International Journal of Electronics Communication and Computer Engineering
Volume 3, Issue 6, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

A Business Case of Telecardiology : Efficacy of The Solution for Business Service Providers

Onkar S Kemkar
PCD ICSR, VMV College Campus
Wardhaman Nagar, Nagpur – 440008
E-mail: onkarsk@in.com

Dr P B Dahikar
Kamla Nehru Mahavidyalaya
Sakkardara Square, Nagpur – 440009
E-mail: pbdahikarns@rediffmail.com

Abstract **- The convergence of the information and communication technology (ICT) has produced many exciting possibilities for developing new services in medical field for the citizens. On the other hand, the industrial countries have a challenge to offer more comprehensive health care services for their population without increasing the costs. It is not a surprise that ICT is considered as a potential solution for distributing health care services for the rural areas. This potential has created a large amount of research and development projects in the area of telemedicine around the world.**

In this paper, we present a concrete business case of telemedicine, where the need of service, technology and economical facts meet each other. The available technology is suitably modified and used for experimentation. The experiment is found to be economically feasible and will provide medical help to needy anywhere, anytime.

Keywords **- Telemedicine, TeleHealth, eHealth, eCardiology, tele-cardiology**

I. INTRODUCTION

Telemedicine is a techno savvy method by which medical facility is taken to rural areas through the help of computers, video conferencing and image transfers [1,2]. Telemedicine enables a doctor from one end to interact with his patients sitting at a remote end in a through video conferencing, share data through a computer and diagnose the patient through various Telemedicine diagnostic equipments. There are many advantages in this field. For example the patient can get help from expert doctors from anywhere in the world, the patient need not travel all the way to the hospital to get an opinion, thus the patient can save a lot of time and money. Though initially considered “futuristic” and “experimental” telemedicine is today a reality and has come to stay [3].

High quality medical services can be brought to the patient, rather than transporting the patient to distant and expensive tertiary care centres. A major goal of telemedicine is to eliminate unnecessary travelling of patients and their escorts. Image acquisition, image storage, image display and processing, and image transfer represent the basis of telemedicine. Telemedicine is becoming an integral part of health care services in several countries including the UK, USA, Canada, Italy, Germany, Japan, Greece, and Norway and now in India [4].

Now a day’s use of telemedicine applications has been referred conventionally as “eHealth”. In this scenario eMedicine is the commonly used word which again refers to telemedicine methodology [5,6].

II. WHAT IS THE USE OF TELE-MEDICINE?

Telemedicine is an application and not a technology. It uses a hybrid technology incorporating elements of television, telecommunication, computers, engineering and medicine. Services can be delivered on a combination of technologies with a variety of equipment [7,8].

Requirements for a Basic Telemedicine Facility: (Ref Your paper in the same conference)

- Either ISDN Line of more than 128 Kbps or broadband of above 512 Kbps
- NT Box required for ISDN line
- 20" and above Colour TV
- PC with Multimedia Kit
- 1.5 KVA UPS
- Terminal Adapter required for ISDN line
- 128Kbps ISDN Video Conferencing Kit / other VC Solutions
- VGA to PAL converter
- High Resolution Digital Camera (3.1mp) or above
- Router for Broadband Line
- Now a days Wireless technologies are also available

With all the above equipments and a junior Doctor to assist, a basic Telemedicine facility can be made available in a Hospital [9,10].

III. RESEARCH OBJECTIVE

The installation of eCardiology Solution in rural hospitals is designed to enable 'real-time' consultative services from tertiary medical centers, with goals of improving access and quality of care provided to patients in rural communities. This paper examines the extent to which telemedicine can be used for the provision of cardiology services, and the financial impact of its use on the tertiary center cardiology clinic.

A. STUDY DESIGN

Cardiology services via telemedicine have been utilized in collection of data and its effect on the rural community for efficient ATM (Any Time Medicine).

Data on this utilization have been collected and used to develop a model for cost and revenue estimation. The data included the type of patient seen, average time spent with patient, diagnoses seen, distance from telemedicine site to tertiary clinic, and travel time avoided through the use of telemedicine. Cost, quality, and access considerations are the driving force of this model. The focus of this study is the cardiology & radiology clinic located at the tertiary care center. The baseline situation is the physician

remaining at the tertiary care center. There are two alternatives in this case. First, there is a clinic located in the rural community in this case; physicians bear the costs of travel to this clinic on a weekly basis. In the second alternative, the patient can remain in the rural community, the physician can remain at the urban tertiary care center, and the encounter can take place via the use of telemedicine resources.

B. BACKGROUND

Telecardiology or eCardiology & Teleradiology are likely one of the most intensively studied fields of telemedicine. An important reason for its popularity is DICOM (Digital Imaging and Communications in Medicine), a global standard for medical image communication. DICOM enables development of image delivering, processing or viewing systems that can virtually utilize the entire mass of radiological image production. Asking for the second opinion of a particular imaging case is an often applied practice in this field. It enables consultation of the remote specialists and is thus an attractive solution.

The rate of the annually performed radiological & cardiological studies per population is the largest in India among the other developing countries. In particular, the amount of radiological studies performed at the health care centers is significantly high in India. As a consequence, most health care centers were equipped with X-ray equipment. Economical and political decisions have lead into a structural problem in India. The education system does not produce enough cardiologists & radiologists to meet with the large amount of studies made. In addition, the rural areas and small cities are not the most attractive places of residence among the majority of the highly educated professionals. These two reasons emphasize the uneven distribution of imaging and diagnostics resources.

IV. PROBLEM

There are roughly two kinds of cardiological imaging studies – those who required a specialist to perform them and those that can be carried through by Interventional cardiologists. Cath Lab procedure is a typical procedure that has to be performed by a specialist. On the contrary, most of the traditional studies can be performed by the Interventional cardiologists. It is a common practice in India that the Interventional cardiologist sells after-hours diagnostic interpretation service for the small hospitals and health care centers. It is possible that a cardiologist visits a certain health care center every third week. They perform studies and diagnose the imaging studies performed by the local personnel. This mechanism has obvious drawbacks. The time delay from imaging to diagnosis is too long and thus the general practioners have to try to interpret the imaging findings. On the other hand, it is not possible that the visiting cardiologists interpret all of the imaging studies, thus they diagnose only a part of them - e.g. those cases the general practioner has considered to require a specialist's review. In an ideal case, every imaging study should be interpreted with a specialist.

We formed a joint project with a private company, which offers diagnostic service in radiology & cardiology. Our goal was to find a more economical solution for the existing problem. We wanted to find a solution that would allow the majority of the imaging studies to be diagnosed remotely. This would produce cost and time savings for the cardiologists & radiologists and better and cheaper service for the health care organizations.

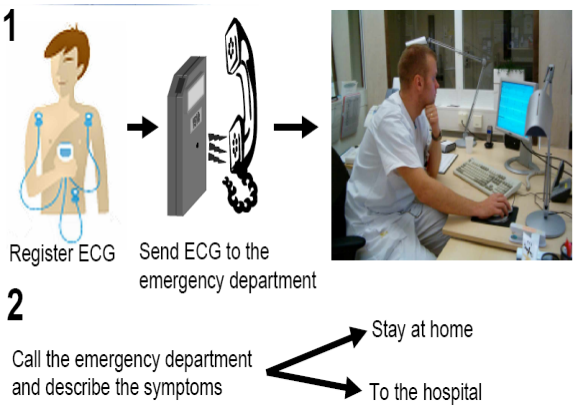
We had to design and implement a system that meets with the following main requirements:

- It enables the health care organization to submit the imaging studies from any of their digital imaging modality to the service provider.
- The service provider has a possibility to set up an office or even several offices where diagnostics are done.
- The system should support the recruiting of the consulting cardiologists & radiologists regardless of their place of residence.
- The costs of the service should be kept low, thus the existing means of communications should be utilized.
- The privacy of the patient data shall not be compromised in any phase of the process.

V. THE SYSTEM

Our main design criterion was to utilize and conform to the international standards in order to provide the maximum interoperability between the systems. The architecture of the complete system is illustrated in the Figure 1.

Figure 1 A shows Architecture of the system



International Journal of Electronics Communication and Computer Engineering
Volume 3, Issue 6, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

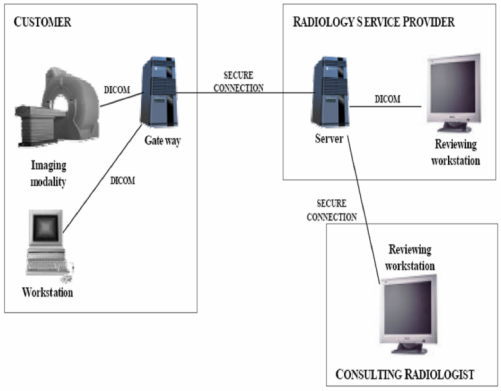


Figure 1. An overview of a remote consultation infrastructure.

The customers, i.e. health care organizations that subscribe to the service, join the system via a gateway that is installed into their premises. Their radiological imaging modalities can transfer images to the gateway by using the DICOM protocol. The gateway delivers the studies via a strongly authenticated and encrypted communication channel to the central server located in the premises of the service provider. The encrypted channel enables the utilization of the existing communication network - regardless of the level of security it inherently provides. The central server, stores the received imaging studies for the duration of the diagnosing process. The studies can be diagnosed with the reviewing workstations, which was initially planned to locate in the premises of the service provider. However, we enabled the remote viewing workstation to join the system via a secure connection. This allows the consulting radiologists to work for the service provider regardless of their place of residence. In addition to image communication, the business logic was built into the system. It consists of the delivery of the narratives and diagnosis, sharing of the diagnostic work between the consultants, salary recording of the consultants, production of the audit trails required by the legislation, and billing of the customers.

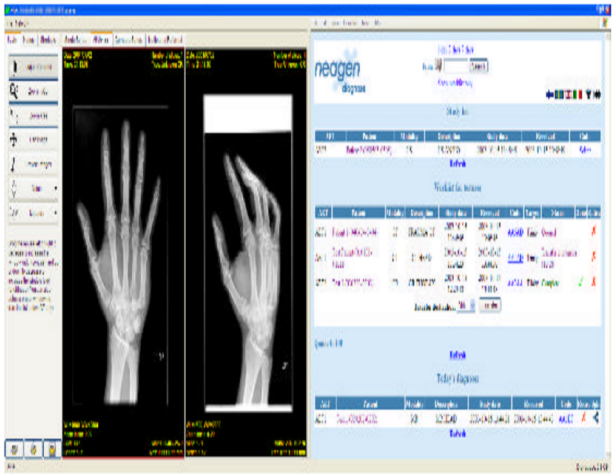


Figure 2. The radiologist's view to the teleconsultation system. The system incorporates image reviewing features and necessary business logic.

Figure 2 demonstrates the view of the system by the consulting radiologist.

In keeping the same configuration for the system parallel system for eCardiology was devised where in the following parameters were considered:

- Doctor to Patient Consultation
- Doctor to Specialist Consultation with 2D Echo, DICOM imaging
- Procedure on Net, where the Cath Lab was made available over the net and the PTCA images were broadcasted live over the net in real time.

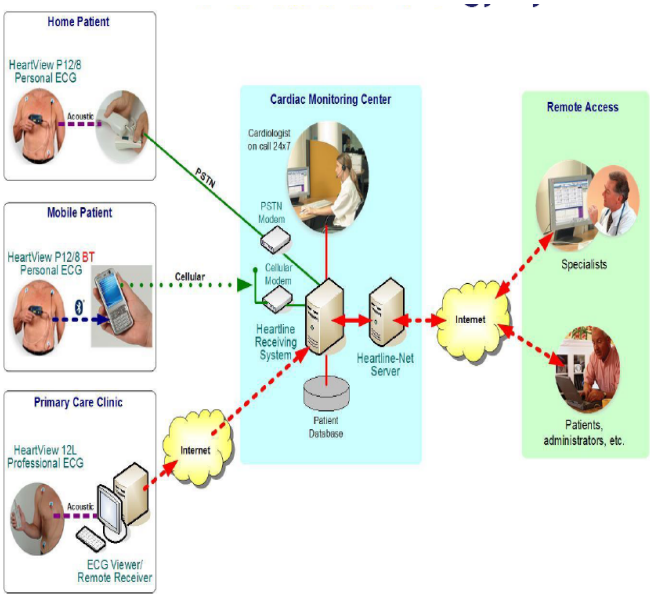


Fig.3. shows the Logical Flow for eCardiology Solution

VI. DISCUSSION

We have participated in several academic telemedicine projects during last three years. Although the potential of telemedicine was acknowledged in the beginning, the results of the majority of the projects were only of academic interest. The same trend can be found from the scientific literature. Although the rapid development of information and communication technology seemed to prepare an easy route for the telemedicine applications - still it was not an exception among the other developments. The development of everyday telemedicine applications required scientific studies, creation of awareness, and the development of the maturity of the underlying technologies, concepts and standards. The telemedicine application presented in this paper is successful, since all of the above mentioned requirements are met.

Any organization performing cardiac procedures & radiological imaging, but having lack of consulting cardiologist & radiologist is able to subscribe to the presented Teleconsultation service. The global standard of medical image communication ensures that their imaging devices are capable to communicate with the system of the service provider. The solution utilizes the existing telecommunication infrastructure, thus no new

investments are needed. These facts make the subscription to the service easy and inexpensive.

The system provides several competing advantages for the private company offering both cardiology & radiology service. The small initial service subscription fee helps to market it to the health care organizations. The reduced need of traveling by the specialist consultants reduces their net operating costs. The system allows them to cut down the time delay from imaging to diagnosing dramatically compared to the current practice, where they visit the customers site every once in a while.

The current wide availability and decent cost of the asynchronous digital subscription line (ADSL) connections provide practical means for transferring the imaging studies to the homes of the consulting specialist doctors. This is an important factor of success of the application. The consultants are also working as private practioners after- hours. Enabling them to work at home at the time they prefer, make the work more attractive, reduce the costs, and increase their productivity.

This telemedicine business case is successful, since it answers to a real need of service, improves the quality and availability of the current service, produces cost savings to the customers and the service provider, and the technology is mature enough to be transparent.

VII. Principal Findings

It is found from the study that:

(1) It is possible to evaluate financial implications of telemedicine, and preliminary findings provide an indication that the value of telemedicine to urban tertiary care centers is non-trivial.

(2) If quality of care and service is maintained via this mode of service delivery, it is obvious that the use of telemedicine resources can save money for the urban care center, at least in the case of cardiology.

(3) These findings can be used to encourage expansion of the use of eCardiology & Teleradiology in similar circumstances and to reinforce the need to modify reimbursement strategies.

(4) It was found that telemedicine resources were used solely for follow-up cardiology cases; never for an initial encounter between patient and cardiologist. Patient satisfaction with the use of telemedicine resources for these follow-up visits was high. Of major importance to the clinic administrators is the fact that the substitution of telemedicine resources for the visit to the consulting clinic results in daily savings per physician according to their payouts.

VIII. Conclusion

The first generation of telemedicine enthusiasts should not forget that technology should be used as a support to treat patients and not viewed as a goal in itself. The challenge today is not confined to overcoming technological barriers, insurmountable though they may appear. **A needs assessment is critical.** Telemedicine today sounds hep and cool and the future however promises to be exciting.

Acknowledgment

The author wish to acknowledge the help received from Dr D A Deshpande, Director, PCD Institute of Computer Studies and Research, VMV College campus for various inputs & methodological techniques in telemedicine.

References

[1] Telemedicine Concepts: Dr R D Lele, Article taken from info media website,2003

[2] Telemedicine Concept Modalities & Implementation: Onkar S Kemkar, 2009

[3] Robert Sh H Istepanian, telemedicine in the united Kingdom: Current Status and Future prospects, IEEE Transaction on Information technology in Biomedicine, Vol 3, no 2, pp158-159, 1999

[4] T Takahashi, The Present and Future of telemedicine in Japan, International Journal of medical Informatics, vol 61, pp131-137, 2001

[5] H S Chen, F R Guo, C Y Chen, J H Chen & T S Kuo, Review of telemedicine projects in Taiwan, International Journal of medical Informatics, vol 61,pp117-129,2001

[6] R K C Hsieh, M N Hjelmn, J C K Lee & J W Aldis, Telemedicine in China, International Journal of medical Informatics, vol 61,pp139-146,2001

[7] N Kasitipradith, The Ministry of Public health telemedicine network of Thailand, International Journal of medical Informatics, vol 61,pp 113-116,2001

[8] B Jankharia, Current statusand history of teleradiology in India, International Journal of medical Informatics, vol 61,pp163-166,2001

[9] S Pavlopoulos, E Kyriacou, A Berler, S DemBeyiotis, D Koutsouris, A novel emergency telemedicine system based on wireless communication technology-ambulance IEEE Transactions on Information technology in Biomedicine, vol 2, no 4,pp261-267 Dec1998

[10] R Benscart, J M Renard, D Delerue & A Sauf, Telecommunication in healthcare for a a better coordination between hospitals and G.P.'S, IEEE Transactions on Information technology in Biomedicine, vol3, no2, pp101-108,June 1999