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**Perspective on the Utilization and the Outcome of Mobile Apps and Other Digital Tools to
Reduce the Burden of Chronic Diseases**

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Health Informatics and Information Management: University of Tennessee Health Science
Center

MHIM 613: Applied Research Project

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Reduce the Burden of Chronic Diseases

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This is dedicated to my beloved family, you deserved this. Thank you for all the support. You all gave me a reason to keep surging forward.

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Abstract

The increasing aging population and the prevalence of chronic diseases among lower socioeconomic groups have led to higher healthcare spending on chronic care management. In this paper, the study revolves around the utilization of Information and Communication Technology (ICT) for the management of chronic diseases, with a particular focus on the elderly population. The study examines various digital health interventions, including eHealth, mHealth, electronic health records, remote monitoring, wearable devices, clinical decision support systems, telehealth, and telemedicine, in the context of chronic disease management. The opportunities, strengths, and weaknesses of digital technology are discussed, highlighting the potential benefits of ICT in improving healthcare outcomes and reducing the severity of chronic conditions. The paper also addresses the barriers to the adoption of digital health interventions, such as lack of skills, privacy concerns, limited access to high-quality healthcare, and disparities in internet connectivity. Despite these barriers, the integration of ICT in healthcare has shown promising results, empowering patients, enhancing self-management, reducing relapse, and increasing patient participation. The study concludes by emphasizing the significance of digital health technology in addressing the challenges posed by the aging population and chronic diseases, while also acknowledging the need for further research and policy considerations for effective implementation.

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CHAPTER ONE

Introduction

The healthcare situation worldwide is becoming more difficult because more people are getting older, and there are more chronic illnesses, especially among those with lower incomes. These factors contribute to higher spending on managing chronic care, placing a considerable burden on healthcare systems. Chronic diseases, such as diabetes, dementia, stroke, chronic obstructive pulmonary disease, hypertension, heart failure, and other cardiovascular conditions, are characterized by long-term disability rather than mortality. The complexity of managing these diseases, along with the poor self-management of conditions, and the unpreparedness of health systems to deliver age-appropriate care exacerbate the issue.

To address these challenges, there is a growing interest in exploring the role of Information and Communication Technology (ICT) in managing chronic diseases. ICT interventions in healthcare encompass a wide range of digital technologies, including eHealth, mHealth, electronic health records (EHRs), remote monitoring, wearable devices, clinical decision support systems (CDSSs), telehealth, and telemedicine. These digital health interventions aim to empower patients in self-management, improve medication compliance, reduce relapse and hospitalization rates, and enhance the overall prognosis of chronic diseases.

This literature review seeks to investigate the opportunities and strengths of implementing ICT in managing chronic diseases, focusing on the conditions mentioned above. Additionally, it aims to assess the barriers and weaknesses associated with the adoption of digital technology in healthcare. By analyzing the existing research, this study aims to provide insights

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into the impact of ICT interventions on clinical outcomes, healthcare utilization, and costs. Furthermore, it will explore the correlation between health literacy levels and the adoption rate of ICT protocols, shedding light on potential gaps in the implementation of ICT within healthcare systems. In the end, the goal of this research is to help us understand how adding ICT to current healthcare systems can make it better to handle chronic diseases. This can lead to better results for patients and reduce the pressure on healthcare resources.

Background of the Problem

The aging population and the high prevalence of chronic diseases in lower socioeconomic groups are the underlying factors leading to higher spending on chronic care management. A significant part of sickness and death caused by chronic diseases happens in older individuals with underlying problems. These issues include not taking good care of their health conditions, health systems not being ready to provide the right care for older people with chronic diseases, and the difficulty of managing several health problems at once (Prince et al., 2015). The burden of disease in older people is determined to increase in direct correlation with the increase in the older population as the older population lives with multiple chronic diseases that need repetitive ongoing management, resulting in overutilization of resources. The mortality rate from acute life-threatening conditions like stroke, heart attack, and a-fibrillation has been considerably reduced with advancements in medical technology, resulting in a bigger pool of older people living with multiple co-morbidities consuming a more significant healthcare resource. "The US health care system is the costliest in the world, accounting for 17% of the gross domestic product

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with estimates that percentage will grow to nearly 20% by 2020" (National Healthcare Expenditure Projections, 2010-2020).

Purpose of Study

The aging population is driving the global epidemic of chronic diseases, but a substantial opportunity exists to improve care for the elderly. The purpose of this research study is to investigate the role of Information and Communication Technology (ICT) interventions in managing chronic diseases, with a focus on conditions such as diabetes, dementia, stroke, chronic obstructive pulmonary disease, hypertension, heart failure, and other cardiovascular conditions. The study aims to explore the opportunities and strengths associated with implementing digital health technologies in managing chronic diseases, and identify the barriers and weaknesses that hinder the adoption of ICT in healthcare. By conducting a comprehensive literature review and analysis of existing research, this study seeks to provide insights into the impact of ICT interventions on clinical outcomes, healthcare utilization, and costs related to chronic disease management.

Specifically, the research aims to assess the effectiveness of ICT interventions in empowering patients to self-manage their conditions, improving medication adherence, reducing relapse and hospitalization rates, and ultimately enhancing the overall prognosis of chronic diseases. The study also intends to examine the correlation between health literacy levels and the adoption rate of ICT protocols to identify potential gaps and disparities in implementing digital health solutions within healthcare systems. By addressing these research objectives, this study aims to contribute to understanding how integrating ICT into existing healthcare systems can

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alleviate the burden of chronic diseases, improve patient outcomes, and optimize the utilization of healthcare resources.

Types of Digital Technology

Digital health technologies encompass a range of Information and Communication Technology (ICT) interventions that play a pivotal role in managing chronic diseases. These interventions include eHealth, which contains various tools and platforms such as mHealth, electronic health records (EHRs), remote monitoring, wearable devices, clinical decision support systems (CDSSs), telehealth, telemedicine, and information technology systems employed in healthcare settings. These digital health technologies improve patient outcomes and enhance chronic disease management's effectiveness.

mHealth, or mobile health, refers to mobile devices such as smartphones or tablets to deliver patients health-related services, interventions, and information. It enables individuals to participate in healthcare by providing self-management tools, facilitating medication adherence, and offering personalized recovery goals. Furthermore, remote monitoring technologies allow healthcare providers to remotely track patients' health parameters and provide timely interventions, reducing the risk of relapse and improving disease management. Integrating electronic health records (EHRs) allows for efficient and secure storage, retrieval, and sharing of patient health information, leading to enhanced continuity of care and informed decision-making. Clinical decision support systems (CDSSs) utilize algorithms and patient data to provide evidence-based recommendations. Telehealth and telemedicine technologies enable remote

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consultations and medical services, bridging geographical barriers and increasing access to specialized care for patients with chronic diseases.

Moreover, wearable devices, such as smartwatches and fitness trackers, provide real-time health monitoring and data collection, empowering individuals to track their physical activity, sleep patterns, and vital signs. These devices contribute to disease management by promoting behavior modification, early detection of complications, and facilitating communication between patients and healthcare providers.

Terminology

Digital Health Technologies (DHT) – Digital technologies with health, healthcare, and living to enhance the efficiency of healthcare delivery.

Clinical Decision Support Systems (CDSS) – ICT tools that provide healthcare professionals with evidence-based information and recommendations to aid clinical decision-making. CDSS can assist in diagnosing diseases, selecting appropriate treatments, and preventing medical errors.

eHealth – Healthcare services provided electronically through the internet
ICT – Information and communication technology is used to assist healthcare professionals in the diagnosis, treatment, monitoring, medical prescribing, referral, information retrieval, communication, documentation, and transactions of patient care.

Mobile health (mHealth) – describes medical services provided and supported through mobile devices.

Information and Communications Technology (ICT) – refers to integrating and using various technologies to manage and exchange health-related information. These technologies are utilized

to improve the efficiency, accuracy, and effectiveness of healthcare services, leading to better patient care and outcomes.

Telehealth – electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration. Wearables – electronic devices that individuals can wear and are designed to collect data and vital statistics regarding the individual’s health.

Electronic Health Records (EHRs) – Digital patient health records containing medical history, diagnoses, treatments, medications, and other relevant information. EHRs allow healthcare providers to securely access and update patient data, promoting coordinated and continuous care.

Health Information Exchange (HIE) – Systems that facilitate the secure sharing of patient information among healthcare organizations and providers. HIE enables healthcare professionals to access critical patient data from various sources without using the same EHR system.

Blood pressure (BP)

Chronic Obstructive Pulmonary Disease (COPD)

Health Insurance Portability and Accountability Act (HIPAA)

CHAPTER TWO

Literature Review

Method

Electronic databases from the health science library were searched for relevant articles. Searches were limited to English, and the article was limited to 2010 or later. PubMed and Scopus are the databases used to conduct the literature searches. Searches used subject headings and subheadings if available, and an advanced search tab was used. Search terms used included Health information management, Digital health, Health technology, telemedicine, Telehealth, Chronic care management, chronic care, and technology advancement in chronic care.

Selection Criteria

The article was included if it met any of the following requirements: 1. Included the use of technology in healthcare; 2. Implementation of smartphone apps and remote monitoring; 3. Adoption of mobile technology; 4. Telemedicine in healthcare; 5. Chronic care burden and expenditures. Articles not relevant to the topic were excluded.

Research Questions

Will investing in Digital health and health informatics improve the outcome of chronic care? Will penetration of health apps and digital technology in certain ethnic and low socioeconomic groups have an improved outcome in chronic care management?

What is the rate of using mobile apps, electronic portals, and other digital tools in patients with chronic diseases? What barriers prevent patients from using mobile apps, electronic portals,

and other digital devices? Are patients of specific age groups more likely to use digital tools? Do patients within a higher education level use digital tool more often?

Results

Thirteen studies were retained after the initial screening of titles and abstracts and the full-text review of the relevant articles. The clinical process outcomes, healthcare utilization, and costs reported in the studies are presented in the following sections.

Clinical Adoption of Digital Health

The utilization of digital health services has experienced rapid acceleration and is expected to maintain its growth trajectory. The global demand for healthcare services is rising, spurred by an aging population and an increasing prevalence of chronic illnesses. Healthcare systems face significant challenges in meeting patient needs, and digital transformation is critical in revolutionizing the sector (Ricciardi et al., 2019). Digital health technologies empower patients to take better control over their health, allowing them to live longer, healthier, and more fulfilling lives. According to an article from Natakusumah et al., telemedicine is a prominent example of digital health that has seen exponential growth, with users increasing from one million in 2015 to 12 million in 2021 (Natakusumah et al., 2022). Technology has enabled patients in remote areas to access high-quality healthcare services, improving health outcomes and reducing health disparities.

mHealth technologies include the use of smartphone applications along with wearable and handheld devices that provides real-time monitoring of patient's physiological parameters. The adoption of mHealth-compatible devices has increased in recent years, and it is used across all

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age and socioeconomic groups (MacKinnon et al., 2020). According to an article by Mackinnon et al., The Apple Heart Study began in 2017 and completed data collection in early 2019 with 419,297 self-enrolled subjects. "The study used the Apple Watch paired with the Heart Study iOS app. PPG detection of repeated irregular pulses triggered a notification for the subject to contact the study physician for a video consultation on the necessity of further arrhythmia workup. Approximately 0.5% of subjects received a notification, and its positive-predictive value for the diagnosis of AF was 84%" (P. 659).

Current consumer BP technology includes BP readings taken from Bluetooth-connected BP devices, which can directly translate the data into the Health Insurance Portability and Accountability Act (HIPAA)-a secure enterprise portal, such as Apple's HealthKit (Milani et al., 2021). Bluetooth-enabled Digital scales that measure weight in heart failure patients and transmit data to the patient's app provide better control of heart failure exacerbations and trigger an alert to see the heart failure clinic, thus reducing hospitalizations and relapses. There is increased use of digital technology, from implantable cardiac monitors and blood glucose recording wearable devices to easy access to patient portals, mobile apps, and patient portal text messaging. Physicians and researchers benefit significantly from these tools, gaining deeper insights into individuals' health and welfare. Implementing mHealth solutions has proven effective in mitigating, tracking, and controlling chronic conditions (MacKinnon et al., 2020). mHealth interventions have shown utility in preventing, monitoring, and managing chronic illnesses.

The study conducted by Milani et al. in 2019 to find the effectiveness of a digital medicine blood pressure program in improving blood pressure control and promoting healthy lifestyles.

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The study involved 156 patients with uncontrolled hypertension enrolled in the home-based self-monitoring program for 90 days. The study also included 400 patients in a usual-care group who received standard care for hypertension. Patients in the digital-medicine program had to submit at least one weekly blood pressure reading. They received medication management and lifestyle recommendations from a clinical pharmacist and a health coach. Additionally, they received monthly updates on their progress and received advice on living a healthy lifestyle tailored to their health screening results. Pharmacists contacted patients to discuss their screening results and treatment options for improving their blood pressure control. Results showed that 71% of the patients in the digital-medicine program achieved blood pressure control compared to only 31% in the usual-care group. The study concluded that the digital hypertension program effectively improved blood pressure control and promoted healthy lifestyle changes. The research offers valuable perspectives on how digital tools can positively impact patient engagement and empower individuals to self-manage chronic conditions such as hypertension (Milani et al., 2019).

The COVID-19 pandemic has accelerated the adoption of telehealth services in the United States. In response, Congress waived certain Medicare telemedicine restrictions, allowing clinicians to provide virtual healthcare services to patients nationwide. This change has resulted in faster access to care, reduced hospital visits, and minimized the risk of infection. Despite the clear advantages of telehealth, its utilization in the country remains relatively low (Kumar, 2020).

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During the pandemic, telemedicine has played a crucial role in infection control. Through telemedicine carts, physicians can remotely connect with patients, limiting physical contact and decreasing exposure for patients and healthcare workers. The Centers for Disease Control and Prevention and the World Health Organization suggest using telemedicine to assess and guide patients during outbreaks. Congress has allocated funding to support telemedicine services, and health insurers actively encourage its use (Kumar, 2020). To further advance telehealth, efforts are needed to raise patient awareness about its benefits. Medical centers are establishing dedicated telemedicine services, providing patients with video consultations for COVID-19 screenings and referrals to specialists when necessary. While telemedicine has limitations regarding physical examinations and diagnostic tests, it can effectively coordinate with healthcare centers and guide symptomatic patients to testing facilities. The long-term impact of the pandemic is expected to increase the popularity and accessibility of telemedicine services in the United States (Kumar, 2020).

Opportunities due to Tech Giants entering Health Space

Healthcare leaders have varying views on the opportunities posed by tech giants such as Amazon, Google, and Apple entering the healthcare space. Overall, there is a recognition that these companies have significant resources, technological expertise, and established consumer trust, which could disrupt traditional healthcare models and potentially reshape the industry. There is a potential for these companies to leverage their vast consumer reach and data capabilities to offer innovative healthcare solutions and services. For example, Amazon's acquisition of Pill Pack and its partnership with JPMorgan Chase and Berkshire Hathaway to

create Haven have raised expectations about the companies' intentions to revolutionize healthcare delivery and lower costs (Chappell & Dwyer, 2018).

Google and Apple, with their strong foothold in the digital space and extensive user base, have also made forays into healthcare. Google's parent company, Alphabet, has subsidiaries dedicated to healthcare research and initiatives, including Verily and Calico (Landi, 2022). Apple has ventured into health-related technologies with its Health app and smartwatch features, aiming to empower individuals to manage their health and well-being. While some healthcare leaders view these developments as potential opportunities for collaboration and innovation, others express concerns about the power and influence these tech giants may wield. People have expressed concerns about data privacy, security, and the possibility of companies having too much control. Also, these companies entering healthcare could cause disruptions for regular healthcare providers and change how things are currently done in the business.

Overall, healthcare leaders recognize the need to adapt and embrace technological advancements while ensuring that patient-centric care, regulatory compliance, and ethical considerations remain at the forefront. The evolving landscape and the involvement of tech giants create excitement and apprehension among healthcare leaders as they navigate the potential benefits and challenges these new players bring.

Barriers to Digital Health

The lower socioeconomic groups are vulnerable to the more significant burden of chronic complex diseases due to few resources, lower education and income levels, and higher levels of risk behavior (William et al., 2018). People have different opinions about whether ICT

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interventions are helpful for older adults with chronic diseases. These interventions could help support the care of older adults with chronic illnesses, but they have yet to be fully included in their healthcare. It is essential to increase awareness and knowledge about ICT interventions for those who could use them, and doctors can help educate and encourage older patients in this regard (Zaman et al., 2022). Other barriers in older people are a lack of skills in using ICT interventions and older adults with chronic diseases who have also been reported to face other challenges such as altered cognition, visual and hearing difficulties, and lack of trust (Zaman et al., 2022). Healthcare providers lose motivation when they realize that older people depend on family members to use ICT, and it can be challenging to communicate effectively with family members. ICT interventions increase the workload of healthcare professionals.

Penetration of ICT in hard-to-reach areas with poor internet connections is a barrier to effectively implementing ICT, which puts certain ethnic groups and socioeconomic groups residing within at a disadvantage. Another challenge relates to worries about privacy and security when using ICT interventions. ICT can be very helpful by connecting different healthcare providers through tools like Clinical Decision Support Systems (CDSS) and Electronic Health Records (EHR). It can also offer useful functions like sharing information with other providers (known as interoperability) and giving patients personalized details, such as how they should take their medications (Zaman et al., 2022). From a patient's point of view, the ways to manage a chronic condition differ depending on their social, cultural, and economic background. On the other hand, from a health system's perspective, various countries have laws and policies for adopting digital health interventions (Bashi et al., 2020).

Improved Outcome

Adopting digital health technology in healthcare delivery for chronic disease management can significantly improve the outcome. According to an article published in the National Library of Medicine, the application of digital health technologies (DHTs) in detecting and managing these diseases (Huat et al., 2019). Digital technology can improve the outcome of healthcare by reducing the severity of hypertension, asthma, joint pain, diabetes, and congestive heart failure. Such technology also enhances patient adherence to drugs and pharmacy. “Mobile applications can improve health outcomes in diabetic patients through self-management and symptom control. DHT can reduce cardiovascular disease (CVD) outcomes and positively influence risk factors for CVD. In cases of hypertension, mobile applications have specific tools for medication adherence and blood pressure tracking through a wireless monitor” (P.1).

Effectively implementing ICT led to decreased face-to-face interactions with clinical staff and with other patients, thus reducing their functional dependency on clinical or hospital services. ICT also reassures to the elderly that their needs are met and they are gaining self-control of their health. The use of ICT interventions also motivated them to keep exercising, stick to a nutritious diet, and quit smoking (Zaman et al., 2022).

Digital health (DH) intervention benefits include providing self-management, achieving personal recovery goals, reducing relapse, and increasing patient participation with mobile-based intervention (Bash et al., 2020). Bash et al. state,” wide range of patient outcomes considered in the reviewed studies including access to care, cost-effectiveness, self-management, improving

behavioral outcomes, facilitating patient-provider communications, motivational feedback, improving technology acceptance and user experience” (P.5).

Cost-Effectiveness

eHealth initiatives, including ICT interventions in health care, are cost-effective for monitoring and controlling congestive heart failure, stroke, chronic obstructive pulmonary disorder (COPD), diabetes, hypertension, asthma, dementia, and depression. ICT interventions, including mobile health (mHealth), can reduce the caregiver’s work burden by supporting the monitoring of medication use and providing significant interaction with the elderly. mHealth provides remote monitoring, and eHealth provides self-management to patients, leading to controlling exacerbations, reducing relapse, and reducing hospitalization- all these have cumulative effects on controlling Medicare health expenditures. However, there is also a cost associated with implementation, infrastructure, and data security. The lack of an appropriate insurance program for the reimbursement of remote monitoring devices required for ICT interventions results in financial challenges in adopting ICT. When there is a fee that patients have to pay, the motivation goes down toward utilizing ICT and mHealth (Zaman et al.,2022).

Conclusion

Adopting digital health technology in healthcare delivery for chronic disease management can create a valuable impact in improving the outcome. Digital technology can improve the outcome of healthcare by reducing the severity of hypertension, asthma, joint pain, diabetes, and congestive heart failure. ICT interventions also encouraged them to continue physical activity, maintain a healthy diet, and stop smoking (Zaman et al., 2022).

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Patients and physicians generally accept telehealth more positively due to its convenience and ability to bridge the gap created by physical distancing measures. Telehealth allows patients to receive necessary medical attention while adhering to safety guidelines, mitigating the risk of exposure to the virus. Physicians have embraced telehealth to continue providing healthcare services and maintaining patient relationships amidst the pandemic (Association, 2020). The challenges arising after the pandemic have dramatically affected the healthcare industry, such as staff shortages and high wages. However, there is a potential solution that holds promise: telehealth. It can help address the problems faced in healthcare, such as burnout, declining interest in healthcare careers, and the ongoing impacts of the pandemic. We need to implement new policies and innovative recruitment methods to tackle these issues. Telehealth has the power to mitigate staff shortages and reduce costs, emphasizing the importance of seamless integration and technological advancements. With our research and policy suggestions, our goal is to bring positive changes to the healthcare industry. We want to focus on patients' needs and promote a robust and adaptable healthcare system.

However, it is essential to note that telehealth does have limitations. One aspect that physicians and direct healthcare providers have observed is the inability to conduct comprehensive physical health assessments through virtual visits. Due to the absence of in-person interactions, certain aspects of healthcare, such as physical examinations, cannot be fully addressed via telehealth. To compensate, healthcare providers have implemented a hybrid approach, alternating between telehealth visits and in-person appointments. Depending on the

patient's health condition, routine telehealth visits may be scheduled with required in-person visits at regular intervals, typically every six months or a year (Association, 2020).

Despite these limitations, telehealth has expanded access to healthcare providers and resources for more patients. Through telehealth, patients can conveniently connect with healthcare professionals, receive medical advice, and manage their health conditions remotely. This accessibility has proven invaluable, particularly for individuals residing in rural or underserved areas with limited access to healthcare facilities.

CHAPTER THREE

Methodology

Method

This study utilized a survey questionnaire to determine the Perspective on the Utilization and the outcome of mobile Apps and other digital tools to reduce the burden of chronic diseases. The healthcare facility utilized for this study was Methodist Health System Dallas. The details outlined in the chapter will present a clear picture of the research design, implementation, and survey analysis.

Research Design

The survey method of descriptive research method was utilized to gather information from participants. This data collection method was deemed to be the most appropriate to describe the perspective on the utilization and the outcome of mobile Apps and other digital tools to reduce the burden of chronic diseases. The survey design ensured that participants had complete privacy to express their opinions without any bias. The survey was designed to have straightforward and easily understandable questions, with minimal involvement from the principal investigator or staff assisting with the survey administration. The data collection methods for this paper adhere to the guidelines provided by the UTHSC Institutional Review Board (IRB) as outlined in the UTHSC template available on the UTHC IRB page. The consent disclosure document, which is a crucial component, has been prepared using the approved version provided by the UTHSC IRB, as specified in the following link (<https://www.uthsc.edu/research/compliance/irb/researchers/consent-forms.php>). The attached

documents, including the consent disclosure and data use agreement, have been prepared with the appropriate UT letterhead and include the current IRB contacts, as required by the disclosure available online. IRB research approval was obtained. It has taken care to ensure that all the necessary information and content outlined in the UTHSC template have been included.

Population Design

The study's chosen participants consisted of individuals aged 18 and above with a fundamental understanding of the English language. Furthermore, the participants were either employees or patients of Methodist healthcare.

Data Collection Method

The data collection tool employed in this study consisted of a questionnaire comprising fourteen questions. These questions were structured as multiple-choice, with one question allowing for an open-ended response. Among the questions, three inquired about patient demographics, including gender, age, and internet access. The remaining eleven questions were formulated to assess participants' perspectives on the use and effectiveness of mobile apps and other digital tools in alleviating the challenges associated with chronic diseases. Below is the list of questions

- 1) Gender:
 - a. Male
 - b. Female
 - c. Other

Rationale: Demographic Impact

2) Age:

- a. Under 30
- b. 30-40
- c. 40-54
- d. 55-73
- e. Over 74

Rationale: Demographic Impact

3) Do you have regular access to the internet?

- a. Yes
- b. No
- c. Rationale: Demographic Impact

4) Do you have a chronic disease? If yes, please specify the chronic disease you have:

- a. Hypertension and other heart disease
- b. Diabetes
- c. Osteoarthritis
- d. COPD
- e. Multiple chronic illnesses

Rationale: Chronic disease classification

5) How long have you been diagnosed for your chronic disease(s)?

- a. Less than 1 year
- b. 1-5 years

- c. 5-10 years
- d. More than 10 years

Rationale: To determine how long participant is having a chronic disease

- 6) Are you regularly seeing a healthcare practitioner to manage your chronic disease?
- a. Yes – regular management – Every 6 months
 - b. No – only when symptoms worsen

Rationale: Determine commitment to manage illness

- 7) Have you ever used mobile health applications or digital health services to manage your chronic disease?
- a. Yes
 - b. No

Rationale: Getting insight into participant's utilization of Health technology

- 8) If yes, please specify the type of mobile health applications or services you have used:
- a. Mobile app
 - b. Telehealth
 - c. Electronic portal
 - d. Remote monitoring device
 - e. More than one from list

Rationale: Getting insight into participant's knowledge and utilization of Health technology

- 9) What features or functions were you looking for when choosing a mobile app or digital tool for managing your chronic disease(s)? (Check all that apply)

- a. Medication reminders
- b. Symptom tracking
- c. Diet and nutrition guidance
- d. Physical activity tracking
- e. Mood tracking
- f. Access to educational resources
- g. Community support and social interaction

Rationale: Getting insight into participant's specific needs for utilization of Health technology

10) Excluding calls to schedule an appointment, have you ever used an electronic device (phone, computer, etc.) to contact your healthcare provider regarding your long-term care?

- a. Yes
- b. No

Rationale: Determine existing comfort with electronic devices

11) Do you feel that the use of telemedicine/telehealth and mobile health applications/services can improve the management of your chronic disease?

- a. Strongly Agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly Disagree

Rationale: Willingness to utilize telemedicine

12) Do you feel that the use of telemedicine and mobile health could reduce the time spent waiting in the clinic for managing your chronic disease?

- a. Strongly Agree
- b. Agree
- c. Neutral
- d. Disagree
- e. Strongly Disagree

Rationale: Participant's opinion on usefulness of telemedicine

13) If provided with proper management techniques, how comfortable would you feel monitoring and reporting the results of your chronic disease to your healthcare provider via electronic communication?

- a. Very Comfortable
- b. Comfortable
- c. Neutral
- d. Uncomfortable
- e. Very Uncomfortable

Rationale: Participant's comfort level with self-management of health disease

14) Has your chronic condition been more controlled since using mobile apps?

- a. Yes, significantly more controlled
- b. Yes, slightly more controlled

- c. No, it hasn't made a difference
- d. No, it has become more difficult to control
- e. N/A, I have not used mobile apps for my chronic condition

Rationale- Participant perspective on outcome of health status after utilization of health technology

CHAPTER FOUR

Results

Response Rate of Population

The investigation spanned a solitary week, utilizing the Qualtrics tool accessible to UTHSC students, which was deployed to dispatch the survey via email to employees of Methodist Healthcare. The email provided unambiguous directives, affirming the exclusion of Protected Health Information (PHI) in the survey emphasizing the entirely voluntary nature of participation. Within this seven-day timeframe, a pool of 62 individuals was solicited for their engagement. From this group, 28 employees initiated the survey, and 26 of them saw it through to completion. The resultant response rate for this inquiry stood at 45%.

Summary of Findings

The results obtained during this study pertain to using of digital health technology for chronic disease management. These results are representative of employees within the Methodist Healthcare System in Dallas. Within this sample, 24% of the population identified as male, 72% identified as female, and 4% preferred not to disclose their gender (Figure 1.). The employee population of Methodist Healthcare studied for this survey was primarily in the age group of 40-54, making up 44% of the total. There were no participants under 30 years of age (Figure 2.).

The inclusion criterion for participation in the study was having one or more chronic illnesses. The entire study group, 100%, had access to the internet. When asked, "Have you ever used mobile health applications or digital health services to manage your chronic disease?" 71.43% of the population responded "Yes," while 28.57% responded "No" (Figure 7.). In response to the question, "If yes, please specify the type of mobile health applications or services you have used," 20% of the population used mobile apps and telehealth each, and 30%

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used electronic health portals, In comparison 30% responded "more than one from the above" (Figure 8.).

When participants were asked about the features or functions they were seeking when choosing a mobile app or digital tool to manage their chronic disease(s), 26.47% of the population indicated medication reminders, 8.82% for symptom tracking, 20.59% for diet and nutrition guidance, 11.76% for physical activity tracking, 11.76% for mood tracking and telehealth each, and 17.65% for electronic resources (Figure 9.).

The primary goal of this study was to determine clients' perspectives on utilizing digital health technology for chronic disease management and their perceived outcomes. The survey results when asked, "Do you feel that the use of Telemedicine/Telehealth could improve the outcome of your health?" 55.56% of respondents strongly agreed, 22.22% somewhat agreed that Telemedicine/Telehealth could improve the outcome of their chronic disease, while 22.23% of respondents did not agree (Figure 11.). There was also a question about whether clients would feel comfortable monitoring and reporting healthcare data to their providers via electronic communication using digital tools. When asked question about how would you feel reporting the results of your chronic disease to your healthcare providers via electronic communication, 70.56% reported that they would be very comfortable or somewhat comfortable with such methods, while 29.34% reported that they would not be comfortable (Figure 12.). When asked, "Has your chronic condition been more controlled since using mobile apps?" 72.72% agreed that it improved the outcome, while 27.28% felt it did not make any difference (Figure 13.).

CHAPTER FIVE

Conclusion

In conclusion, this study employed a survey-based descriptive research method to delve into the perspectives of individuals regarding the utilization of mobile apps and other digital tools in managing chronic diseases. The findings unveiled valuable insights from a sample of 26 participants, reflecting a response rate of 45%. Predominantly female and largely within the age group of 40-54, the participants universally had access to the internet. A significant proportion of the respondents had availed themselves of mobile health applications or digital health services for managing chronic illnesses, encompassing a variety of digital solutions such as mobile apps, telehealth, electronic health portals, and more. Participant preferences for specific features and functions when selecting digital tools for chronic disease management exhibited diversity, with medication reminders and access to educational resources emerging as primary priorities. Notably, a substantial majority of respondents expressed strong agreement that telemedicine and digital health tools held potential to enhance health outcomes. Furthermore, participants indicated their comfort with electronically monitoring and reporting health data to healthcare providers.

In addition to these findings, it is crucial to consider the broader context of chronic disease management. Chronic diseases, such as diabetes, chronic pain, hypertension, and congestive heart failure, significantly strain healthcare resources due to their higher prevalence. The integration of Information and Communication Technology (ICT) within healthcare has shown promise in transforming the delivery of care, especially for complex chronic illnesses.

However, there is a critical need to enhance awareness and education about digital technology interventions among older adults, caregivers, and healthcare providers.

Continued research and development in this domain may yield more effective and patient-centered approaches to chronic disease management, aligning with the evolving landscape of healthcare and technology integration. Recognizing the broader challenges and opportunities in chronic disease management underscores the importance of innovative solutions to enhance patient care and overall well-being.

Limitations

This is not a systematic review; it is a focused review of the use of ICT interventions to reduce the burden of chronic care. Only studies conducted in the United States are reviewed using the PubMed and Scopus databases. The review does not include studies from the Embase database or cover studies conducted in European societies. Despite our intention to be as inclusive as possible, searching two separate databases may have resulted in missing some relevant studies that still need to be included.

Additionally, relying on data from a single hospital for the survey may not comprehensively represent the entire population due to the study's limited sample size. Unanswered questions and potential difficulties in understanding the scope of certain inquiries posed challenges in obtaining comprehensive responses. Furthermore, the survey duration may have caused respondent fatigue, potentially affecting the quality of the answers provided. Time constraints also present an obstacle when dealing with vast data from various disparate resources. Chronic care burden is a more significant problem in the US, and analyzing the

existing data on the use of digital technology in healthcare can be overwhelming. Finding existing data on the health literacy level of the population and the impact of ICT interventions is challenging. Biased views may exist in the existing studies, as they favor positive outcomes. These studies might not offer a comprehensive overview or unintentionally overlook hard-to-reach populations with specific traits, such as low education, poor living conditions, or economic disadvantages.

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Appendix A

Figure 1. Gender

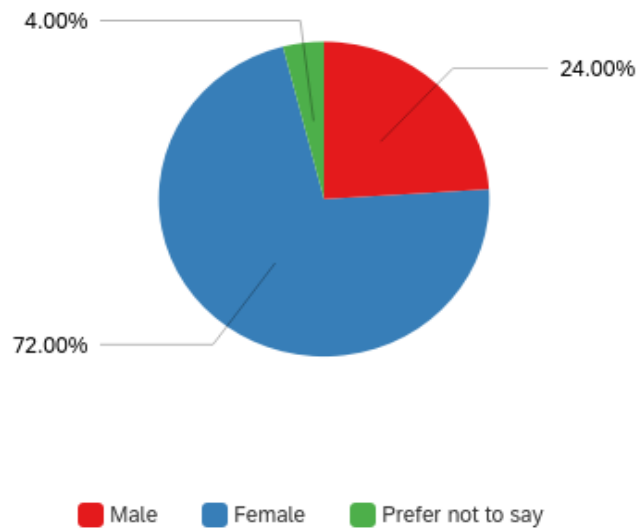


Figure 2. Age

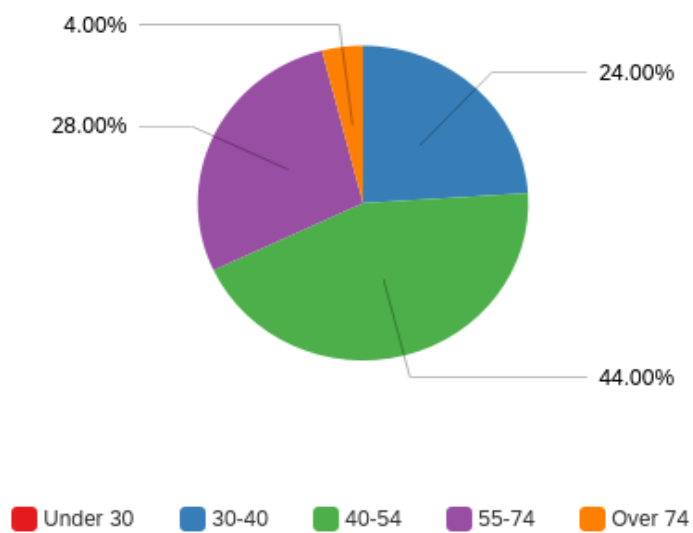


Figure 3. Do you have a chronic disease? If yes, please specify the chronic disease you have?

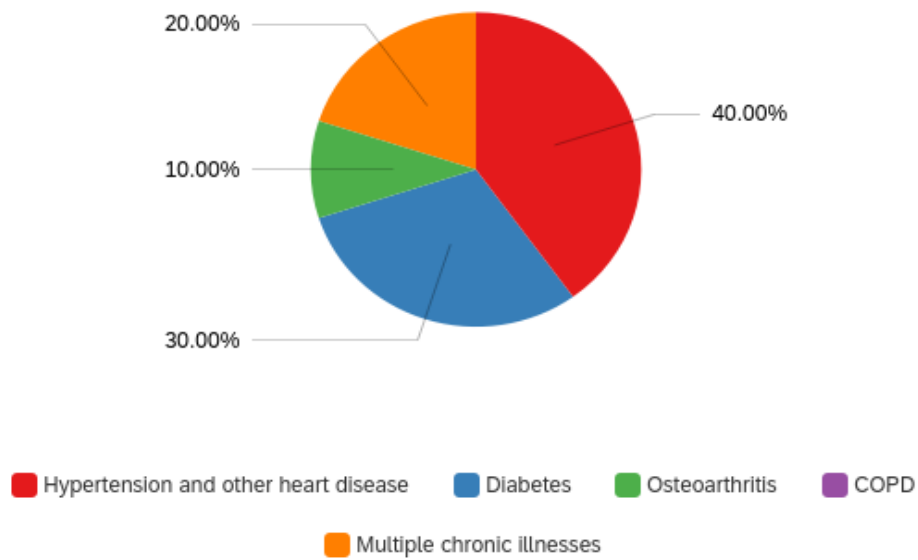


Figure 4. How long have you been diagnosed for your chronic disease(s)?

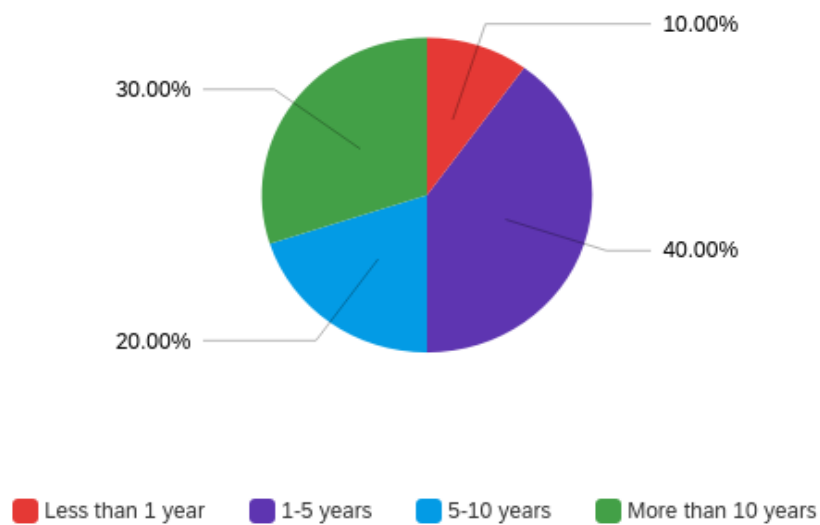


Figure 5. Are you regularly seeing a healthcare practitioner to manage your chronic disease?

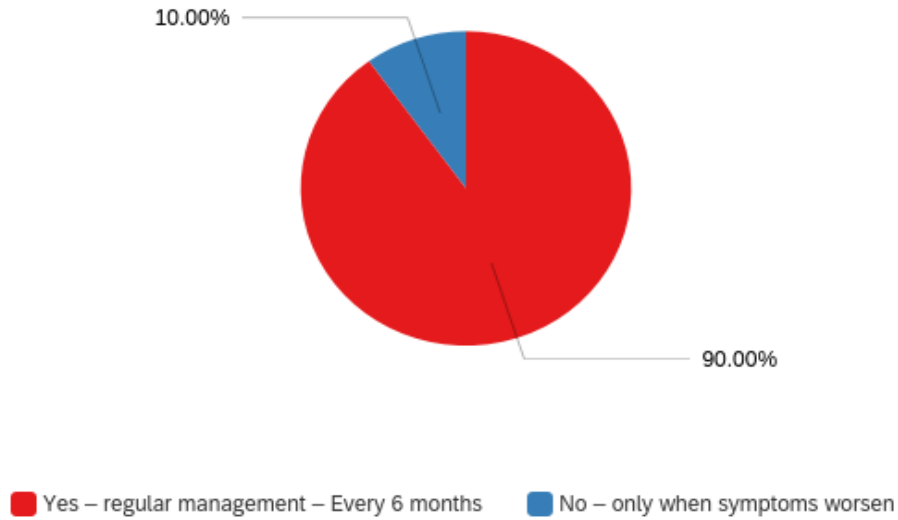


Figure 6. Do you have regular access to the internet?

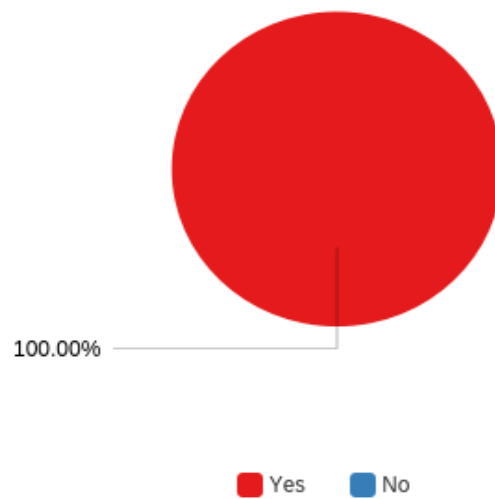


Figure 7. Have you ever used mobile health applications or digital health services to manage your chronic disease?

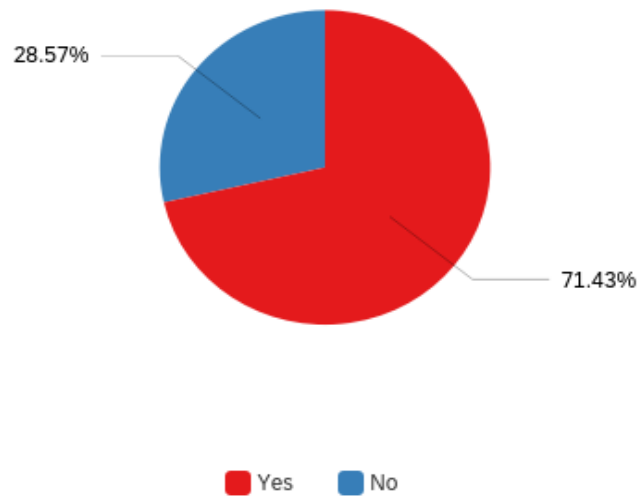
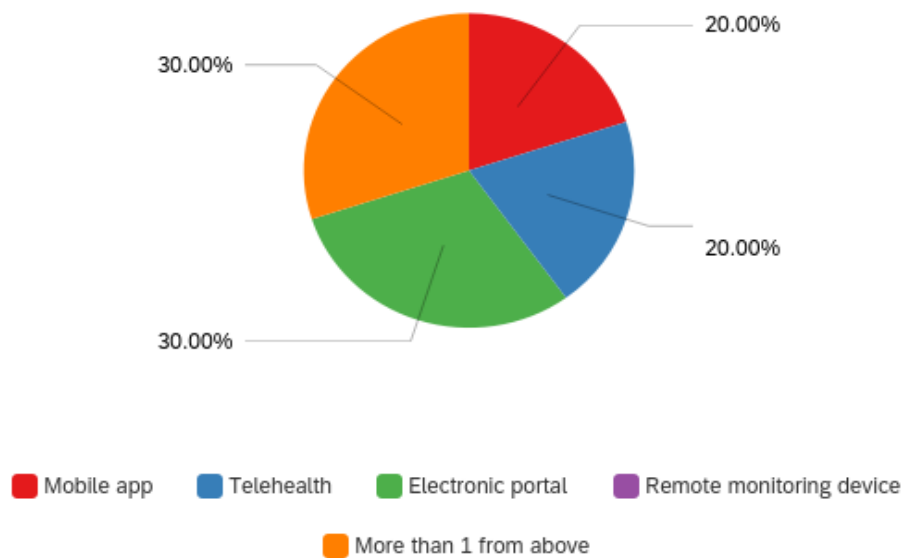


Figure 8. If yes, please specify the type of mobile health applications or services you have used:



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Figure 9. What features or functions were you looking for when choosing a mobile app or digital tool for managing your chronic disease(s)?

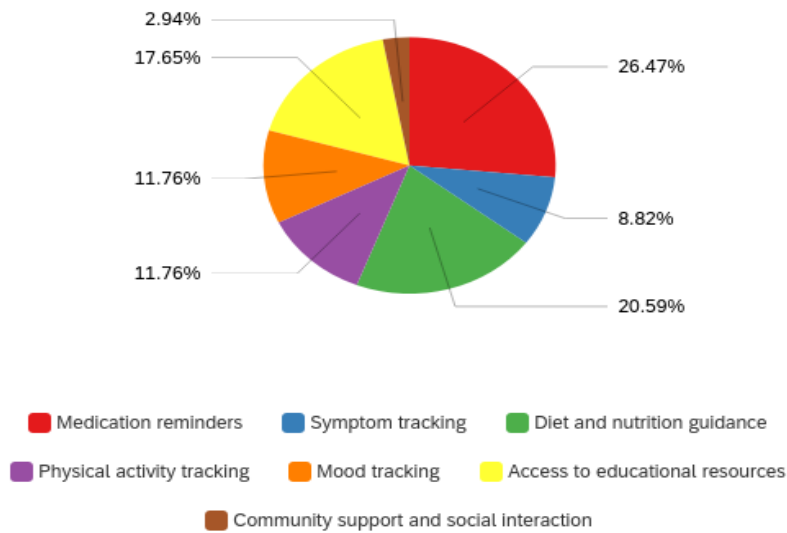
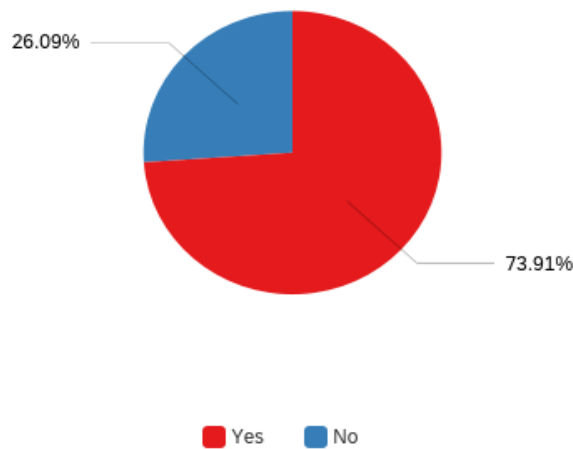


Figure 10. Excluding calls to schedule an appointment, have you ever used an electronic device (phone, computer, etc.) to contact your healthcare provider regarding your long-term care?



Reduce the Burden of Chronic Diseases

Figure 11. Do you feel that the use of telemedicine/telehealth and mobile health applications/services can improve the management of your chronic disease?

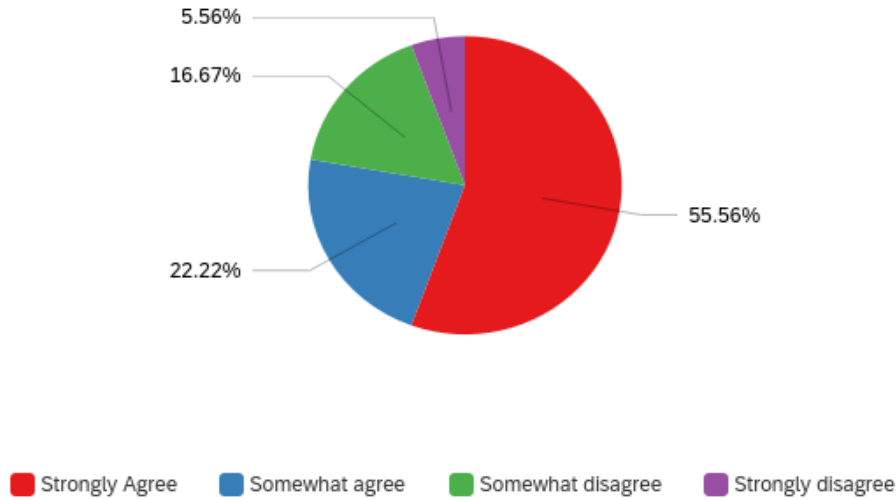


Figure 12. If provided with proper management techniques, how comfortable would you feel monitoring and reporting the results of your chronic disease to your healthcare provider via electronic communication?

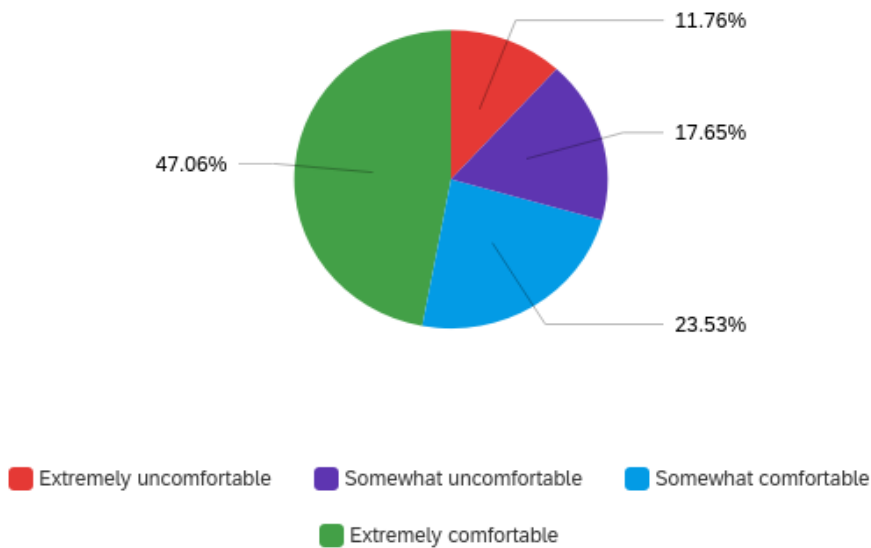


Figure 13. Has your chronic condition been more controlled since using mobile apps?

