Review

Telemedicine implementation: barriers and recommendations

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Telemedicine solutions have successfully enhanced the quality and accessibility of medical care by allowing distant providers to evaluate, diagnose, treat, and provide follow-up care to patients. Telemedicine uses telecommunications technology as a medium for the provision of medical services to overcome geographical barriers, and increase access to healthcare services. The rapid developments in the technology are enabling healthcare organizations to see new methods of providing healthcare. Telemedicine is a key initiative for healthcare organizations today. Telemedicine is needed to optimize and support more types of health services for all ages. It makes healthcare more affordable for the poor and the elderly. Telemedicine can be used to provide preventive care in addition to emergency treatment. It is a useful way to provide remote rehabilitation monitoring and chronic disease relief. However, Telemedicine deployment is facing a lot of barriers at different levels. Following the best practices and Recommendations will mitigate the risk of implementation failure.

Key words: Telemedicine, Information and Communication Technology (ICT), healthcare, health services.

INTRODUCTION

Telemedicine has several definitions. One of the best definition is: "The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities" (Strehle and Shabde, 2006).

Healthcare organizations are working to implement telemedicine solutions for several reasons including reducing costs, improving patient services, providing improved access to specialists, access to care, educating patients, and expanding the geographic footprint of the organization.

Telemedicine's common elements are providing clinical support, overcoming geographical barriers, involving the use of various types of ICT, and improving health services. The massive improvement and high utilization of technology by the general population have been the biggest drivers of telemedicine over the past decade, rapidly creating new possibilities for healthcare service and delivery. “Telemedicine holds great potential for reducing the variability of diagnoses as well as improving clinical management and delivery of healthcare services worldwide by enhancing access, quality, efficiency, and cost-effectiveness” (WHO, 2010).

This paper reviews Telemedicine primary or current solutions in the area of Telemedicine and how to improve the health services. It lists some significant challenges and recommended steps to avoid the implementation failure and maximize the Telemedicine benefit.

LITERATURE REVIEW

Telemedicine overview

Telemedicine applications can be classified into three basic types. The first type is store-and-forward or asynchronous; this telemedicine involves the exchange of pre-recorded data between two or more individuals at different times. For example, the patient or referring health professional upload description of a medical case to web-based application and expert who later sends back an opinion regarding diagnosis and optimal management. Second example, the patient or referring
health professional sends an e-mail description of a medical case to an expert who later sends back an opinion regarding diagnosis and optimal management (Rao and Lombardi, 2009). The second type is real-time, or synchronous, this telemedicine requires the involved individuals to be simultaneously present for immediate exchange of information, as in the case of videoconferencing. The third type is hybrid or virtual which is combination of both store-and-forward and real-time (static and dynamic); having the advantages of both types. The communication can be health professional-to-health professional or health professional-to-patient.

“Telemedicine has been advocated in situations where the health professional on duty has little or no access to expert help; it can offer physician remote access to otherwise unavailable specialist opinions, providing reassurance to both doctors and patients. Telemedicine programs have been shown to directly and indirectly decrease the number of referrals to off-site facilities and reduce the need for patient transfers. Telemedicine also provides opportunities for learning and professional development by enabling the provision and dissemination of general information and the remote training of healthcare professionals” (WHO, 2010). Furthermore, telemedicine programs have the potential to motivate rural practitioners to remain in rural practice through augmentation of professional support and opportunities for continuing professional development (Gagnon, 2006). Portable devices can be configured with various onboard applications that connect to special sensors via a standard wireless interface. A physician and a patient can easily conduct a videoconference from both of their mobile devices. Also, telemedicine consultations can conduct a videoconference between two different medical clinics or a physician’s office and a patient’s home (Alexander et al., 2011).

Telemedicine deployment

Telemedicine deployment attempts to bring change to an organization. A telemedicine practitioner must realize that the proper introduction and management of change is essential. The following are steps to achieve success on implementation of Telemedicine programs (Mortensen, 2015):

**Step #1: Defining operating and financial strategy**

Successful telemedicine programs consistently presented a clear vision of the program as well as a clear vision of how the telemedicine program contributes to the overall vision of the organization. At the start of any telehealth initiative, the organization must define and list all issues needed to be solved, situations needed to be addressed, and results to be achieved. The first step in setting a program vision is to identify and understand the strategic and tactical objectives and vision of the overall organization. It is helpful to know what objective the organization wants to use telemedicine to accomplish. This depends on the business model or motivations the organization is pursuing. Examples are:

(a) **Access to Care Model:** Delivering care in rural and underserved communities—groups that traditionally suffer from lack of access to health care due to geography or limited resources.

(b) **Cost Savings Model:** Creating new healthcare delivery methods to reduce cost like, allowing the sharing of resources between hospitals.

(c) **Access to Market Model:** Expanding the market that can be served by a healthcare provider.

(d) **Chronic Care Model:** Targeting specific populations having a common disease state, e.g., diabetes that currently consume the majority of high-cost services.

(e) **Primary Care Support Model:** Leveraging the significant investment in resources and expertise of the entire health system. For example, retail clinic support, urgent care clinic support, diagnostic imaging centers, complementary medicine, specialty hospitals or units, and centers of excellence.

(f) **Wellness or Prevention Model:** “a strategy that starts with the revenue and cost models at the forefront. The goal may be to demonstrate cost savings to a patient’s population, while also closely managing the revenue and cost for the provider organization. For example, a provider organization may wish to establish outreach programs in partnership with a Payer, partner with large self-funded employers to offer remote care for employees from a campus-based health center, or target industries with remote locations where travel is difficult and costly” (Mortensen, 2015).

The model selected likely results from the goals and objectives of the organization.

**Step #2: Define business scenarios and use cases**

Once the overall strategy and objectives are defined, the functional areas within the organization will refine the specific scenarios. In the exercise of defining business scenarios and used cases, the organization will identify specific desired business outcomes. To ensure this is achieved, the organization needs to identify the measurements that contribute to the business objectives and imperatives associated with the program. There can also be a strong case for productivity enhancement for employed physicians, and thus with increased productivity can come increased revenue from greater patient throughput and increased job satisfaction on behalf of the employed physician. This productivity increase most often comes from the reduction in travel.
time to see a patient or a more efficient schedule due to shorter duration of telehealth visits.

Once the financial model has been understood, the next step is to identify the desired business outcomes and their associated value metrics. This process starts by defining the relationship map between the business scenario, the detailed use case being addressed, the desired business outcome, and finally the metric used to identify the value associated with the flow.

As shown in Figure 1, an organization is planning to implement a Telestroke program that links a stroke specialist at their main “hub” hospital and the emergency team at their remote “spoke” hospital. They are looking to achieve two specific business outcomes: increased admissions of stroke patients at the remote hospital and increased follow-up rehabilitation of those patients using specialists at the “hub” hospital. The financial or value measurements are tied to increased revenue and utilization of staff for the stroke treatment program at the remote “spoke” hospital (Mortensen, 2015).

Step #3: Make deployment plan

The first step to any telemedicine deployment is defining the project outcomes. The recommended step here is to contact other clinical leadership, hospital executive leadership, and other stakeholders in the organization to gather their business requirements, desires, and initiatives. The organization should gather requirements across the organization rather than a single department, clinical leader, or service line.

A successful deployment of any solution involves unison of people, process, and technology. Defining the desired workflow of a telehealth deployment is the Process part of that trio. The workflow includes scheduling, reason for a visit, notification of appointment request, queuing, medical device integration, billing, pharmacy, lab and monitoring device integration. The organization should gather the requirements for how the targeted users will use the system and what functionality they will require in achieving their needs. Also, successful deployment of any solution involves technical requirements like voice, chat, video, skill-based routing, notification of waiting patient, patient registration, document sharing, recording, and endpoints. It is crucial to defining a project champion and giving them full support. The three major champions are clinical champion, IT champion, and telemedicine champion.

During the planning of the deployment of the solution, the organization should develop a plan for training. This includes training on the technology and training on the workflow.

Step #4: Architecture components

After defining the use cases and workflow, it is time to put together the architecture components to address that solution. It is recommended to use open standards communications infrastructure that cannot only serve multiple use cases for telemedicine but also provide video, voice, and chat services for the organization’s other internal and external communications used cases.

Telemedicine Architecture contains layers. “These layers are:

(a) Network and Computer Infrastructure: The foundation of any IT system contains the route/switch and wireless infrastructure that will quickly transmit the data securely from one location to another, and any compute components (servers) that will house the applications that provide the service’s functionality.
(b) Collaboration Services: Video and communications back-end servers build on the Network and Compute Infrastructure. Collaborative systems can simplify the establishment of telemedicine expert groups with tools that enable physicians to improve their clinical practice (Monteiro et al., 2016).

(c) Applications and Devices: It involves the end user facing components.

(d) User Experience: There are also cases where additional workflow software is needed. Additional functionality like integrating billing, virtual queuing, EMR integration, e-prescriptions, and skill based routing is required (Mortensen, 2015).

Current telemedicine solutions

There are some services that telemedicine is capable of supporting today. The major services currently used worldwide are:

(1) Teleradiology: “This is the use of Telecommunication to transmit digital radiological images, such as X-rays, Computed Tomograms (CT’s), and Magnetic Resonance Images (MRI’s) across geographical locations for interpretation and consultation” (Fatehi et al., 2015). One of the main benefits of using teleradiology is financial. Teleradiology by its very nature is an efficient and high-quality manner by which patients’ images can be interpreted and diagnosed by qualified specialists. Teleradiology is a key means for optimization of radiology workflow, by bringing the images to the radiologist rather than vice versa. Teleradiology service can be implemented on top of cloud services where we can get the benefit of cloud service and the quality of radiology services. It will facilitate the sharing of clinical information, medical imaging studies and patient diagnostics (Monteiro et al., 2016).

(2) Telepathology: This is the use of Telecommunication to transmit digitized pathological results (e.g. microscopic images of cells) for the purpose of interpretation and consultation. “Pathology plays an important role in identifying the characteristics as well as a cause of a disease in the medical field. Together with current technological advances in medicine, pathology continues to play a role in providing information to medical professionals as well as researchers for further investigation in the form of telepathology. Telepathology, as the name suggests, is an application of pathology under the specialty in which the study itself is conveyed to a distance with the use of images in an electronic format rather than the view from a glass slide” (Lim and Krishnappa, 2012).

(3) Teledermatology: This is the use of Telecommunication to transmit medical information concerning skin conditions (e.g. tumors of the skin) for the purpose of interpretation and consultation. “Teledermatology has been advocated as a model of health care delivery that may diminish inequalities in the provision of an overstretched service and improve access to dermatological care, especially for remote or isolated communities” (Eedy and Wootton, 2001). There are four factors that are associated with a higher number of face-to-face appointments avoided by teledermatology programs: (1) effective preselection of patients for teleconsultation, (2) high-quality photographic images, (3) dermoscopy if pigmented lesions are evaluated, and (4) effective infrastructure and culture in place to implement teleconsultation recommendations (Landow et al., 2014).

(4) Telepsychiatry: This is the use of Telecommunication for psychiatric evaluations and consultation via video and telephony. The use of telepsychiatry provides increased access to mental health services and enhances services to adults, children, and families.

Store-and-forward approaches are the most formalized initiatives; they are relatively simple to implement, require basic infrastructure and are not disruptive to traditional workflows of health professionals and patients. The store-and-forward approach is used predominantly in three of the four telemedicine services examined: teleradiology, telepathology, and teledermatology. Telepsychiatry requires more real-time, bandwidth-intensive data transfer such as videoconferencing for consultations.

BARRIERS TO TELEMEDICINE

Figure 2 shows a list of ten potential barriers facing countries in their implementation of telemedicine services (WHO, 2010). The barriers are as follows:

(1) The most major barrier to the deployment of telemedicine solutions globally is the perception that costs of telemedicine are too high. A shortage of studies documenting economic benefits and cost-effectiveness of telemedicine applications is also a challenge. It does not encourage the organization’s owner to invest in the telemedicine programs.

(2) Legal issues surrounding patient privacy and confidentiality is playing a vital role, competing for health system priorities, and a perceived lack of demand to be barriers to telemedicine implementation. Legal considerations are a major obstacle to telemedicine uptake. Related to legal considerations are technological challenges.

(3) The third-most prevalent barrier reported worldwide was an organizational culture unusual with the sharing and exchange of knowledge and skills with professionals and patients located in remote locations via telecommunication. One such challenge is a complex of
human and cultural factors. Some patients and health care workers resist adopting service models that differ from traditional approaches or indigenous practices while others lack ICT literacy to use telemedicine approaches effectively. The adoption of telemedicine systems requires the acceptance and satisfaction of users involved in the process. Otherwise, the solution will not be utilized.

(4) Infrastructure challenges most of developing countries before or during the telemedicine implement. For example, power supplies, insufficient communication networks, and Internet speed. “Demonstrating solid business cases to convince policy-makers in embracing and investing in telemedicine has contributed to shortcomings in infrastructure and underfunding of programs” (Craig and Patterson, 2005).

(5) Lack of technical expertise is one barrier since the users are not familiar with the new technology. The systems being used are complex, and there is the potential for malfunction, which could trigger software or hardware failure.

(6) “Affirming that cost of equipment, maintenance, staff training, and transportation required for telemedicine is a daunting issue for governments and health providers. One possible reason for this is that telemedicine has not yet proven its value in cost-effectiveness or access and quality improvement compared to traditional health service delivery models” (WHO, 2010).

OBSERVATIONS AND RECOMMENDATIONS

The following are the most significant observations and recommendations:

(1) “Building a Long Term Financial Plan is critical. Programs that start with a solid financial justification and meet the measurements of the plan more easily capture future funding and support. Start with a solid, well-defined plan. Include all the steps to completion and understand the “critical path” issues” (Vander, 2004).

(2) The work Environment should be ready and effective. The services must be available where it is needed. The tools must be available at or very near to where care is provided and where the consulting physician works.

(3) Telemedicine should engage and integrate into the Standard Care Process. Delivering care with telemedicine or without should be the same. Unsuccessful telemedicine programs are that they saw themselves separate from the overall organization and had independent objectives.

(4) Collaboration, participation, and capacity building are essential to the success and sustainability of telemedicine implementation.

(5) High utilization should be an objective of any telemedicine program implementation. Without utilization, the program will decline.

(6) “Some programs start by providing as many sites as possible with a very limited amount of capability in each site. This addresses the widest “horizontal” audience. Other programs start with very few sites with very extensive capability in each site. This gives one or two initial sites exceptionally broad “vertical” capability. A successful strategy is a balanced approach. Establishing a limited number of reasonably capable sites (perhaps 10 – 20% of the anticipated total) appears to work best. This focuses management attention. It also keeps the audience manageable and focused. It simplifies communication and support and maximizes the likelihood of success of the initial sites” (Vander, 2004).

(7) Training is critical. The organization should create a training plan to help the health professional how to use the services.

(8) Marketing is needed. It will help the organization to get new customers and maximize the profit. It should be included at the beginning of the program.
(9) Finally, telemedicine services should strengthen the existing health services rather than compete with it.

CONCLUSION

Healthcare organizations need to establish a vision and architecture strategy for deploying a telehealth program at scale. Telemedicine programs should have goals and measurements. Telemedicine is supposed to provide a good and effective work environment. The organization has to provide training and effective support. Also, provide a good management, assistance, and leadership. The planning and execution of Telemedicine services require extended collaboration with stakeholders. The medical and ITC industries have to set policies to protect individual patients from privacy violations, especially with problems surrounding access to medical information, confidentiality and security. Lastly, the system is nothing if it does not deliver value to the business.

REFERENCES


