

A Technology Acceptance Model-based Analytical Framework for Telehealth Adoption using Green Digital Infrastructure

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ABSTRACT

Generally, health care services are provided to patient in person at clinic, hospital or medical office. But as new technologies like computer, phones are playing vital role in health care sector this scenario changes drastically. Telehealth is one of the new ways of delivery of health care services remotely via use of technology. It includes visit over computer and monitoring health of patient remotely. Hence patient can get advice from experts those are far apart from patient. In telehealth Patient can either communicate with doctor via online mode or via messages, images get advice from doctor. In the telehealth technique patient can sent health care related data to doctor and get advice. Telehealth apps are growing faster with time. The goal of this chapter is to describe telehealth services and social implications of telehealth in day-to-day life. This chapter focus on adaptation of telehealth with the help of technology access model. Telehealth includes four ways to communicate between doctor and patient "live video conferencing, Store & forward video conferencing, distant patient monitoring, Mobile health" out of which Mobile Health is currently in trading. The telehealth aids can be rise in profit, spot additional patients, conveniences, rate saving name of few recent innovations in Telehealth includes Robot, the chair, Dropping Readmission and I-Pad whereas the telehealth roles and responsibility includes identification of team members, defining the role and recognize the group fellows of an initiating site. This script includes telehealth introduction, telehealth communication ways, aids of telehealth, history of telehealth, telehealth application, rural services, innovation in telehealth and roles of responsibility of telehealth.

General Terms

Healthcare Information Systems, Information Technology, Human-Computer Interaction, System Design

Keywords

Telehealth, Telemedicine, Telemonitoring, Technology Acceptance Model

1. INTRODUCTION

1.1 Definitions

Telehealth is nothing but supply of medical services & knowledge via online information & telecommunication machineries. It permits remote patient & doctors (staff of hospital) connection, guidance, reminders, schooling, involvement, 24-hour care [4].

Telemedicine frequently used as a synonym or is active during a supplementary limited sense to clarify remote clinical facilities, like diagnosis, monitoring, etc. When rural locations,

lack of transport, a shortage of mobility, lessened funding, or a shortage of staff control access to concern, telehealth might bridge gap.

Telehealth can include two clinicians conversing a case on video conference, robotic surgery taking place through far-off access, physiotherapy done through digital monitoring devices, live feed & application mixtures, tests being promoted between services for interpretation via a better expert, home observation through incessant conveyance of patient health statistics, client to doctor operational conference, or it could be videophone clarification during a look up[4].

1.2 Telehealth Includes the Following Ways for Communication Between Doctor and Patient

- 1.2.1 *Live video conferencing*: a two-way audio video connection in a patient and provider.
- 1.2.2 *Store & forward videoconferencing*: communication of a verified health past to a health medical doctor, frequently a specialist.
- 1.2.3 *Distant patient monitoring*: the practice of connected microelectronic gears to record individual health & health data at a location for evaluation by an earner in additional place, typically at a time.
- 1.2.4 *Mobile health*: medical care & health data supplied by mobile phones. The data might include overall instructive statistics, expected texts & notifications around disease epidemics [12].

1.3 Aids of Telehealth

1.3.1 Rise Profits

Since the beginning of telemedicine its seeming benefits is to allow providers & physicians to enlarge their reach out their premises to as much as corner of planet wherever connectivity licenses. This permit provider to exploit their reach especially for those situated during a fewer dense zone.

1.3.2 Spot Additional Patients

Provider time is valuable but there's continually time once there's preparation gap of 10 mins to 1 hour. Provider can exploit their time by slotting in telehealth calls among using telehealth system which takes lounge functionalities, appropriate that they can grip call whenever they need.

1.3.3 Convenience

Convenience of your time lost in transportation of providers or patients, waiting long outside the physician room, wasting time when patient unused appointment, patient is very sick to leave their home.

1.3.4 Rate Saving

You do not necessarily physical clinic to practice treatment. Telehealth Solution allow you a virtual clinic as of your headquarters; it lets patient to attempt to preparation, on demand visit, can manage patients through the system, it also maintains patients visit & medical record, billing solution.

1.3.5 Receive quick Second Opinion

Time is vital for patient and doctors got to receive opinion from additional specialist, using telehealth software. Doctors can easily establish a video call to desire the 2nd opinion saving the patient's life.

1.3.6 Better Healthcare Quality

Studies have always shown quality of healthcare takes risen when telehealth is installed with dropping readmission rate. Providers are agreeing to perform regular follow up of their patients related to traditional visit.

1.3.7 More Intelligent Solution

With telehealth companies including EMR that is electronic medical record, billing resolution, AI judgment, telehealth system is progressing at faster rate than traditional brick & mortar services. Using telehealth solution resources, the doctor tap into new technologies via a lesser charge of change [8].

1.4 History

The history of telehealth is intensely rooted with technology growth & its acceptance in society. Telehealth was experienced in past. In current era with the invention of the web, moveable policies & other digital strategies are playing transformative role within healthcare & its delivery. Some of medical data are frequently communicated to distance easily as verbal data.

1.4.1 Ancient Telehealth

Communication among towns was communal. Additional means of over distance communication turn into widely adopted. At the same time, many of such communication mediums precisely smoke signals & lightweight reflection remained want to connect medical information. Long-distance communication means were used to signal epidemics of plagues.

1.4.2 Early Telemedicine

The past of current telehealth was started by the developments of the telegraph and telephone. Earlier to telegraph and telephone communication developments not expand the space of telehealth. Mail another widespread communication medium was hand-me-down for medical communication.

With the telephone the stage of development connected world here. Major hospitals use telephones. Within few years, many residents had telephones at their homes. Then physician hash out the telephone to patients & delivers medical advice.

1.4.3 Telemedicine and Internet

The growth of the web in the 1990s brought knowledge explosion. Web protocols permissible support for almost all data needed for telehealth, includes, text, photos, video, image standards. Then many doctors switch over Facebook and twitter to give medical advice. Where patients can post comments to physicians.

Plenty online medical applications are also in society. Patients examination their symptoms via "doctor Google" earlier to find out physician.

Telehealth is now completely embraced the internet communication media [2][5].

1.5 Telehealth Applications

Telehealth gives the convenience, cheap solution, and accessibility of health information & communication via the web. The application of this covers a good & diverse scope together with online databases make sure standards, patient outcomes, Computer aided diagnosis, Operative drug information system and e-prescription, improved availability of investigation data.

Clinicians are agreeing to handle many more patients than old-style care models allow and with enlarged access, physicians & patients work together to understand their goals, within home[12].

1.6 Telehealth Services at Rural Communities are

Long-lasting care interventions in telehealth to provide patients their medical care visits. Patients can access emergency services in real time and consult to local even for example Avera eCARE. Home monitoring can be possible. Chronic Disease Self-Management is an illustration for this. Avera eCARE ICU offers 24/7 medical attention of critically seek patients through telehealth.

Lasting care offered via telehealth can convey specialized care for elders who exist in lasting care in rural location. Online therapy & remote counseling in rural residents through urban health and psychological counseling services.

Interpreter services were frequently transmitted on demand via audio or visual technology to patients who express limited or not in English.

Programs reinforced by telehealth proposal new methods to improve healthcare entree and quality through extending reach of services, enlightening the influence of rural providers to pact with range of medical situations as an example see RHHub's[14].

Some widespread telehealth services areas are as follows:

1.6.1 Telemedicine

It is subcategory of telehealth which is also known as virtual health.

With telemedicine technique patient directly make a call, SMS, video to a doctor or provider via telephone services.

1.6.2 Tele monitoring

Remote patient monitoring term can be used interchangeably with telemonitoring. It is use observe patient health even after outside of clinical settings. Telemonitoring use to automatically transmit data between patients & physicians

1.6.3 Telehealth nursing

It is use by nurses to distribute care remotely. It allows nurses to communicate with patients, observe their situations via phones, computers, audio, video tools.

1.6.4 Telehealth physiotherapy

Also known as telePT enables doctors to distribute far-off care of patients via technology-based meetings instead of hospital/clinic. It includes orthopedic, geriatric physiotherapy, & neurological physiotherapy.

1.6.5 Telepsychiatry

Known as telehealth psychological state / teletherapy can include direct communications between patients &

psychiatrists. Examples includes LARKR, Pacifica, Talk space and so on [10].

1.7 Recent Innovation in Telehealth:

These innovations represent the inspiration that fuels development as healthcare workers in 21st century.

1.7.1 Robot

To begin with there are many robots who works with telehealth services. With robot's doctors & nurses are equipped to focus on patient while it functions independently. Robot can be an extraneous stand by for a doctor & cooperate with additional doctor.

1.7.2 The Chair

Massage chairs have seen in malls shops, enjoyed, but no one buys them. But chair can provide huge array of bio data including weight, temperature, motion analysis and reflex response time. The patient must sit within chair and let an external clinician do work.

1.7.3 Dropping Re-admissions

Since dropping hospital re-admissions is the one number money saving side. The Re-admission Avoidance focuses on practical care transition development, focuses on patient, after discharge care management and remote monitoring. It even executes discharge orders.

1.7.4 I-Pad

I pads are portable and popular among the young generation. It is used as learning tool. Through VSee patient via single click videoconferencing connect to doctors[3][13].

2. ROLES & RESPONSIBILITIES OF TELEHEALTH TEAM

2.1 Telehealth Team

It contains Telehealth Workers, Nurses & Clinical Lead who effort with patients analyzed with long term conditions to support them display, manage & control their individual health. Long Term circumstances may include Diabetes, BP & heart problems that need to be achieved carefully to evade periods of infection and unnecessary visits to hospitals & admissions.

Building Team involves; Detect the team fellows of a archetypal Distant site, delineate the roles of Telehealth team followers, discriminate between the diverse roles and tasks of Telehealth team followers, and classify the team followers of a archetypal Inventing position [11].

2.2 Roles and Responsibilities of Team

Building good team is building positive telehealth program. There are numerous key roles mandatory for a telehealth system to achieve success.

2.3 Program Champ

In any organization for any new program a strong Program Champ is done. In this case the Program Champion must have a superb considerate of telehealth & its benefits to the patient. Engagement, experience, leadership are necessary qualities. Program & project Administrator

Work of manager is to examine the outcomes. And to check whether the outcome matches to goal or not. So, this person should deeply understand the policies and procedures of the organization. Must know patient diagnosing process as well as knowledge of technology.

2.4 Instruction Manager

Team must be educated, and this is managed by this manager. His/ Her role is depending on organization dimension and the availability of the resources.

2.5 Hardware Manager

The hardware Manager is responsible for installation, uninstallation & cleaning devices. Safety of device is also to be considered. Good technical, and problem-solving skills are main contributors.

2.5.1 Nurse

Nurse is key part of team. As she is responsible for continuous monitoring of patients, follow guidelines of doctors, maintain inventory.

2.5.2 Marketing Manager

It is vital to identify someone in organization with marketing skills to successfully market program [1].

3. CURRENT TECHNOLOGY OF TELEHEALTH

Management of Telehealth programs and infrastructure: For smooth execution of telehealth system management of it is very necessary. There are numerous guides to plan telehealth system.

“An institute design a telehealth suite must make the key undertake the steps, reiteration the technique with supplementary passes, and transform each phase until it's self-reliant that the design faithfully signifies a suite which will be applied with a high possibility of victory. After attaining this equal of self-reliance, the institute must make a pledge to instrument the plan.”

Following are the steps used to manage telehealth system:

3.1 Calculate Necessities and Viability

Define the requirements to deal with a telehealth program involves well trained yourself, analyze services, develop feasibility of time and cost, Create business plan.

3.2 Implementing a Care Services Plan

After telehealth services are selected to be incorporate in system, its implementation is planned. Team must set targets, objectives to be achieved, responsibility of staff. Protocols of system is also considered here.

3.3 Built a Commercial Plan & Risk Analysis

Emerging commercial plan might be a critical phase that is regularly omitted. The goal of program can be predictive in pilot phase. Though, projection cost, revenue sources within future are the term to support make believers & key administrators which can guide respective step. Kit replacement rate must be considered after every 5 years.

3.4 Develop a Technology Plan

Technology plan should support real needs service plan, business plan which increase chances of sustainability of telehealth system. Make prediction of cost needed in technology equipment to serve telehealth system.

3.5 Train Peoples

Develop & implement an awareness for working out peoples to unite them aimed at the onset of the technology; and its use in patients as well as earners.

3.6 Pilot Facility

Pilot study must be done with few patients and team for technology plans and care for some duration. This study can predict the outcome of actual telehealth system.

3.7 Evaluate Results

Quality assurance team of organization must analyze the outcome to check whether it match to expected telehealth system outcome or not. Hence research is needed here.

4. COMPONENTS

Following are the components which are required to build successful telehealth infrastructure.

4.1 Hardware

When building a telehealth program, the hardware component first which will be united into a telehealth application to work out need gap. Hardware needed is carts, tablets, terminals & private devices.

4.2 Software

Once hardware of telehealth programs selected, it's crucial to possess the supplementary telehealth software that easily integrate with all hardware & current healthcare system.

4.3 IT Setup

A telehealth setup includes all necessary hardware and software for implementation with multiple healthcare platforms.

4.4 Patient Data & His Security

Patient's data & his security is vital element. If there is some problem in security then it results in a breakdown in telehealth services, or inappropriate entree to patient data. [7]

5. CHOOSING PROPER TECHNOLOGY FOR TELEHEALTH

Here are several the differing points which are most vital to selection of technology for telehealth implementation:

Design and designers understanding of platform

Cloud based technology

Data security

Mobile phone friendliness

How technology worth in other practices

E-prescription (electronic prescription)

Easy to use.

6. INNOVATIVE FRAMEWORK FOR TELEHEALTH USING GREEN TECHNOLOGY FOR SUSTENANCE OF HUMAN LIFE

Davis (1986) established the Technology acceptance model which relates further precisely with forecast of the suitability of a system. Goal of model is forecasting the adequacy of an instrument & to spot alterations those are essential be distributed to the scheme so as to procedure it suitable to users. This shows acceptance of system is mainly depending upon two things: perceived usefulness & perceived simple use.

This same model is proven true for telehealth. Researches proves that alleged utility and alleged ease of usage are the most conjoint and important factors of telehealth reception. These two factors play very important role in adaptation of telehealth.

It is observed that in abroad countries telehealth is used more frequently than in India. There some factors in India which influence perceived usefulness and perceived ease of use towards telehealth as shown in fig.

That factors include:

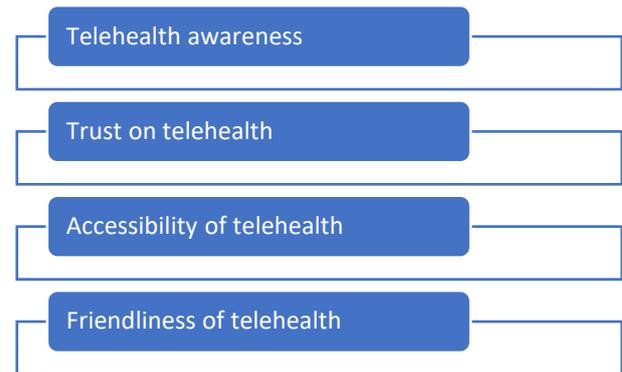


Fig 1: Factors that in adaptation of telehealth use

6.1 Telehealth awareness:

India is developing country so people in metro city know and use telehealth when needed, but people in rural areas are not aware of telehealth application. So, awareness regarding the same can be created by visiting physically in villages and make them to understand use of telehealth.

6.2 Trust on telehealth:

Those people who are aware of telehealth application they cannot trust easily on system as well as new telehealth team. So, it is important to include popular as well as local telehealth team into the system.

6.3 Accessibility of telehealth:

Accessing telehealth is easy in cities but in rural areas it is not easy. So, access through government person like Asha or by providing them facilities to use telehealth like device, vendor, etc.

6.4 Friendliness of telehealth:

Friendliness of telehealth is also important to use it. Simple, small procedure should be there to use telehealth by considering frustration level of user. Even language problem is also considered while development of telehealth application.

Table 1: Comprehensive Evaluation Parameters

| Parameter | Impact Level | Analytical Interpretation |
|-----------------------|---------------|---|
| Perceived Usefulness | High | Directly affects sustained telehealth adoption. |
| Perceived Ease of Use | High | Reduces resistance and improves engagement. |
| Trust & Security | High | Essential for long-term patient retention. |
| Awareness | Moderate-High | Determines initial system exposure. |
| Accessibility | Moderate | Dependent on digital infrastructure availability. |

7. SOCIAL IMPLICATIONS OF TELEHEALTH ON DAY TODAY LIFE

Telehealth uses electronic material and telecommunications skills to support remote clinical healthcare might be a growing tendency that gives better patient access, price savings, and additional engaged patients. For nurse who mark patients through a sort of situations, telehealth helps to improve health care services to underserved peoples. Though, there are tests including wide differences in the rules & regulations, and practice plans surrounding telehealth. At real time, individual attitudes towards technology growths and telehealth also are varying positively. Young generations & elders have begun to use the outcomes.

Here are few implications of telehealth on day-to-day life of patient as well as health care team: better patient access, Nurse can use telehealth to improve health delivery to patients, Patients in ICUs(Intensive care Unit) by telehealth have considerably reduced death rates, condensed complications, reduce cost hospital visits, reduce cost of patient transfers for emergencies, can help more patients, Nursing shortages are solved, Rural clinicians quickly consult specialists, patients relate to family, reduces the carbon footprint.

8. DISCUSSION

The chapter focuses on telehealth technology and its use in society. It also suggests advantages of the telehealth services[6]. It has been observed that even though there are many benefits of using the telehealth services there are few parameters which affect the adoption of the services[7]. These parameters are awareness, user friendliness, trust and accessibility. When these parameters are improved automatically use of telehealth services are increased in future[9]. Even new secured application can be developed to increase the use of telehealth services.

9. CONCLUSION

Many technology growths hold the possible to improve the standard of lifetime of folks and make life easy. Lifestyle is drastically changed due to technology innovation. The Technology Acceptance Model framework for telehealth acceptance in current era is presented in the study. The output confirms that telehealth utility, user friendliness and security affect the acceptance. Telehealth is now used as a rate effective and effective tool in distributing healthcare services at remote for refining the clinical results and increasing patient participation within the care. It also supports to green technology because it reduces printing, less paperwork required here. But still, we've to require efforts to simply accept telehealth in India specifically in rural areas, as there are few factors which affect adaptation of telehealth. In future smart tele diagnostics, block chain enabled medical data security, 5G enabled rural telehealth enlargement, multilingual adaptive edges, prognostic analytics for long-lasting disease supervision, and large scale longitudinal experiential authentication using real world datasets.

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