Telehealth - Patient Integration

Final Research Project

System Analysis & Design

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Department of Applied Computing

MS (Health Informatics)

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Introduction

According to healthIT.gov, "The Health Resources Services Administration defines telehealth as the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration."

In layman's terms, telehealth may be defined as the delivery of healthcare services using telecommunications technologies. It can be a mobile health application, videoconferencing, or remote patient monitoring. It has the potential of being particularly useful for people living in remote or underserved areas and the individuals who have difficulty traveling to a healthcare facility. It is a collection of means to enhance the care and education delivery.
The main components of telehealth may include:

1) Live Video - It is real-time communication between patient and healthcare provider. This component of telehealth allows the patient to receive the medical advice and diagnosis remotely, without physically visiting the healthcare premises.
2) Store-and-forward - It involves the transfer of patient data and medical information among healthcare providers. It is helpful in case of specialist consultation of the second opinion.
3) Remote Patient Monitoring - This is helpful in monitoring the patient health remotely through wearables, other medical devices. The data is regularly transmitted to healthcare providers who can continuously monitor the patient's condition and intervene if required.
4) Mobile Health - This is the usage of mobile applications such as MHealth and other technologies to deliver healthcare services and support to patients. These have proved to be helpful in providing patient education, medication reminders, and access to telehealth services.

Chronic diseases may be defined as conditions lasting at least three months or more that require ongoing medical attention, limit activities of daily living, or both. Chronic diseases include diabetes, hypertension, heart disease, cancer, etc. In the USA, chronic diseases are the leading causes of death and disability.

According to the Centers for Disease Control and Prevention , chronic diseases are responsible for 7 in 10 deaths each year, with heart disease, cancer, and strokes being the leading causes of death.

According to the National Library of Medicine, 80% of elderly Americans have at least one chronic disease.

Characteristics of subjects in the weighted AHEAD sample	
Variable	**Mean**
Age as at baseline **(elderly patients)**	84.3 (3.56)
Female	60.00%
Years of education	11.3 (3.48)
Marital status:	
Not married	7.30%
Married	36.20%
Widowed	56.50%
Prevalence of ADL (Activities of Daily Living) disabilities as at wave 2006:	
Bathing	34.30%
Dressing	28.40%
Transfer bed /chair	18.30%
Walking	30.30%
Toileting	21.10%
Eating	17.60%
Prevalence of ADL disabilities as at wave 2014:	
Bathing	50.00%
Dressing	51.00%
Transferring bed /chair	33.60%
Walking	42.70%
Toileting	33.60%
Eating	36.10%
Ever have a 'big four' chronic disease (1998–2014)	76.60%
By condition:	
Cardiovascular disease (CVD)	59.40%
Cancer	22.00%
Diabetes	14.50%
Chronic lung disease	13.00%
Any of these 'big four' conditions	75.00%

Notes: The weighted full sample comprises 4,587,315 subjects (unweighted: 1604). Of these, 3,514,052 subjects (unweighted: 1203) either had a major chronic disease at 1998 baseline or developed such a condition over the follow-up period. The comparison group comprises 1,073,263 subjects (unweighted: 401)
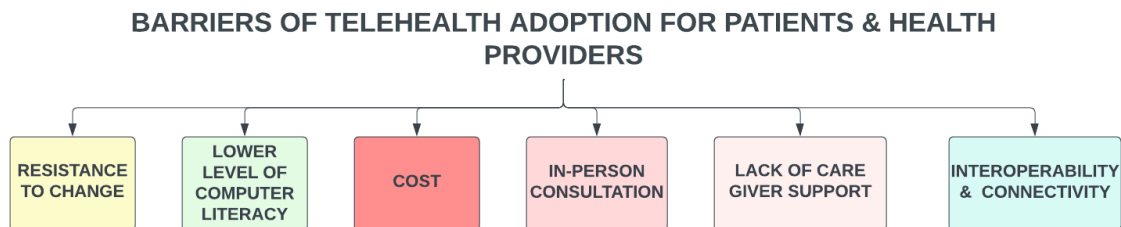
In the above table the statistics show that elderly patients are being disabled and cannot move to the healthcare premises. Thus, We need the solution for this menace. Telehealth can be the game changer in the care of these patients.

The telehealth industry got a boom during the COVID-19 situation because the practitioners and the patient had no other solution to prevent the COVID-19 spread. This was the time when chronic disease patients and also the elderly patients had no choice but only telehealth services. People are starting to take interest in telehealth. After C0VID-19 the traditional way of Doctor-Patient interaction started again but few patients were still interested in telehealth and now the telehealth needs a little more advancement and there are few problems that need to be resolved to continue the same method of patient care but with a lot of advancement.

Through this project, we have tried to cover all those issues. This project aims to explore the barriers hindering the adoption of telehealth among the elderly population and health providers, including inadequate technical support, lack of access to user-friendly telehealth platforms, and insufficient training. The objective of this project is to develop patient/end-user implementation guides and "easy to understand" user guides for a telehealth application, remote patient monitoring equipment, and a participation checklist to ensure that everyone has the necessary resources to be a part of the telehealth patient monitoring network. The implementation of these resources is expected to improve the adoption and utilization of telehealth monitoring among the elderly population, leading to better health outcomes and overall quality of life.

Problem Statement

Telehealth has the potential to improve access to healthcare and health outcomes for both elderly patients and healthcare providers. However, there are several common barriers that hinder the adoption and implementation of telehealth.

BARRIERS OF TELEHEALTH ADOPTION FOR PATIENTS & HEALTH PROVIDERS

RESISTANCE TO CHANGE	LOWER LEVEL OF COMPUTER LITERACY	COST	IN-PERSON CONSULTATION	LACK OF CARE GIVER SUPPORT	INTEROPERABILITY & CONNECTIVITY

1. Resistance to change : Both elderly patients and healthcare providers may be hesitant to adopt new technologies and change their usual routines. Additionally, both groups may have concerns about the privacy and confidentiality of telehealth services.

2. Lower levels of computer literacy : This can make it difficult for patients and providers to access and use telehealth services.

3. Cost : It is another common barrier that affects both elderly patients and healthcare providers. For elderly patients, the cost of technology and internet access can be prohibitive. For healthcare providers, the cost of implementing telehealth services and the lack of reimbursement for these services can be a major barrier.

4. In-person consultation : Some patients may feel that telehealth services are not as effective as in-person consultations, especially when it comes to physical examinations and assessments. Similarly, some healthcare providers may feel that telehealth services are not as effective as in-person consultations when it comes to building rapport and trust with patients. This can make it challenging to convince patients and healthcare providers to switch to telehealth services.

5. Lack of caregiver support : Many elderly patients rely on family members or caregivers to assist them with their healthcare needs. However, telehealth services may require more independence and technical proficiency from patients, which can be difficult for caregivers to manage. Additionally, some caregivers may feel that telehealth services are not as effective as in-person consultations, which can make it challenging to convince them to support the use of telehealth services for their loved ones.

6. Interoperability and connectivity : Elderly patients may struggle with limited bandwidth and connectivity issues that can make it difficult to use telehealth services effectively. Healthcare providers may also face challenges with interoperability between different telehealth platforms and electronic health record systems.

To overcome these barriers, it is important to provide many solutions to both patients and healthcare providers to help them understand the benefits and limitations of telehealth services in elderly population. By addressing these common barriers, we can promote the adoption and implementation of telehealth services and improve access to healthcare for all patients.

Research of Clinical Application or System:

Telehealth Technology:

1.Video conferencing:

The use of video conferencing technology permits patients and healthcare practitioners to have remote consultations. This technology allows providers to conduct virtual visits, check-ins, and follow-ups, which eliminates the need for in-person visits.

2. Electronic Health Record System:

These are digital records of patient health information (including medical histories, prescriptions, test results, imaging, etc.) that can be accessed remotely by healthcare providers.

3. Remote Patient Monitoring:

Remote monitoring tools, such as wearable sensors and smart medical equipment, allow healthcare professionals to monitor patients' vital signs, symptoms, and medication compliance from a distance. Internet of Medical Things (IoMT) devices are internet-connected devices that perform specialized functions and communicate with each other and cloud health information systems. These gadgets offer real-time information that can be utilized to modify treatment strategies and enhance patient outcomes.

4. Mobile health (mhealth) applications:

These applications allow patients to track health measurements, set medication and appointment reminders, and share information with clinicians. Users can access hundreds of mHealth applications, including asthma and diabetes management tools as well as weight loss or smoking cessation apps.

5. Data analytics:

Tools for mining patient data for patterns, trends, and treatment gaps can be employed in data analytics. By using these findings, providers can raise the standard of care, identify high-risk patients, and focus interventions.

6. Artificial intelligence (AI):

AI is a tool that can be used to analyze massive amounts of patient data, spot patterns and trends, and create prediction models. The application of AI by healthcare professionals can help them create individualized treatment programs and spot patients who are at risk of consequences. AI is being used to provide real-time feedback to physicians. This is done by using machine learning algorithms to analyze patient data and provide insights that can help improve care. Teladoc, which offers a platform that uses machine learning to provide real-time insights to doctors during in-person consultations,

AI is being used by providing automatic reminders to patients. This is done by using machine learning algorithms to analyze patient data and provide insights that can help improve care.

Ideologies for overcoming telehealth hurdles:

1. Access to technology:

Access to technology, especially for underserved groups, is one of the largest obstacles to telehealth. Healthcare professionals and other interested parties can seek to improve patient access to technology by expanding the availability of computers, cellphones, and tablets while also teaching patients how to use them.

2. Payment procedures:

It can be challenging for healthcare practitioners to deliver telehealth services since they are sometimes not compensated at the same rate as in-person consultations. In order to address this, authorities might seek to modify the way that healthcare practitioners are compensated and offer telehealth services by offering financial incentives.

3. Licensure and regulation:

Telehealth services are subject to state licensing and regulation, which may present difficulties for medical professionals who wish to work in several states. Policymakers can try to address this issue by removing unneeded obstacles that stop healthcare professionals from providing telehealth services and by developing more uniform licensing and regulating laws across jurisdictions.

4. Connectivity and infrastructure:

Inadequate internet connectivity and infrastructure, particularly in remote regions, might restrict access to telehealth services. Policymakers can act to invest in broadband infrastructure and guarantee that patients have access to dependable and reasonably priced internet services to address this issue.

5. Patient privacy and security:

Patients who use telehealth services may be concerned about the secure transmission of their personal information. Healthcare providers can address this problem by implementing strong data security measures like encryption and multi-factor authentication and by informing patients about the protections their data is subjected to.

6. Deal with technical difficulties:

Healthcare practitioners can assist patients with technical help to resolve any problems with telehealth platforms or devices.
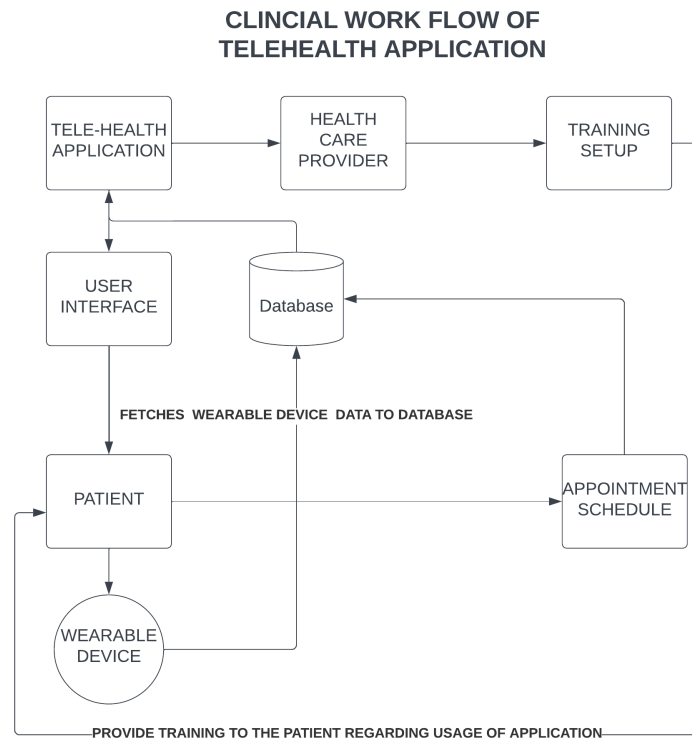
7. Raise telehealth awareness:

To encourage greater use of telehealth services by patients and healthcare professionals, legislators and healthcare providers can collaborate to raise telehealth awareness.

Home telehealth apps (also known as telehomecare applications) use telecommunications and videoconferencing technology to connect a health care professional at a clinical location to patients in their homes. A virtual visit is a videoconferencing encounter like this. The typical visit by the healthcare professional to the patient's house, which involves a face-to-face encounter, is referred to as an "actual visit." In addition to using videoconferencing to improve interactions, telehomecare programs make use of vital signs and other reporting devices, which allow patients to become more active and, in many cases, manage the monitoring process. In addition to this, the video system includes peripheral equipment for assessing cardiopulmonary status.

Care Convene Platform:

CareConvene is the most comprehensive virtual health platform on the market, with the goal of proactively improving health outcomes via safe patient access.

CLINCIAL WORK FLOW OF TELEHEALTH APPLICATION

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┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│ TELE-HEALTH  │ ───► │ HEALTH       │ ───► │ TRAINING     │
│ APPLICATION  │      │ CARE         │      │ SETUP        │
│              │      │ PROVIDER     │      │              │
└──────────────┘      └──────────────┘      └──────────────┘

┌──────────────┐      ┌──────────────┐
│ USER         │      │ Database     │
│ INTERFACE    │      │              │
└──────────────┘      └──────────────┘

      FETCHES  WEARABLE DEVICE  DATA TO DATABASE

┌──────────────┐                        ┌──────────────┐
│ PATIENT      │                        │ APPOINTMENT  │
│              │                        │ SCHEDULE     │
└──────────────┘                        └──────────────┘

   ╭──────────╮
   │ WEARABLE │
   │ DEVICE   │
   ╰──────────╯

  PROVIDE TRAINING TO THE PATIENT REGARDING USAGE OF APPLICATION
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In this case, a lot of patients have landlines, not cell phones. So there is no way to get a tutorial beforehand. A document is left behind that shows each and every step of care in big red circles and bold text. At that point, it is really up to the patient to utilize the care. Some of the patients do not have any internet at home,so it is arranged for them. Some of the things to worry about are the reading levels of the patients, and there is still a population that is not literate enough to understand some of the things that are given in the document (the guidelines of the telehealth app).

Currently, this project is mainly focused on overcoming this issue by preparing a video tutorial in a language that is easy to understand. That screen capture video is going to be a two-minute video that is very focused, in which a verbal dialog is going to follow somebody interacting in the application. This focuses on the visual part of the lesson. There are several advantages, like the fact that it provides a medium for people to learn on their own time without having to read or really just watch and listen. If there is no wifi connection, they are going to set it up with that. Enough visits are made within the areas, and technical assessments are made.

There's an interface between telehealth applications and electronic health records. Both interfaces can be reached using ' Drug Secure Messaging' and CCD (Continuity of Care

Document), which carry discrete data. CCD is a transport mechanism for sending messages directly and securely from one system to another. One of the main challenges in an EHR is that when one document comes in, it pulls up a patient name after confirming the patient's identity and merging the patient's data. Other issues with them are that they state they can consume a lot of data elements while sticking to only four to five data elements.

The Care Convene platform uses a template called a "crowd-sourced template," which means that when a hospital sends a discharge notification, it sends a continuity of care document with all the patient's information. It is put into a structure so that someone can see it in different categories and break it down. There are two sections: discharge medications that are at the time of discharge and discharge minus medications that are updated to the CCDA conformance guide. When this is supposed to be adding data, the data is being replaced, causing a big stir, which has become a barrier in HIEs right now. A Care Convene visit is not a transactional interaction between the providers, but multiple conversations are possible within one visit. Firstly, the system could ask a few questions about what the provider wants to know priorly and the answers are collected by the care convene chat to the providers such that they are ready to give care. A huge effort is being made between the providers for caregiving. After the virtual Visit , instructions and next steps are moved to the patient's record such that patients can go back and review the notes later.

The Care Convene platform could be useful for patients with chronic conditions who live in rural areas and require long-term follow-up care. One of the advantages of the platform is its ability to facilitate remote patient monitoring and virtual visits, which can help patients to receive care without the need to travel long distances to see a healthcare provider.

The platform's ability to collect and organize patient data, including medication lists and discharge summaries, could also be beneficial for patients with chronic conditions who require ongoing care management. Additionally, the ability to communicate with providers and access care instructions and next steps through the patient's record could help to ensure that patients are receiving the right care at the right time.

However, it is important to note that the effectiveness of the Care Convene platform for patients with chronic conditions in rural areas will depend on a number of factors, including the availability of reliable internet connectivity, the accessibility of healthcare providers who are able to use the platform, and the willingness of patients to use digital health tools. Care Convene platform could be one of the solutions to address the challenges of rural healthcare delivery, but it should be implemented and used appropriately to maximize its potential benefits.

Overcoming Barriers:

1. Patients' reluctance to receive care via telehealth can affect the overall result of remote healthcare delivery. To overcome this barrier, it's important to introduce telehealth gently and explain why it simplifies care. By establishing continuous communication to maintain patient knowledge and keep them up-to-date with upgrades

2. Providers can offer training and support to patients to improve their computer literacy skills, simplify the technology, use alternative methods of communication, provide technical support, and collaborate with community organizations to provide computer literacy training and support. This can be done through one-on-one training sessions, group classes, or online resources. Telehealth technology can be made more user-friendly by simplifying the interface, using clear language, and minimizing the number of steps required.

3. Providers can advocate for reimbursement from insurance companies and government programs to cover the costs of implementing and providing telehealth services. They can use low-cost technology, partner with community organizations, offer sliding-scale fees, and prioritize high-need patients for telehealth visits. These strategies can help make telehealth services more affordable for patients on a limited income.

4. Healthcare organizations can take several steps to overcome the barriers of patient and healthcare provider skepticism around telehealth services. These include educating patients and providers about the benefits of telehealth, providing clear and transparent information on the telehealth process, ensuring that telehealth services are user-friendly and accessible, providing training and support for healthcare providers, and offering a hybrid approach that includes both in-person and telehealth services. These steps can help to overcome the barriers of patient and healthcare provider skepticism around telehealth services, such as increased access to care, reduced wait times, and improved convenience.

5. Healthcare organizations should ensure that telehealth platforms are easy to use and require little technical knowledge to operate, educate patients and caregivers on how to troubleshoot common connectivity issues, provide technical support, form partnerships with telecommunications companies, implement standardized protocols for sharing patient data between different telehealth platforms and electronic health record systems, and encourage the adoption of common data standards.

Recommendations for Process and System Improvements

<u>In-Person Consultation:</u>

In-person consultation is a barrier to the adoption of telehealth for patients and stakeholders. No doubt, telehealth has the potential to provide a better, more convenient, and more accessible way of delivering healthcare services remotely, but it is not a complete solution to in-person consultation. People unfamiliar with telehealth will usually prefer in-person consultations. Along with that, the healthcare providers may also have concerns regarding the care provided in this remote mode of consultation.

There can be technical challenges, which we have discussed as a different barrier in our project. Thus, it is urgent to develop a user-friendly interface with adequate training and support. After overcoming the barriers, only the benefits of telehealth can be fully realized.

Finally, the adoption of telehealth requires the collaborative efforts of patients, healthcare providers, and telehealth service providers to ensure that the technology is accessible, reliable, and meets the needs of all stakeholders.

Steps needed to minimize the barrier of in-person consultation in the adoption of telehealth in the United States:

1) **Application awareness:** A proper marketing strategy must be prepared to spread application awareness. Healthcare providers can educate their patients about telehealth and encourage application usage among patients during routine consultations. This can be successfully achieved through a simple conversation between healthcare providers and patients or by providing brochures or handouts explaining the benefits and use of telehealth. Also, education about the complement of in-person consultations They can also provide information on how to access and use telehealth services. Providers can also use existing communication channels like email newsletters or social media to spread telehealth awareness. Additionally, there are ample online resources that providers can use to educate themselves and patients, e.g., the American Telemedicine Association website and the telehealth basics guide available on this website.

2) **Reimbursement or incentives:** The government can provide incentives for healthcare providers offering telehealth services. This will help in the adoption of telehealth among stakeholders and provide patients with access to remote healthcare services. This will require additional time and resources, like changing the government's reimbursement policies. We need more policies like the recent expansion of Medicare reimbursement for telehealth services. Even professional associations (such as the American Medical Association, the Healthcare Information and Management Systems Society, etc.) can come together to advocate for expanded reimbursement for telehealth services.

3) **Training:** Healthcare providers can partner with community organizations to provide in-person training sessions or workshops on telehealth usage. Government agencies can provide training programs and resources to help both patients and healthcare professionals become more comfortable with telehealth. Also, healthcare providers (like nurses, pharmacists, or receptionists) can provide training on telehealth during routine consultations. Existing online resources, such as video tutorials or FAQs, can be used to train and provide information on how to use telehealth services effectively.

4) **Ensuring accessibility:** It means making all the services accessible to all patients, including those with disabilities and those who may not have access to suitable technology or internet connectivity. This can be easily resolved by providing devices on loan or partnering with community organizations to provide internet access.

Resistance To Change:

Jobs to be done process: The concept of "jobs to be done" (Clayton Christensen, the theory of jobs to be done) is an approach to product development and marketing that focuses on understanding the fundamental goals and desires of the customer. Instead of simply looking at the features and functions of a product, this approach seeks to understand what customers are trying to achieve, or what "job" they are trying to get done. For elderly patients, the "job to be done" might be something like "maintaining independence and quality of life while managing chronic health conditions." For example, this platform could allow them to find healthy food to eat or create a community among them where they can share information about their concerns.

Involve Family Members: Involving family members or caregivers can help ease the elderly patient's transition into telehealth. With this approach, trust will be the main factor that could facilitate the integration of this technology. It will be simpler to implement remote monitoring because family members have already provided other services (such as daily tasks around the house) and the relationship is stronger and more established.

Education and Training: Providing education and training sessions for elderly patients about the benefits and usage of telehealth can help alleviate their fears and concerns. This can be done through online tutorials, instructional videos, and live sessions with telehealth specialists. It is essential to make the education process easy to understand and tailored to the individual patient's needs.

Simplify Technology: Many elderly patients may struggle with the technology aspect of telehealth. The technology used should be user-friendly and straightforward. Designing a user-oriented approach based on their routine and things they are familiar with could potentially increase the adoption rate of this service.

Personalize Care: Offering personalized care is another way to address resistance to change among elderly patients. Patients can have a one-on-one session with their healthcare provider using telehealth, which can make them feel more comfortable and at ease with the system.

Provide Support: Offering technical support to elderly patients can help them overcome their fears and concerns. This support can be in the form of a helpdesk or a hotline that patients can call for assistance with their telehealth system.

Lower Level Of Computer Literacy:

One of the barriers to telehealth adoption in the US is the lower level of computer literacy, which is especially problematic for older people, people with disabilities, and people who live in underserved neighborhoods. More thorough remedies for overcoming this obstacle include the following:

1) Platforms for telehealth may be made more user-friendly and intuitive, with simple prompts and instructions to lead patients through the process. The platforms ought to be created with the requirements of senior citizens and people with disabilities in mind, with larger fonts, buttons, and audio and visual signals to help them navigate the interface.

2) Educate and train patients: Stakeholders can train patients on how to use telehealth platforms and devices. In-person instruction, written materials, or online tutorials can all be used to deliver this training. Patients who are more accustomed to using technology might need less instruction, while those who are less adept at using it might need more assistance.

3) Utilize community resources: To assist patients in feeling more at ease with technology, community organizations, senior centers, and libraries can offer computer literacy workshops or support. Additionally, these organizations can direct patients on how to use telehealth services while assisting in their access and discovery.

4) Provide technical support: Stakeholders can assist patients in resolving any technical problems they may be experiencing with telehealth platforms or equipment. To accommodate patients with busy schedules, this assistance should be more readily available and accessible by phone, email, or chat.

5) To increase patient access to telehealth services in a physical area where they may, if necessary, obtain support from trained professionals, a telehealth booth can give patients access to telehealth services. For patients who might not have access to a computer or the internet at home, these booths can be installed in public settings like community centers, hospitals, or retail locations.

6) Use virtual assistants offered by some telehealth systems to help patients navigate the telemedicine process. These assistants can also respond to questions and offer support. Patients who may not be computer literate can greatly benefit from this assistance.

Cost:

Financial Support by the Government or Health Care Provider: Waivers to purchase technology support and the possibility of financial support or subsidies are both options to remove the cost barrier for elderly patients accessing telehealth services. Copayments may be waived to eliminate the financial burden of telehealth visits, while purchasing prerequisites like internet access, data plans, or smartphones could also be considered. Either the government or healthcare providers may offer these waivers and financial support, ensuring that elderly patients have the necessary technology and internet access to use telehealth services.

Healthcare providers can implement the abolition of copayments for telehealth services very rapidly because it only requires a change in policy. But in order to make up for the loss, providers might need to consider how this change will impact their finances and find new sources of income.

Ways to provide financial support for telehealth services to elderly patients:

Policymakers and healthcare providers have several tactics to mull over as they deal with the added expenses related to financing telehealth services for the elderly. These include supporting financial aid and subsidies, among others.

Securing funding from the government, businesses, and nonprofits can support telehealth initiatives. Healthcare providers can also collaborate with community organizations or advocacy groups that are eager to enhance healthcare accessibility for elderly patients. While subsidies from these sources are attainable, the process of securing funding demands significant time and resources. A viable option for healthcare providers would be to pursue grants and partner with organizations to successfully access funds that support telehealth subsidies. Though it may require substantial effort, this solution is sustainable for the long term and effectively reduces the cost of telehealth services for elderly patients.

Adopt innovative practices to optimize resource allocation and reduce overall telehealth costs. Healthcare providers have an opportunity to leverage existing resources, including telehealth equipment and infrastructure obtained through government grants or private insurance subsidies. Restructuring operations and using healthcare staff and infrastructure in a new capacity can lead the way in cost-effective telehealth care services.

Telehealth services should be prioritized for patients with high needs. Providers could narrow their focus to elderly patients with chronic conditions or disabilities since they would most likely reap the benefits of remote care. By doing so, subsidies could be more efficiently used, and the extra costs involved with supporting a vast population could be reduced.

Use cost-saving strategies: Providers can use cost-effective or free telehealth platforms, haggle for lower prices from vendors, or use telehealth services for routine treatment, which may be less expensive than in-person visits.

This solution necessitates a thorough analysis of the telehealth services' cost structure and the identification of potential cost-saving measures. In order to cut expenses, providers may want to consider employing less expensive technology or outsourcing some telehealth-related tasks.

Overall, a multifaceted strategy involving strategic alliances, innovative finance mechanisms, and a focus on high-need patients would be needed to manage the higher expenses related to providing financial support or subsidies to older patients for telehealth services.

Enhancing Bandwidth Availability by Limiting Internet Activities

Families and caregivers can take a few measures to improve their home's internet connection to guarantee a seamless telehealth visit. They should first think about ceasing activities like streaming movies, playing video games, and browsing the internet while they are there. The Wi-Fi network at home will have greater bandwidth available as a result. People in the family are asking for free upgrades for users who have school-aged children with their internet service provider. They can also get in touch with their cell service provider to find out if an inexpensive or free upgrade to an unlimited data plan is available. Families can lessen the possibility of delays or interruptions during a loved one's telehealth visit and possibly prevent additional internet-related charges by taking these steps.

Reimbursement:

Reimbursement is a very effective solution to improve cost-effective telehealth services for older people with chronic diseases. Healthcare organizations can make use of a platform that monitors spending, assists in properly documenting receipts required by payers, and keeps track of the reimbursement amounts that insurance is permitted to pay out. By doing this, it will be ensured that the providers of telemedicine services to senior patients with chronic diseases are paid the highest amount available.

The expansion of telemedicine services' coverage by private insurance carriers and public programs like Medicare is another issue that healthcare providers can promote. This involves educating insurance providers and lawmakers on the financial savings of telemedicine, particularly for elderly patients with chronic diseases who might need regular and ongoing medical care.

Healthcare professionals, by fighting for telehealth service coverage, can lessen the cost to elderly patients with chronic diseases by resolving payment obstacles. This will result in better overall health and quality of life.

Due to the abundance of readily available, reasonably priced software options, this solution can be implemented with a small investment of resources. Healthcare professionals can also lobby for increased government and private insurance program funding for telemedicine services.

Waiving copayments, providing subsidies, seeking funding from government or private sources, leveraging existing resources, prioritizing telehealth services for high-need patients, and implementing cost-saving measures are all ways to overcome the cost barrier for telehealth services for elderly patients. Investing more in telehealth architecture and technology has long-term benefits, eventually leading to a reduction in overall health expenditures. Healthcare providers may need to prioritize based on how much each option will cost to adopt compared to its potential advantages.

Lack of caregiver support

Lack of caregiver support is a barrier to telehealth adoption as there are many challenges, such as caregivers might be unaware of telehealth services and their benefits; they may have limited knowledge of using technology and prefer face-to-face traditional consultation; they might think about the costs of telehealth services and consider it a time-consuming task to learn, adopt, and use this technology. Caregivers need assistance, guidance, and encouragement to adopt these telehealth services.

Several innovative technologies that can benefit family caregivers are highlighted below:

Healthcare providers and stakeholders should collaborate with caregivers to provide guidance, understand their needs and concerns, provide the resources required to adopt telehealth technology, and offer training and education.

Technology: Develop technology that is user-friendly so that caregivers can use it effectively to provide care for the patient.

Improved IoT and Technology Platforms: Wearables and IoT devices will evaluate patient data to alert caregivers to health changes and automatically connect them to resources and healthcare team members.

Voice: The voice-enabled interfaces like Alexa, Google Home, and Siri category covers understanding spoken orders, notifications, questions, and behavioral action. These technologies, which combine artificial intelligence (AI), natural language processing (NLP), and speech recognition, are accelerating voice technology adoption across multiple dimensions.

Remote monitoring: Telehealth, or remote monitoring, will assist caregivers in monitoring and managing care recipients' health remotely. Online forums, video

conferencing, store and forward, virtual reality, and chatbots will allow caregivers to access mental health professionals and support groups from anywhere.

Financial technologies: Older people's financial capacity, whether it be knowledge, skills, or judgment, can result in financial fraud or poor choices on financial tasks like fee payments or credit card balance transfers, which include or are discoverable by technology**.** Integrating with banks and insurance firms will allow family caregivers to monitor older people's financial accounts.

Virtual and augmented reality: Virtual and augmented reality are increasingly being used to train family caregivers to handle home emergencies and perform medical and nursing tasks, which are often central to their duties and will enhance the care for the care recipients.

Assistive technology: Family caregivers may benefit from integrating some assistive technologies. Technology-enabled interventions for vision, hearing, and mobility are one of the best ways to empower care users and their caregivers. Microsoft smart phones now have built-in screen readers, text capture, speech recognition, screen scaling, notification timing, spoken commands, AI narration, and other features for people with disabilities.

Interoperability And Connectivity

Interoperability:

Interoperability plays an important role in the successful adoption of telehealth, which is vital for providing seamless patient care, streamlining workflows, and allowing data exchange between healthcare providers. To make the most of telehealth and its potential, it is essential to address any interoperability issues. In this regard, the following suggestions can be implemented:

1) **The adoption of open standards and APIs**

   Publicly available specifications, known as "open standards," are used to provide a framework for product, service, or technology design and implementation. Application Programming Interfaces (APIs) facilitate communication between software applications by setting out rules for interaction. The adoption of telehealth can be greatly enhanced by using open standards and APIs, as they enable multiple systems, EHRs (Electronic Health Records), and medical devices to effectively exchange data. This increases the efficiency of healthcare services and provides an improved patient experience. Popular open standards for telehealth include HL7, DICOM, and FHIR, in addition to APIs such as SMART on FHIR and RESTful APIs.

It is highly feasible to adopt open standards and APIs since they are widely available and widely used. Because these solutions often require software modifications rather than large-scale infrastructure changes, they require minimal resources to implement. Moreover, open standards and APIs can be implemented relatively quickly, providing immediate benefits for telehealth adoption.

2) **Efforts to create a unified framework through collaboration:**

A unified framework can help reduce fragmentation within the telehealth industry, with different stakeholders such as telehealth service providers, EHR platform developers, medical device manufacturers, and healthcare professionals coming together to create standard protocols and interfaces for improved connectivity and interoperability. This collaboration can be achieved through industry consortiums, cross-organizational working groups, or government-initiated standardization committees, thus ensuring all systems and devices work together effectively.

Creating a unified framework through collaboration is feasible but may require more time and resources than other solutions. The process involves coordinating and aligning various stakeholders, developing common protocols and interfaces, and reaching consensus on standards. This requires moderate resources and a medium- to long-term timeframe to see results.

3) **Updating and maintaining regularly:**

In order to maintain compatibility with the latest technological advancements and standards, telehealth systems, EHR platforms, and medical devices need to be updated regularly. Support for new interoperability standards, software patches, and security improvements can be included in these updates. Keeping telehealth services accessible, secure, and efficient can be achieved through regular updates and maintenance.

As regular updates and maintenance are essential for maintaining compatibility and ensuring telehealth system effectiveness, they are highly feasible. Some updates may require minimal resources, while others may require substantial investments, especially when incorporating new technologies. In order to ensure continuous improvement and adaptability, this solution requires continuous commitment.

4) **Integrating platforms:**

Integration platforms serve as the link between different telehealth systems, EHRs, and medical devices. These platforms facilitate the sharing of data, communication, and coordination among various technologies, tackling interoperability and connectivity issues in a competent way. Examples are health information exchanges

(HIEs) and interface engines. Investing in these solutions could help streamline the communication process, get rid of dependence on custom solutions, and elevate the efficiency of telehealth services all together.

As they require investments in new technology and infrastructure, integration platforms are moderately feasible. It is, however, worth the investment for its streamlined communication, reduced dependence on custom solutions, and improved efficiency. It may take a medium-term timeframe to implement these platforms, depending on the complexity of the systems involved.

5) **Education and training:**

Healthcare practitioners, telehealth service providers, and other stakeholders must get training and education in order to ensure interoperability and connectivity. They need to comprehend the advantages and procedures involved in using interoperable solutions. Workshops, webinars, and online courses can be utilized to teach participants about open standards, APIs, data sharing protocols, and best practices for developing and maintaining interoperable telehealth systems.

Education and training programs are very viable since they may be adjusted to match a variety of budgets and resource limitations. By conducting seminars, webinars, and providing online courses, we can make education and training flexible and cost-effective. Based on the complexity and level of education needed, these programs can be planned accordingly.

6) **Regulations and incentives from the government:**

By enforcing regulations requiring the use of standardized protocols and interfaces, government bodies can play a crucial role in fostering interoperability and connectivity in telehealth. Companies that develop and adopt compatible systems can also receive incentives, such as tax breaks or grants. Regulations and incentives can significantly influence the adoption of interoperable telehealth systems, leading to a more connected healthcare ecosystem.

It depends on the willingness and ability of government bodies to enforce and fund such initiatives as to whether or not government regulations and incentives are feasible. Although these solutions can be very effective in promoting interoperability and telehealth adoption, they usually require medium- to long-term implementation timeframes due to the fact that they involve policy changes, regulatory processes, and budget allocations.

Connectivity:

Connectivity is a vital element of telehealth implementation, as it makes possible the smooth transfer of data and communication among healthcare providers, people needing care, and telehealth systems. Without dependable and strong connectivity, the advantages of telehealth services cannot be fully realized. Addressing connectivity problems is fundamental to guaranteeing successful telehealth implementation and a positive patient experience. The following suggestions focus on improving connectivity in connection with telehealth adoption:

1) **Utilizing Wireless and Mobile Technologies:**

   By offering higher speeds, greater coverage, and more reliable connections, wireless and mobile technologies can improve connectivity for telehealth services. Healthcare organizations and telehealth providers should utilize these technologies to ensure that patients and providers have consistent access to telehealth services, wherever they are.

   It is generally feasible to utilize wireless and mobile technology to improve connectivity in telehealth services. However, in order to guarantee consistent access to telehealth services, it may be necessary to make an investment in the necessary infrastructure and technology, such as wireless routers, mobile devices, and signal boosters.

2) **Investing in robust network infrastructure:**

   A reliable and high-speed network infrastructure is important for telehealth services since it ensures the smooth transmission of data, video, and audio. To minimize downtime, healthcare organizations and telehealth providers should enhance their network infrastructure, including upgrading bandwidth, optimizing network configurations, and implementing redundancy.

   It is generally possible to make investments in network infrastructure, but doing so may involve a large investment of both time and resources. To guarantee that network activities run smoothly and without interruption, upgrading bandwidth and optimizing the network may require specialized technical knowledge, and continuing maintenance may be essential.

3) **Remote Monitoring and Telecommunication Devices:**

   By enabling patients and providers to engage in telehealth consultations and remote monitoring, telecommunication devices, such as smartphones, tablets, and wearable devices, can enhance connectivity. Patients receive efficient and continuous care. These devices will facilitate real-time communication and data transmission.

   Since telecommunications equipment is already widely accessible and usable, using it

for remote monitoring and consultations is feasible. However, maintaining device compatibility and data security may present difficulties.

4) **Offering telehealth services to underserved areas:**

In order to increase connectivity, telehealth providers and healthcare organizations can open telehealth centers in underserved regions in collaboration with local governments and community organizations. These facilities can offer dependable connectivity and telehealth services to locals in outlying or rural locations with the correct infrastructure and technology.

5) **Establishing partnerships with internet service providers (ISPs):**

Healthcare organizations and telehealth providers can work with ISPs to offer specialized telehealth connectivity packages, such as dedicated bandwidth, prioritized traffic, or discounted rates for telehealth services. For telehealth consultations and data transmission, these partnerships can ensure stable and high-speed connections.

It is possible to establish agreements with ISPs, but to guarantee proper coverage and connectivity, it might be necessary to bargain with many providers. Additionally, ISPs could need perks like lower prices or priority traffic in order to offer customized telehealth connectivity packages.

By implementing these recommendations, telehealth adoption can be improved through enhanced interoperability and connectivity, leading to better patient care, more efficient healthcare services, and reduced costs for both patients and providers.

Feasibility:

It is possible to overcome resistance to change with the right education and communication. Patients can gradually learn about the advantages of telehealth from their providers, who can also answer any questions or concerns they might have. With available resources and at a low cost, this is possible.

Programs for training and support can be used to address lower levels of computer literacy. Healthcare practitioners can provide online materials or one-on-one or group instruction to show patients how to use telehealth technology. By employing already-existing staff resources and perhaps forming partnerships with neighborhood organizations, this can be accomplished at a low cost.

The high cost of telehealth is a major deterrent, but there are ways to make it more accessible to patients. Healthcare practitioners can collaborate with neighborhood groups, charge on a sliding scale, and prioritize telehealth visits for patients in dire need. To put this into action,

extra funds could be needed for things like contacting neighborhood organizations or creating a sliding-scale payment system.

Although some situations still call for in-person consultations, this obstacle can be overcome by using a hybrid strategy that combines both in-person and telehealth services. This can call for more resources, such as purchasing telehealth equipment and instructing medical staff on its proper use.

Offering training and assistance can help address the lack of caregiver support by enabling caregivers to use telehealth technology and support their loved ones during remote consultations. The implementation of this can call for additional resources, such as creating training materials and providing technical support.

For telehealth, interoperability and connection are crucial factors to take into account, yet doing so could be expensive. Healthcare institutions may need to invest in telehealth platforms that work with electronic health record systems and are interoperable with them. They may also need to put in place standardized methods for transferring patient data and possibly partner with telecom firms. The hiring of IT specialists and the purchase of new technology are only two examples of the kind of time and money that these initiatives could demand.

Review of Literature

Demiris et al. (2013) examine patient-centered applications (PCAs) in disease management and wellness. They define PCAs as technology solutions that empower patients and their families to actively participate in their treatment and explain their potential benefits, such as improved information access, healthcare provider communication, and self-management. PCAs can save healthcare expenditures through preventive care and hospital readmissions, according to the authors.

Demiris et al. (2013) acknowledge that concerns about data security and privacy, usability and design, and integration with current healthcare systems are obstacles to PCA implementation. The authors provide case studies of successful PCA implementations, including a mobile app for diabetic self-management, a web-based platform for chronic obstructive pulmonary disease management, and a post-discharge heart failure telemedicine program, to highlight PCAs' potential. Demiris et al. (2013) conclude that PCAs must be innovated to transform healthcare delivery and improve patient outcomes. They propose patient-centered design, adoption hurdles, and patient involvement to achieve this.

Reference: *Demiris, G., Afrin, L.B., Speedie, S., & Courtney, K.L. (2013). Patient-centered applications: information technology for disease management and wellness AMIA Knowledge in Motion Working Group White Paper AMIA Journal, 20(1), 218–227. Doi: 10.1136/amiajnl-2012-001458*

In their 2013 article, Czaja, Zarcadoolas, and Vaughon present a thorough analysis of the most recent studies on the use of telehealth for older individuals, emphasizing its potential to enhance patient outcomes, lower costs, and broaden access to care. The authors analyze the benefits and drawbacks of the research methods, telehealth technologies, and outcomes evaluated while summarizing major findings in four areas: management of chronic diseases, mental health, rehabilitation, and caregiver support.

They also address important problems such as program design and implementation, patient and caregiver education, privacy and security concerns, and the requirement for legislative changes to allow for the reimbursement of telehealth services. The authors stress the importance of enhanced cooperation between researchers, healthcare professionals, legislators, and patients, as well as additional studies to prove the efficacy of telehealth and determine the best implementation options.

Reference: *S. J. Czaja, C. Zarcadoolas, & W. L. Vaughon (2013) review of the research on telehealth for senior citizens. 223-231 in Maturitas, 75(3). cite: 10.1016/j.maturitas.2013.03.011*

Lam et al. (2020) investigate the readiness of older people in the United States for telemedicine during the COVID-19 pandemic. To determine the usability of technology, desire to use telemedicine, and perceived limits, they performed a cross-sectional survey of 1,000 people 65 and older. According to the research, 41.8% of participants had never

utilized telemedicine previously, and 39.7% said they lacked the appropriate technology. Additionally, telemedicine use was lower among older people with poorer incomes, less education, and no caregiver support.

The authors stress the need to solve the issues that prevent older people from using telemedicine, such as providing technological and caregiver support, enhancing health literacy, and addressing the lack of in-person consultations. The COVID-19 pandemic needs the use of telemedicine, but many older patients are unprepared; therefore, healthcare practitioners must struggle to guarantee that everyone has access to high-quality medical care, according to Lam et al.'s (2020) analysis.

Reference: *See Lam, K., Lu, A. D., Shi, et al. for further information (2020). Identifying the Unreadiness for Telemedicine Among Older People in the US During the COVID-19 Epidemic. doi: 10.1001/jamainternmed.2020.2671 JAMA Internal Medicine, 180(10), 1389–1391*

Telemedicine utilization in postoperative treatment is examined in a systematic review by Chapagain et al. (2022). Postoperative telemedicine includes videoconferencing, remote monitoring, and mobile health, according to the authors (mHealth). Videoconferencing, the most common modality, improves patient satisfaction and cost-effectiveness compared to conventional therapy.

Wearable remote monitoring reduced hospital readmissions and enabled early problem detection. Mobile health proved effective for patient education, symptom tracking, and health improvement. Telemedicine in postoperative treatment may face funding and infrastructure issues despite the good outcomes. Chapagain et al. (2022) recommend integrating telemedicine into postoperative care regimens. They also recommend more research into the best telemedicine technologies and ways to overcome adoption hurdles.

Reference: *Chapagain, N. R., Karmacharya, P., Sharma, S., & R.M. (2022). Postoperative Telemedicine: A Systematic Review Telemedicine and e-health Pre-publication online. DOI: 10.1089/tmj.2021.0359*

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