TELERADIOLOGY – IS IT A HEALTHY PRESCRIPTION FOR INDIAN PHARMA INDUSTRY

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Abstract-Telemedicine is the application of numerous technologies for the transfer of clinical information. The introduction of the internet has enabled telemedicine to expand its reach across every medical specialty – its use in radiology is termed "teleradiology."Radiology encompasses the diverse techniques used by medical professionals to capture images of the internal body (eg. x-rays, MRIs, ultrasounds), to aid in the process of diagnosis or treatment.Teleradiology is the ability to obtain these medical images in one location and their transmission over a distance so that they can be viewed and interpreted for diagnostic or consultative purposes by a radiologist.This recent practice is becoming widely implemented by hospitals, urgent care clinics and specialist imaging companies. The study aims to analyse the knowledge acquired by the doctors, hospitals and patients about teleradiology and to check their awareness level about Teleradiology. Radiologists need to adapt to the changes in technology in order for the profession to deliver the service that patients expect and medical progress requires. With so many technological advances it is not surprising that radiology utilisation of high-cost studies such as CT and MR is expanding rapidly worldwide. Teleradiology may increase productivity in some circumstances such as night cover in smaller practices and provision of radiology reporting services to rural communities.

Introduction

The process of teleradiology is based on an essential triad; an image sending station, a transmission network, and a receiving image station that must have a high-quality display screen that has been cleared for clinical purposes. In fact, there are now specialized computer programs that are dedicated to sending radiological images with the same ease associated with sending an email with image attachments.Teleradiology improves patient care by allowing radiologists to provide their expertise without being present with the patient. This is particularly important when radiologist specialists (e.g. MRI radiologists, pediatric radiologists, neuro-radiologists) are needed, since these professionals are generally only located in large well-established areas working during day time hours.

Teleradiology can be a means through which medical professionals can collaborate when they are not otherwise reachable to each other (e.g. they are in remote locations). This can be an effective input for diagnosis and symptom control as it often helps with obtaining a second professional opinion.By using the services of outsourcing companies or radiology groups to provide and maintain the required radiology coverage, smaller hospitals are able to make better use of their own on-site professionals and allows them to maintain their normal working hours.This can also be economical for the hospital as the outsourced institution will only require payment per radiological exam. The provision of these specialist services to manage inpatients at small hospitals without specialists on site has been shown to be an effective way of providing high quality care that would otherwise be unavailable.Furthermore, teleradiology is entirely dependent on technology so should there be no access to the internet (e.g. if the hospital's internet is down for service), teleradiology is no longer an option and patients will remain undiagnosed or even untreated.

Statement of the problem:

Radiology is now the key diagnostic tool for many diseases and has an important role in monitoring treatment and predicting outcome. It has a number of imaging modalities in its armamentarium which have differing physical principles of varying complexity. The anatomical detail and sensitivity of these techniques is now of a high order and the use of imaging for ultra structural diagnostics, nanotechnology, functional and quantitative diagnostics and molecular medicine is steadily increasing. Technological advances in digital imaging have also enabled the images produced to be post-processed, manipulated and also transmitted rapidly all over the world to be viewed simultaneously with the transmitting centre.

Radiologists have been strongly involved in these technological developments and have been responsible for much of the evaluation of the strengths and weaknesses of different investigations. Radiologists have developed the knowledge of the appropriate integrated imaging algorithms to maximise clinical effectiveness. They have also been responsible for the implementation of these developments into the clinical setting and for ensuring the best use of assets and healthcare resources.

It has also been used in some countries to compensate for manpower shortages and when used in a proactive and controlled fashion may help to avoid loosing turf to clinical colleagues. It is not however the ultimate solution to manpower problems which are better resolved by training sufficient radiologists to provide the service within the locality of the clinicians and patients. Teleradiology must not be allowed to commoditise imaging services and should only be used to support the comprehensive diagnostic service provided by radiologists within groups or local area networks.

Teleradiology is a part of the growing telemedicine trend, as technology enables the speedy transfer of medical data over the Internet to virtually anywhere. Health care is seeing a boom again thanks to contributions by the information technology in health care. With the quantum of work that a radiologist faces in his day-to-day life increasing by leaps and bounds and the number of

images he has to see and more importantly accurately report getting almost unmanageable, teleradiology seems like the only answer available. Share the work is the right answer.Another obvious driving force behind teleradiology is the economics of it all. It saves time and money both. And I think anybody would agree that it is better to have your images read by a consulatant abroad than a resident in town who is half asleep and fatigued.

Need for the study:

The field of tele radiology is becoming vast and complex. This trend is nascent in India. Furthermore, clinical sub specialization, such as neuroradiology, pediatric radiology etc is important to develop a better clinical understanding of the subject and will enhance the practice of radiology, including teleradiology.In this era of internet technologies, all of radiology is moving towards teleradiology. Many teleradiology outsourcing centers are sprouting up now, if teleradiology services are provided in accordance with rules and regulations, with a focus on maintaining quality, then they will provide tremendous value to the medical industry and the public overall.

Objectives of the Study

To analyse the knowledge acquired aboutTeleradiology.
To study the awareness level of the telereadiolgy services.
To suggest on the usefulness of teleradiology through the findings of the study

Review of Literature:

R. WELZ, M.D.,Y. LIGIER, M.D.,O.M.D. RATIB, Ph.D. A teleradiology system intended to provide a user-friendly environment for exchanging images and working cooperatively on them. With the development of a hospital-wide picture archiving and communication system (PACS), the University Hospital of Geneva and several other health institutions in the region became interested in teleradiology. Because of the heterogeneous needs of the potential participants, the following requirements were identified: (1) remote consultation and interpretation of images; and (2) cooperative interpretation of medical images, allowing real-time interaction between physicians. To satisfy these needs, a multipoint teleradiology system has been implemented that incorporates an innovative image display and manipulation software program known as OSIRIS, which supports the full spectrum of imaging modalities. Images and data are transmitted over the public telecommunications Integrated Services Digital Network (ISDN). To accommodate different computing environments at the various locations, platform-independent software has been designed that has the same "look and feel" for PC-Windows, Macintosh, and UNIX-X11 work-stations. The teleradiology system can be used in two modes: synchronous (cooperative) or asynchronous. Special efforts have been made in the development of the synchronous mode. Within the European Telemed Project, a specific protocol has been designed to allow cooperative work between remotely located workstations.

Vincent K. Omachonu* Norman G. Einspruch Many of the innovations in healthcare have been initiated by the healthcare stakeholders (patients, patient advocacy groups, healthcare organizations, physicians, other healthcare professionals, etc.) In some cases, the need for change is forced upon the healthcare organizations by the government in an effort to mitigate healthcare concerns and challenges. Once the need is identified, the next challenge lies in determining whether the need can be met internally or by a healthcare innovation company. If the innovation originates from within the healthcare organization, it is tested, modified and adopted. If it does not originate from within the healthcare organization, the need is instead met by a healthcare technology company that develops, tests and markets the technology to healthcare organizations. In certain cases, a healthcare innovation company takes what might be an imperfect attempt at innovation from a healthcare organization and refines it into a better product, and then markets it to healthcare organizations. It is important to understand the internal process of innovation within a healthcare organization such as a hospital, nursing home, home health, or managed care company. These organizations typically do not have the luxury of a huge research & development department, and so must rely on the raw talent and creativity of internal staff and work teams.

NishigandhaBurute and BhavinJankharia The lack of availability of timely diagnostic services causes great problems for clinicians during emergencies and during the night hours. Moreover, the Health Care Financing Administration (HCFA) in the US mandates round-the-clock services in every hospital. By outsourcing radiology reporting to places such as Australia, Europe, and some Asian countries (including India) hospitals in the USA, UK, and Singapore can be assured of competent and timely professional help. The immediate availability of diagnostic services, which is extremely important during medical emergencies, is a big advantage that outsourcing offers. Outsourcing of 'on-call' night reporting is popularly called 'nighthawking.'

Another reason for the growth of teleradiology is that most parts of rural India do not have good radiological services and personnel. With teleradiology, this deficiency can be overcome by using the help of more experienced personnel in the larger centers in the cities. Also, even in the cities, not all imaging centers have subspecialty expertise; difficult cases in specific areas of radiology can be sent to experts for their opinion.

MATERIALS AND METHODS

The research is conducted using primary and secondary data. The secondary data is collected from various published and unpublished sources. A structured questionnaire has been used to collect primary data from doctors and hospital administrators. Simple random sampling method was used to collect primary data. 150 questionnaires were distributed and 128 were collected by the researcher and 100 questionnaires were chosen for the purpose of the study. A pilot study was conducted to validate the questionnaires and to confirm the reliability and feasibility of the study. A sample of 30 questionnaires was distributed for pilot study. The Cronbach's Alpha Criterion was applied to test the reliability.

The value was determined as 0.926. This also explains that the statements in the questionnaires are understood by the respondents at 92.6% level. The quality of the questionnaire was ascertained and the test showed high reliability. The variables considered for the analysis are satisfying the normal probability distribution. Based on the pilot study, the questionnaires were modified suitably to elicit response from the sample group.

Teleradiology history

The quick advance of communication technology over the last century enabled rapid development of various telemedicine services, which include teleradiology. One of the first telemedicine sessions happened during the 1930s when online liner Queen Mary equipped their medical facilities with equipment that could share medical data with ground-based teams using the wireless radio. The onboard doctors used the early version of the marine radiotelephone to consult with specialists on the ground.

These early radio and telephone techniques slowly evolved over the decades, eventually becoming capable of sending more than a simple audio or video feed. The first occurrence of radiology images being shared via telephone or airwaves happened during the 1960s and 1970s. Experiments and research studies that were done during those years established first techniques for using broadcast television and closed circuit data sharing for sending X-ray imagery to remote locations. These early telemedicine sessions were mostly focused on sharing images from pathology, dermatology and radiology fields of medicine. An especially important breakthrough in telemedicine occurred when Dr. Kenneth Bird from Boston's Massachusetts General Hospital managed to establish a real-time television feed between Logan Airport and a nearby hospital. This enabled airport visitors to take better advantage of not only on-site staff and their medical care services but also specialists from a remote hospital.While there were several other similar examples of teleradiology being used in the 1970s, all those services were plagued with the various limitations and incredibly high costs of implementation, usage, and maintenance. For example, early television broadcast or closed circuit TV systems were capable of transmitting only a basic image quality, which left radiologists access to images and video feeds that were of a very low resolution and poor contrast. In addition to that, these systems were difficult to use since they were only capable of showcasing a single image at a time. All these disadvantages made early teleradiology services more of an exhibit than practical tools that could be effectively be used by medical professionals, leading to many hospitals to actively avoid implementing it.During the 1980s, high costs of video transmission pushed teleradiology into a new era – an era in which physical film copies were mailed to the radiologists, and they in return would record a cassette tape with their report, conclusion, and recommendations, and mail it back to original sender. The entire turnaround for this procedure was at best days, and at most several weeks, which excluded the use of this kind of telemedicine service for any kind of emergencies. Because of the difficulties in film management, several manufacturers tried to implement first examples of digital medical imaging in MRIs, CTs and X-ray machines. The National ElectricalManufacturers Association and American College of Radiology joined in 1983 to create a standard called ACR/NEMA 300, which managed to introduce digital imaging to the medical community. However, their implementation had issues that prevented it from becoming successful. But they did not wait for a long time, eventually releasing ACR/NEMA V2.0 standard in 1988 that enabled service for transmitting digital images via EIA-485 cable. This standard was much more widely adopted, becoming used by many companies that manufactured medical devices. The third version of this standard (DICOM) was released in 1993.

RESULTS AND DISCUSSION

The study aims to analyse the knowledge acquired by the doctors and hospitals about teleradiology and to check their awareness level.

Table 3.1.1.a Gender and Awareness Level:

Gender	Frequency	Valid percent	YES		NO	
			Frequency	Valid percent	Frequency	Valid percent
Male	70	70%	40	57.1%	30	42.9%
Female	30	30%	18	60%	12	40%
Total	100	100%	58	58%	42	42%

Table 3.1.1.b Association between Genderand awareness level:

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.132[a]	1	.716
Likelihood Ratio	.133	1	.715
Linear-by-Linear Association	.131	1	.717
N of Valid Cases[b]	100		

Table 3.1.2a Age and awareness level:

Age	Frequency	Valid percent	YES		NO	
			Frequency	Valid percent	Frequency	Valid percent
25-35	28	28%	22	78.5%	6	21.4%
36-45	33	33%	24	72.7%	9	27.2%
46-55	19	19%	10	52.6%	9	47.3%
56-65	15	15%	6	40%	9	60%
Above 66	5	5%	2	40%	3	60%
Total	100	100	64	64%	36	36%

Table 3.1.2.b Association between Age and awareness level

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.737[a]	4	.045
Likelihood Ratio	9.707	4	.046
Linear-by-Linear Association	8.973	1	.003
N of Valid Cases	100		

Table 3.1.3.a Sector and Awareness Level:

Gender	Frequency	Valid percent	YES		NO	
			Frequency	Valid percent	Frequency	Valid percent
Government	42	42%	30	71.4%	12	28.6%
Private	58	58%	40	68.7%	18	31.33%
Total	100	100%	70	70%	30	30%

Table 3.1.3.b Association between Sector and awareness level:

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.671[a]	1	.031
Likelihood Ratio	4.795	1	.029
Linear-by-Linear Association	4.624	1	.032
N of Valid Cases[b]	100		

Table 3.1.4.a Profession and Awareness Level:

Profession	Frequency	Valid percent	YES		NO	
			Frequency	Valid percent	Frequency	Valid percent
Doctors	25	25%	20	80%	5	20%
Radiologists	75	75%	50	66.7%	25	33.3%
Total	100	100%	70	70%	30	30%

3.1.4.b. Association between Profession and awareness level:

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.083[a]	1	.149
Likelihood Ratio	2.178	1	.140
Linear-by-Linear Association	2.063	1	.151
N of Valid Cases[b]	100		

From the above tables **(Table 3.1.1.a. and Table 3.1.1.b.),** it is clear that 70% of the respondents are male and 30% of the respondents are female and there is an association between gender and awareness level. The male respondents are having a wider knowledge about the Teleradiology than the female respondents.

From the above tables **(Table 3.1.2.a and Table 3.1.2.b)**, it is obvious that 28% of the respondents are in the age group of 26-35. 33% are in the age group of 36-45. The respondents within the age group of 46-55 are covering 19% of the total sample.15% of the sample falls under the age group of 56-65 and only 5% are above 65. There is a very strong association between the age group and the awareness level. 20% of the respondents are yet to get themselves acquainted with Teleradiology practices. The noteworthy point is that 61% of the respondents below the age of 45 are thorough with the features and applicability of Teleradiology. The matter for concern is 39% of the respondents over 45 years of age are completely ignorant about Teleradiology. It is very obvious that higher the age lower is the awareness level about the new technology. The knowledge level and awareness level about Teleradiology is high among the younger generation respondents than the older generation.

From the above tables **(Table 3.1.3.a and Table 3.1.3.b),** it is concrete that 42% of the doctors work for government hospitals with a private clinic and 58% work for private hospitals with a private clinic. There is a strong association between the occupation and awareness level about the Teleradiology. The doctors working for Government hospitals and doing private practice are using Teleradiology to the optimum possible extent. 71% of the doctors practicing in private hospitals are well versed with the concept of Teleradiology and e health management. Two thirds of the doctors working for private hospitals are unaware of the concept of IT in health care management system.

From the above tables **(Table 3.1.4.a and Table 3.1.4.b),** it is apparent that 25% of the doctors and 75 % of them are radiologists having the awareness about Teleradiology practices.There is a strong association between profession and awareness level. The usage of Teleradiology is found to be very high amongthe doctors than the radiologists. 80.% of the specialty doctors carry out their patient management through Teleradiology practices, whereas only 66 % of the radiologists are efficiently using Teleradiology.

Conclusion:

The first teleradiology standard was published in 1994 by American College of Radiology. This standard suggested that both points of the communication lines should be served by radiologists who have hospital credentials. By the late 1990s, several teleradiology companies were founded to serve only the needs of this telemedicine field. One of them, Nighthawk, was especially notable since it allowed sharing data between radiologists located in Australia and Europe, which helped maximize time zone differences for serving patient requests in the U.S.

Today, the proliferation of internet technologies, mobile hardware, and highly capable medical equipment has enabled the field of teleradiology to expand with incredible pace. Today's teleradiology market is being served with hundreds of medical and telecommunication companies, hundreds of telehealth platforms and an untold amount of radiologists from countries all around the world. If current trends continue, the field of teleradiology will continue to grow, enabling even the smallest medical practices and patients in rural communities to take advantage of the radiologist's expertise.

References:

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