To study the acceptance of telemedicine by the patients and investigate their intention to use it as a preferred mode of healthcare.

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EPPS 7318: Structural Equation and Multilevel Modeling

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ABSTRACT

Background: Telemedicine began to see an increase in usage throughout the U.S. after the pandemic as a means to cover the gaps in services that could not be provided through traditional healthcare means. However, this emerging technology goes beyond filling a gap and offers a more convenient and cost-effective alternative for people to receive health care without leaving their homes. The increase in accessibility and acceptance can provide a solution required to meet the needs of people.

Objective: The research aims to study the acceptance of telemedicine by the patients and investigate their intention to use telecare. The study shall deal with the factors thereof and its influence on the suitability of telehealth as a mode of healthcare delivery.

Methodology: This paper is built on analyzing a survey done in a medical institute as a sample unit and using Health Belief Model for model construction. Confirmatory factor analysis (CFA) is used to test the reliability and validity of the measurement model and structural equation modeling (SEM) is used to explain the causal model.

Conclusion: The findings demonstrate that to promote the use and acceptance of telehealth in patients with chronic diseases, the promotion of usefulness of telehealth should be prioritized. The focus should be laid on the perceived benefits of telecare with secondary focus on the cues to action.

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1. Introduction

As a result of the COVID-19 pandemic, many people were discouraged from leaving their homes for non-essential services. This included most routine healthcare services that were not considered urgent or critical to one's health. From these restrictions, telemedicine grew as an alternative way for patients to receive certain healthcare services without the need to leave one's home. This technology, although not new to the healthcare market, rapidly grew in popularity across the U.S. Today telemedicine is not just an alternative for when traditional healthcare is not accessible. Both suppliers and consumers are realizing the additional benefits that telemedicine has to offer over traditional healthcare.

Telemedicine is often defined as "the use of telecommunications and information technology to provide access to health assessment, diagnosis, intervention, consultation, supervision and information across distance" (Centers for Medicare and Medicaid Services, 2021). On the surface, this tool provides an opportunity for increased accessibility to healthcare. Telemedicine has proven to be effective in helping patients with chronic diseases (e.g., diabetes, heart disease). Identifying the information related to the patient's needs and attitude towards telemedicine is vital for increasing the rate of telehealth use and thus will be the focus of the research.

1.1 Health Belief Model (HBM)

The Health Belief Model (Figure 1) focuses on four components,

(1) **Perceived Benefits (PBs):** it refers to the individuals' perception of the benefits gained from reducing disease risk and other unhealthy status;
(2) **Perceived Disease Threats (PDTs):** it refers to the individuals' subjective perception of the possibility of having a specific disease and the severity of its influence on the individual;
(3) **Perceived Barriers of taking action (PBTA):** it refers to the individuals' perception of the negative influences created by actions like high cost,inconvenience, time consumption etc.;
(4) **Individuals' Cues to actions (CUES):** it refers to the process change due to the introduction of certain factors such as internal factors (ICUE) like physiological

conditions and external factors (ECUE) like mass media education, urging to medical professionals etc.

These four components further define the Attitude Towards Telecare (ATT) and the Behavioral Intention to use telecare (BI).

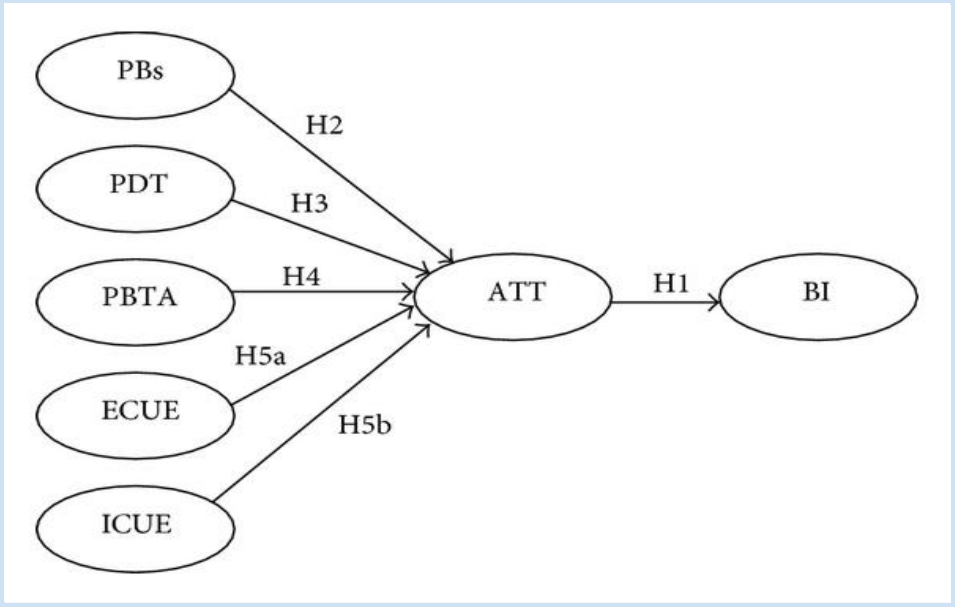

Figure 1: Research Structure with 7 constructs of Health Belief Model

HBM is commonly used in health behaviour research and is used to explain or predict the health related behaviors of individuals. Therefore, HBM is used to study the intention of patients with chronic diseases to use telehealth services.

1.2 Hypothesis

The study proposes the following five hypothesis :

(1) **H1:** There is a positive correlation between individuals' attitude towards using telecare (ATT) and the behavioral intention to use telecare.
(2) **H2:** Individuals with higher perceived benefits of telecare will have a higher positive attitude to use telecare.
(3) **H3:** Individuals with higher perceived disease threat will have a higher positive attitude to use telecare.

(4) **H4:** Individuals with higher perceived barriers of taking action will have a lower positive attitude to use telecare.

(5) **H5a:** Individuals with higher external cues to action will have a higher positive attitude to use telecare.

H5b: Individuals with higher internal cues to action will have a higher positive attitude to use telecare.

2. Methodology

2.1 Data Collection

The study is based on subjects which are patients of a medical institute with chronic diseases. The study investigated the intention of the patients to use telecare. Patients older than 20 years who had chronic diseases were surveyed using sampling and a total of 500 questionnaires were collected. So our sample size is N=500. Of the respondents, 55.8% are females and mostly aged 45 years and above. The 44.2% of the males were mostly 50 years and above. Most of the respondents are high school graduates (29%).

2.2 Measurement Constructs

HBM consists of seven constructs: PB, PDT, PBTA, ECUE, ICUE, ATT and BI. Table 1 shows the indicators that have been used to describe the seven constructs. There are 23 indicators in total.

Table 1: Model Construction of Reliability and Validity Results

Categories	Measure
Perceived Benefits (PBs)	
PB1	I find that using telecare is helpful
PB2	I find that using telecare is safer
PB3	Telecare can enhance my level of convenience in accessing medical care services
PB4	Telecare can enhance the quality of my life
Perceived Disease	

Threats (PDT)	
PDT1	I find that I can fall ill quicker than others
PDT2	I find that I can suffer from chronic diseases in future
PDT3	I find that my health is deteriorating
PDT4	I find that I might suffer from chronic diseases in future and could be forced to change my previous lifestyle
Perceived Barriers of Taking Action (PBTA)	
PBTA1	I am concerned that telecare is not completely secure
PBTA2	I am concerned that telecare would violate my privacy
PBTA3	I am concerned that instruments used to telecare are not highly accurate or reliable
External cues to action (ECUE)	
ECUE1	Relatives encourage and support me to use telecare
ECUE2	Friends encourage me to use telecare
ECUE3	Medical care personnel encourage me to use telecare
ECUE4	Media endorses the use of telecare
Internal cues to action (ICUE)	
ICUE1	How many times did you fall sick in the last few months
Attitude towards using (ATT)	
ATT1	I like using telecare
ATT2	Overall, I consider telecare to be just right
ATT3	In future, using telecare would be ideal
Behavioral intention to use(BI)	
BI1	Overall, I am highly willing to use telecare
BI2	If necessary, I would use telecare often
BI3	In my old age, I am willing to use telecare
BI4	In my old age, I might use telecare often

2.3 Data Analysis Methods

Confirmatory factor analysis (CFA) is used to examine the reliability and validity of measurement tools. Structural equation modeling (SEM) is used to interpret the causal model.

LISREL and Stata were used to find the results. The fitness of the model was determined using the following indicators: goodness of fit (GFI), adjusted goodness of fit (AGFI), normalized fit index (NFI), relative fit index (RFI), comparative fit index (CFI) and the root mean square error of approximation (RMSEA).

3. Results

3.1 Validity and Reliability of Measurement Model

In this study, the measurement model includes 23 indicators describing the seven latent variables. The results of the confirmatory factor analysis are shown in Table 2. The overall model fit was assessed by using six goodness of fit indices: GFI (goodness of fit index), AGFI (adjusted goodness of fit index), CFI (comparative fit index), RFI (relative fit index), NFI (normalized fit index) and RMSEA (root mean square error of approximation). Fit indices CFI, RFI, NFI and RMSEA all reached the suggested standards of goodness of fit. The indicators GFI and AGFI were slightly lower than the required standards.

Table 2: Fit Indices for measurement and structural model

Fit Indices	Model Value	Benchmark
GFI	0.81	>=0.9
AGFI	0.75	>=0.8
CFI	0.94	>=0.9
RFI	0.92	>=0.9
NFI	0.94	>=0.9
RMSEA	0.08	<0.1

A GFI value of 0.9 or greater is considered to be a good fit for the model. The HBM has a GFI of 0.81 which means the model is a fair fit. It is not up to the standard benchmark though. An AGFI value of 0.8 or greater is considered to be a good fit for the model. The HBM has a AGFI of 0.75 which means that the model is a fair fit. For CFI, RFI and NFI, a value of 0.9 or greater is

considered to be a good fit for the model. The HBM model has a CFI value of 0.94, a RFI value of 0.92 and a NFI value of 0.94. All the three values are above the benchmark level and thus are excellent fit for the model. The RMSEA value is considered to be the most important indicator of the goodness of fit of the model. A value less than 0.1 is in the acceptable range where the lower the value the better it is. For the Health Belief Model here, the RMSEA value is 0.08 which means the model is a fair fit.

The structural equation analysis (SEM) by Hans Baumgartner and Christian Homburg published in 1994 showed that 24% and 48% of the published papers reported that GFI and AGFI fit indicators lower than the suggested standards could still be considered as acceptable. Therefore, after comparing all the fit indicators with the suggested standards, this study concludes that the fit indicators of the structural model are within the acceptable range.

3.2 Structural Model

The causal model was explained using the structural equation modeling (SEM). Figure 2 shows the results of the structural model with the help of a path diagram.

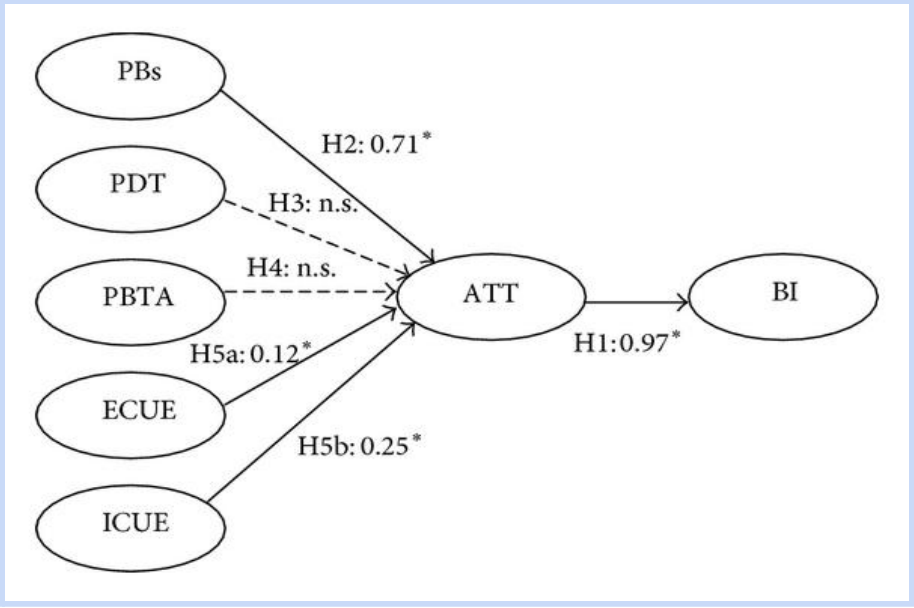

Figure 2: Path diagram with the results of the structural model

In this study, the hypothesis 1, 2, 5a and 5b were supported based on the structural model whereas hypothesis 3 and 4 did not show any significant results. The attitude towards using (ATT) was found to positively influence the behavioral intention to use (BI) significantly (standardized path coefficient of (H1) = 0.97) while perceived benefits (PBs) were found to positively influence the attitude towards using (ATT) significantly (standardized path coefficient of (H2) = 0.71). Hypothesis 5a and 5b; external cues to action (ECUE) and internal cues to action (ICUE), also positively and significantly influence the attitude towards using (ATT) where the standardized path coefficient of (H5a) = 0.12 and the standardized path coefficient of (H5b) = 0.25.

Neither perceived disease threat (PDT) nor the perceived barriers to taking action (PBTA) has a statistically significant influence on attitude towards using (ATT); therefore the hypothesis 3 and 4 were not supported by the analysis. Furthermore, the R^2 value for behavioral intention to use (BI) is 0.97, which is larger than 0.5, indicating that a high degree of variation could be explained by the Health Belief Model in this study.

4. Discussion

This study was aimed to use the Health Belief Model to predict the intention of the patients with chronic diseases to use telecare. Structural equation modeling showed that the perceived benefits (PBs), external cues to action (ECUE) and internal cues to action (ICUE) all had significant and positive influences on attitude towards using telecare (ATT) which in turn had a significantly positive influence on the behavioral intention to use (BI). The highest influence came from PB, followed by ICUE and ECUE. This study concludes that while promoting the use of telehealth, priority must be given to promotion of the users' perceived benefits (PBs) as it has the most impact on the patients and their inclination towards using telehealth. Another focus could be on providing external cues to action, such as advice from friends and relatives, increasing the influence of important people. In doing so, multiple advantages of telecare could be reached in regards to the welfare of patients with chronic diseases.

Also, the study did not find any significant influences of the perceived disease threat (PDT) and perceived barriers of taking action (PBTA) on the attitude towards using telecare (ATT). Surprisingly, this insignificant correlation of PDT and PBTA with ATT was quite unusual as

compared to the conclusions of other readings and researches. In my opinion, both these factors play an important role in any patient's decision making ability to use telecare and therefore PDT and PBTA should have had a positive influence on ATT.

5. Conclusion

This study has a number of conclusions. First, the findings demonstrated that patients with chronic diseases use telecare differently from the general public. The main objective of this study was to explore the intention of patients with chronic diseases to use telecare. Secondly, different methods should be used to promote the attitude towards using and the actual usage of telecare according to the different demographic characteristics of the subjects. Third, when promoting the use and acceptance of telecare in patients with chronic diseases, technology developers should prioritize the promotion of the usefulness of telecare. The findings of this study could provide an important reference for future related research. Given these favorable conclusions, it is anticipated that telehealth will continue to be an integral component of healthcare in the years to come. These findings will help the providers, payers and regulators to establish the policies and practices that will guide this transition.

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