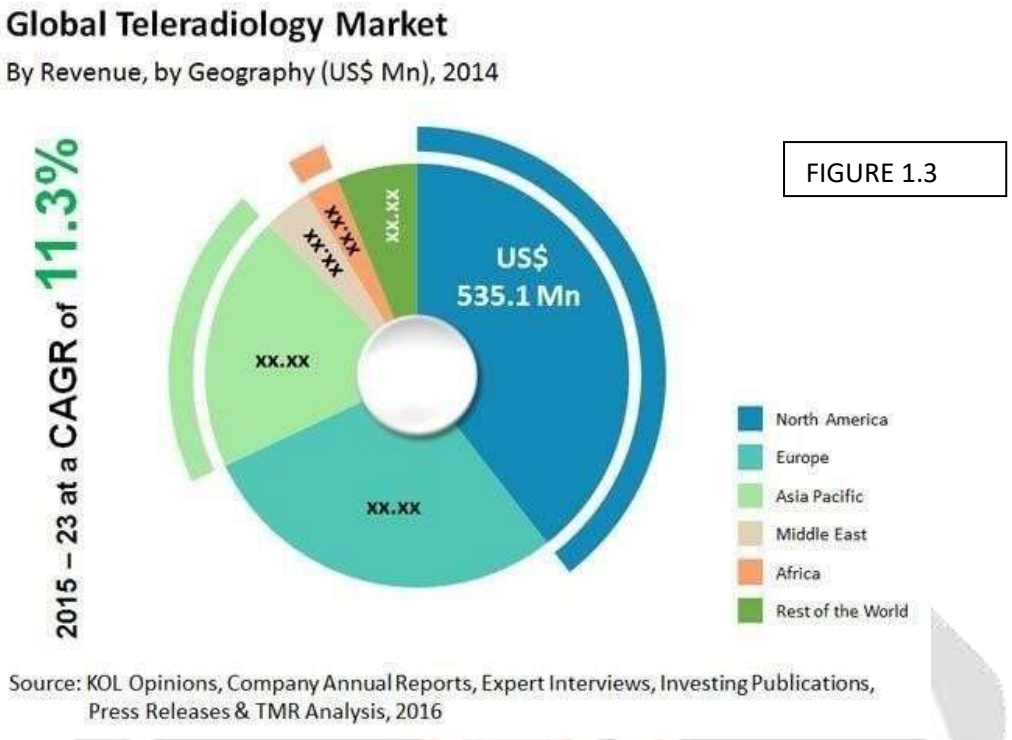


FIGURE 1.3

CONCLUSION

The use of teleradiology shows positive results in India; however, implementation process is slow. If implemented especially in rural region, will help in development of India.

RECOMMENDATIONS

For smooth implementation of teleradiology in India, it is recommended to hire technicians who have cognizance about the technology, as seen in Ramakrishna Mission Hospital. Hospitals can also invest to train the staff hired for sooth implementation of teleradiology.

The scope of public private partnership can be explored and free PACS software with broadband internet service might help in improving the healthcare sector.

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BIOGRAPHIES

Dr. Chidambra Makker
BDS, MBA in Hospital and Healthcare Management (Hospital stream),
cmakker@gmail.com

	Dr. Divey Kapoor BDS, Master's in public health- Macquarie University, Sydney. Divey.kapoor@gmail.com
	Dr. Surbhi Chaturvedi BDS, MBA in Hospital and Healthcare Management (Health stream), Surbhi.chaturvedi@gmail.com