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Introduction

According to the 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 laymen, telehealth may be defined as 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 in 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 a 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 the 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, access to telehealth services.

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

According to the Centers of Disease Control and Prevention , Chronic diseases are responsible for 7 in 10 deaths each year with heart disease, cancer, strokes being the leading cause of death. (https://www.cdc.gov/chronicdisease/center/index.htm)

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)

Reference: *"Fong JH. Disability incidence and functional decline among older adults with major chronic diseases. BMC Geriatr. 2019 Nov 21;19(1):323. doi: 10.1186/s12877-019-1348-z. PMID: 31752701; PMCID: PMC6873710."*
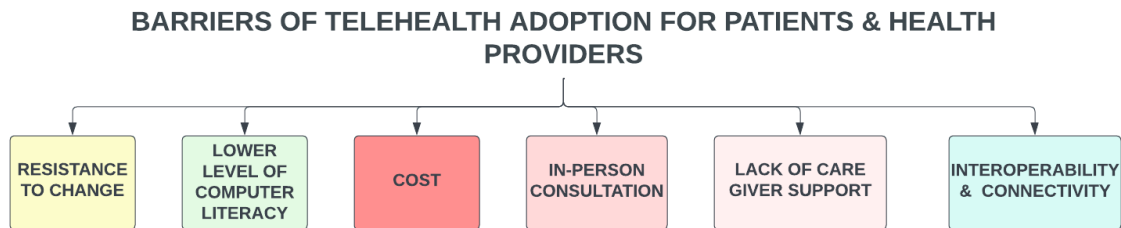
In the above table the statistics show that elderly patients are being disabled and cannot move to the healthcare premises. Thus, We need the solution for this menace. Telehealth can be the game changer in the care of these patients.

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.

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) admit that PCA implementation is hindered by concerns about data security and privacy, usability and design, and integration with existing healthcare systems. The authors provide case studies of successful PCA implementations, including as 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 study 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*

The readiness of older individuals in the United States for telemedicine during the COVID-19 pandemic is examined by Lam et al. (2020). To determine the usability of technology, desire to use telemedicine, and perceived limits, they performed a cross-sectional survey of 1,000 persons 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 persons with poorer incomes, less education, and no caregiver support.

The authors stress the need of solving the issues that prevent older persons 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(2020) .'s 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 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*

Research of Clinical Application/system:

Telehealth Technology:

1.Video conferencing:

The use of video conferencing technology permits patients and healthcare practitioners 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, and 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 patient 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. The quality of care can be improved, high-risk patients can be identified, and interventions can be targeted by providers using these findings.

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 by providing 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 data

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 provide 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
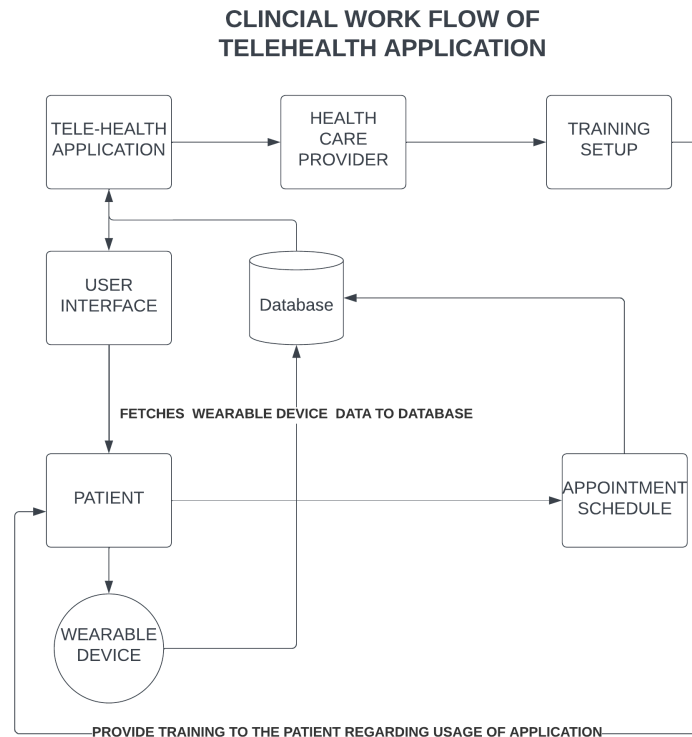
In this, a lot of patients have landlines and not cell phones. So there is no way to get a tutorial priorly. A document is left behind that shows each and every step of care in big red circles and bold text. At that point it is really up to the patient to utilize the care it would be like.Some of the patients do not have any internet at home so internet is arranged for them. Some of the things to worry about are the reading level of the patients and still there is a population who are not literate to understand some of the things that are given in the document (guidelines of the telehealth app).

Currently, this project is mainly focusing on overcoming this issue by preparing a video tutorial in a language easy to understand.That Screen capture video is going to be a two minute video which 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 teaching. There are several advantages like it provides a medium for people to learn on their own time without having to read and really just watching and listening. If there is no wifi connection, they are going to set up with that. Enough visits are made within the areas and tech assessments are made .

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

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

Care Convene platform uses a template called 'crowd sourced template' that is when a hospital sends a discharge notification, it sends a continuity of care document with all the patient's information. It is put into structure so that someone can see it in different categories and break it down.There are two sections of discharge meds that are at the time of discharge and discharge minus medications that are updated to 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 HIE's right now. 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 barrier 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 barrier 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.