How can acceptance of wearable health technology affect behavioral intent to use telehealth services by elderly patients

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ABSTRACT,
The capabilities of the Internet of Things has grown exponentially allowing for new services to be implemented for the benefit of connecting people to businesses and services. The healthcare sector was greatly affected the past few years due to Covid-19 thus the development of healthcare platforms can be beneficial. The focus of this paper is on the adoption of a telehealth platform by the elderly, and to understand how telehealth can support the elderly through wearable health technologies that assist the healthcare services and the elderly, by providing them with a systematic disease management process. Early identification of disease deterioration and timely medical intervention are the cornerstones of telehealth. Using the Technology Acceptance Model by Davis,1989. we can gain an insight on the attitudes towards these wearable health technologies through their perceived ease of use and usefulness, ideally, leading to the adoption of a telehealth service. Quantitative research was done, which consisted of a survey focused on understanding the demographics and perceived attitudes of the elderly towards wearable health technology and a telehealth system. Through multiple linear regression analysis, the findings showed that perceived usefulness has a positive effect on acceptance while it was found that perceived ease of use did not have such a positive effect on acceptance of telehealth. It was found that factors such as New Technology Usage and Smart phone usage had a significant effect on elderly's perceived ease of use. Concluding that acceptance of technology indeed had a positive effect on behavioural intention to use, with the influence of a positive perceived ease of use.

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Keywords
Technology acceptance model, Elderly, Telehealth, Wearable health technology, Healthcare, IoT

1. INTRODUCTION

It is anticipated that the elderly will have a more significant impact on health care systems in the future (Kekade eta., 2018). Elderly people require regular hospital visits and ongoing monitoring of their parameters to maintain good health, but this can be challenging due to deteriorating physiological conditions, high expenditures, transportation problems, and other factors (Kekade eta., 2018).

Technology and the Internet of Things (IoT) have the potential to revolutionize healthcare. The Internet of Things (IoT) is a current technology that encompasses smart things that include physical components such as sensors and actuators for sensing the internal condition of the object or the external environment and acting depending on the data acquired. The Internet of Things is slowly making its way into the healthcare and wellness industries. Sensors for sensing data, cloud computing for long-term data processing, fog computing for short-term data processing, and wireless body area networks for communication between sensors on or near the patient and data processing devices like routers and gateways are all used in IoT healthcare applications (Yin et al., 2016)

Real-time monitoring and alerts generation, Telemedicine, Chronic disease detection and prevention, and Home and senior care are the four categories of IoT in healthcare applications.

Telemedicine is the practice of providing healthcare to individuals over the Internet and other forms of information and communication technology. Telemedicine drastically reduces medical personnel's operational costs while also improving patient health efficiency. Rohokale et al., 2012 developed a rural healthcare monitoring system that would track vital signs such as blood pressure, sugar levels, and aberrant cellular development. A system that collects ECG readings from patients for further study (ECG android app) and another that allows clinicians to give emergency healthcare utilizing a remote health app and M2M patient monitoring (Fuzzy based Inference System) (Yin et al., 2016)

Telemedicine can empower patients by providing them with a systematic disease management process. Early identification of disease deterioration and timely medical intervention are the cornerstones of telemedicine (Anker et al., 2011). In an ideal world, a telemedical center with specified physiological measurements would detect early heart failure decompensation and prevent a crisis. The notion that medical decisions for patient management are made quickly, ideally by heart failure nurses or physicians, is a key feature of this strategy. Patients should be able to participate actively in the management of their own health care through telemedical management. (Anker and colleagues, 2011)

Telemedicine paved the way for the development of healthcare platforms. Fürstenau et al. (2019) identified three fundamental functions of newly emerging healthcare platforms. The sharing of information is the first and most crucial role. By accessing, translating, and sharing medical data from diverse healthcare providers, the healthcare platforms enhance information exchange. They abide by trust frameworks, rules, and regulations already in place (Informatieberaad Zorg, 2019; KPMG, 2019). The second significant role of healthcare platforms is service integration, which allows providers and patients to collaborate by providing digital assistance for healthcare operations. Continuity of care will be improved, and collaborative care pathways will be realized as a result. Service innovation is the third and last function. Most healthcare platforms allow third-party applications to be connected to them, which brings possibilities to add functionalities and innovate healthcare processes at a fast pace. (Kamphuis, 2021)

Healthcare services would find vast uses in IoT-based telemedicine, where many patients may be successfully and remotely monitored, with their critical diseases detected, diagnosed, prevented, and treated (Gonzalez et al., 2017).

The IoT telemedicine network and the IoT Telemedicine Healthcare Services and Applications are the two aspects of the IoT telemedicine architecture; this article will focus on the latter in relation to patients in need for a remote health care system and the acceptance of innovation (telemedicine). This paper aims to better understand the adoption of telemedicine and how it may help healthcare providers by answering the research question:

How can acceptance of wearable health technology affect behavioral intent to use telehealth services by elderly patients

Wearable health technology enables human physiological parameters to be continuously monitored during life activities. Immediate medical attention can be provided to patients with sudden health state changes among other contributions such as disease monitoring, detection and prevention. The concept is used for home use by patients allowing the possibility of eliminating life-threatening situations, which are monitored by the family or remote doctors. Wearable health technologies such as Electrocardiogram which assist in monitoring cardiac health within telemedicine, movement detectors (sensors , smart watch) are considered vital for the recognition of human actions along

with risks of falling and helpful to motivate patients to do exercise and rest. (Albahri et al., 2021)

Many benefits are added to elderly quality of life, the elderly can use applications in rural areas to monitor their activities and assess their health status which minimizes burden of health and social services. A telemedicine platform with the IoT capabilities can assist the elderly in rehabilitation and elderly monitoring for active ageing, particularly for in home treatments.

2. LITERATURE REVIEW

2.1Technology Acceptance Model

Telemedicine services are innovative and complex ICT-based services aimed to assist elderly users, but patient acceptance of such services has not received much attention and a few studies have examined this area from the user's perspective. (Cimperman et al., 2016) Despite the advancements in telemedicine services the end-user adoption of telemedicine technology is the main barrier for telemedicine implementation. Understanding elderly attitudes towards the use of telemedicine technologies and intention to use telemedicine present the main challenge in successful adoption of telemedicine services.

Wearable health technology (WHT) is a proposed technology to assist in telemedicine, which has huge potentials in delivering an effective and scalable way to respond to increasing demand for aged care and the independence of elderly persons (Srizongkhram et al., 2018) WHT can be used in health monitoring of elderly to decrease hospitalization and mortality rate, alert caregivers/physicians about unhealthy changes, improve mental life, provide a healthier lifestyle and help in the management of emergencies. (Kekade et al., 2018) Sensing technologies are patient-oriented and act as both enabling and key technologies in IoT-based health care systems. The devices are developed to diagnose patients' conditions and provide real-time information of patients' health indicators. These wearable devices can be integrated with portable devices such as mobile phones and watches.

Technology acceptance has been described as “the approval, favorable reception and ongoing use of newly introduced devices and systems". (Arning and Ziefle,2007) Davis 1989 created the Technology Acceptance Model (TAM) to investigate the correlations between factors such as "perceived usefulness" (PU), "perceived ease of use" (PEOU), Attitude (ATT), Behavioural Intention (BI), and actual use (AU). Acceptance of technology refers to whether a person is willing to use technology. Level of acceptance contains an attitude toward a certain behaviour and the usage behavior itself. According to TAM, the two most important factors in explaining acceptance and usage of an information system are perceived usefulness and perceived ease of use (Davis et al., 1989) The healthcare business has been driven to incorporate technology to provide quick services to patients as the use of IT has increased in recent years. The TAM constructs, such as perceived ease of use and perceived usefulness are critical to older adults, as for usefulness, since older adults place high value on independence and perceived impact on quality of life (Steele at al., 2009)

The elderly, on average, use less new technology than younger generations. This trend may be seen in the use of personal computers at home and at work (Czaja and Moen, 2004), as well as the Internet (World Wide Web) (Morrell et al., 2002) Older persons are less likely to be early adopters of new technologies, as characterized by diffusion of innovation study (Rogers, 2003), but they are not opposed to adopting it (Morrell et al., 2000).

When it comes to the elderly's adoption and acceptance of information and communication technology (ICT)-based services, they are often resistive to change (Cimperman et al., 2016). One of the problems in the successful acceptance and commercialization of Wearable health technology is understanding their behavior and decision-making in the context of WHT adoption (Czaja et al., 2013; Gao et al., 2015). According to previous research, wider adoption is influenced by a variety of complicated and multi-factorial factors, not just the effectiveness of the service (Lee and Coughlin 2015).

Changes that occur throughout aging should be considered to better predict the elderly's acceptance of WHT. Aging is a long-term, multidimensional process (Mathur and Moschis 2005; Moschis 1992) characterized by bio-physical changes (Kaufman and Elder Jr 2002) that result in progressive loss of motor and sensory nerve system functions. As a result of these losses, as well as declining physical and cognitive capacities, the elderly find it challenging to embrace and use new technologies (Phang et al., 2006). The opinions of the aged differ in three ways: biologically, psychologically, and sociologically. Lee et al., 2011; Heinz, 2013).

The aging population requires more healthcare and assistance to address cognitive, mobility, and psychosocial problems in older persons through wearable health technologies. (Erber, 2013; Chen and Chan, 2011). With the introduction of a smart wearable technologies, elderly adults can now maintain their independence by receiving real-time input on their vital indicators, by communicating physical conditions to a medical center through wireless sensor networks (Li et al., 2019). Health technologies, according to McCann et al. (2011) would allow the elderly to have access to ongoing healthcare. Wearable healthcare technologies can be used at homes, lowering the expenses of physical examinations and reducing the likelihood of admission to the hospital.

2.2. Research Model

To comprehend Behavioural Intention to Use (BIU), we must first comprehend senior people's attitudes towards wearable health technology and what are their Perceived Usefulness (PU) and Perceived Ease of Use (PEU) towards wearable health technology

2.2.2 Perceived Usefulness (PU)

This was defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance their job performance". It means whether someone perceives that technology to be useful for what they want to do. In the technology acceptance model, the major predictor of adoption is perceived usefulness, which is defined as the degree to which a system is expected to increase job performance (Davis et al.,1989).

The accessibility of medical records and patients has a direct impact on telehealth's perceived usefulness, and physician guidance has a major favorable impact on patients' adoption of it (Zhou et al., 2019). After using the telemedicine system for a while, some elderly people have displayed a more positive attitude about practicality (Cimperman et al., 2016). Hence, the following hypothesis was made:

H1: Perceived Usefulness of telehealth has a positive effect on acceptance of technology

2.2.1 Perceived Ease of use (PEU)

PEU is defined as the degree to which someone thinks using a particular system would be effortless (Wu and Chen,2016). PEU has been shown to have a favorable impact on user adoption of new software systems or hardware devices in previous studies (Cimperman et al., 2016). The more that users find a particular system both easy to use and useful, the attitudes and usage intention towards the system will be positively influenced (Davis et al., 1992) Doctors' acceptance of telehealth demonstrates that ease of use is one of the most important features. Patients are more likely to adopt a telemedicine system that is simple to use. As a result, we make the following hypothesis

H2: Perceived ease of use of telehealth has a positive effect on acceptance of technology.

2.2.3 Acceptance of Technology (AT)

Davis (1989) proposed that PEU and PU as beliefs that influence the acceptance and willingness to use information technology.

Acceptance of technology refers to whether a person is willing to use technology and the level of acceptance contains a positive attitude toward a certain behavior and the usage behavior itself.

H3: Acceptance of technology has a positive effect on behavioral intent to use telehealth services

2.2.3 Behavioral intention to use (BIU)

The tendency of an individual to use a telemedicine service is referred to as telemedicine behavioral intentions (TBI). Individuals indicate the intensity of their behavior choice during the decision-making process. As a result, behavioral intention is a critical step in the development of every behavior and the deciding factor before the behavior develops. Many theories in social and health psychology suggest that intentions lead to behavior. (2019, Zhou et al.) There are a variety of techniques to assess telemedicine systems' behavioral intentions, including willingness to use telemedicine services, dependency on telemedicine, and if telemedicine services are the first option.

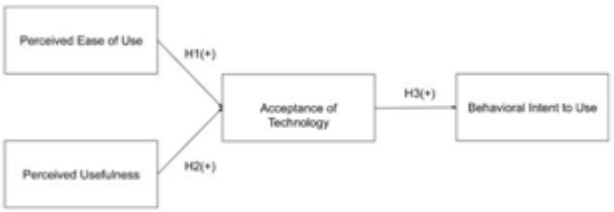


Figure 1:TAM Model

3. METHODOLOGY

In this following chapter the methodology of this study is going to be discussed by determining the setting, subjects, data collection and data analysis.

The context of the study takes place within the healthcare domain. Specifically, that of telehealth, by providing a remote health service to patients, allowing them for greater control of their health hence improving health management and overall quality of life. To provide a better health management system, wearable health technology is the tool for an efficient and functional telehealth service. By analysing the adoption of technology by the elderly we can investigate the factors/variables that positively influence behavioral intention to use technology.

Variable	Description	Frequency	Percentage(%)
Gender	Male	16	40
	Female	23	57.5
	Non-Binary	1	2.5
Age	50-59 years	15	45.5
	60-69 years	15	45.4
	Moren than 70 years	2	9.1
Previously ill with	Nothing	18	45
	Asthma	5	12.5
	Cancer	2	5
	Hypertension	10	25
	Hypertension + Asthma	2	5
	Hypertension + Blood disorder	2	5
	Hypertension + Diabetes	1	2.5
Living Arrangment	Living Alone	5	12.5
	With Family	35	87.5
Smart Phone Usage	Yes	34	85
	No	6	15
New Technology Usage	Frequent User	14	35
	Occasional User	18	45
	Non-user	8	20

Table1. *Frequency*

Table 1 shows the distribution of Gender with n= 40 with the majority being female respondents 57.50% which is even. The average age of the respondents is 60.677 with 7 respondents refusing to identify their age correctly due to personal reasons, however, the survey was intended to reach people of the age of 60 and above to better understand their perception of technology especially that of wearable healthcare technology. Table 1 also shows how the respondents interact with modern technology and smart phones. We can see that 65% of respondents either do not use or rarely use technology with 35% being more open to experimenting with innovative technology. A surprising result, regardless of not adopting recent technology, smart phones are an exception, with 85% of respondents frequently using smart phones.

We can also see what illnesses are being dealt with to understand what technologies can be used to assist such ailments. 45% of

respondents responded with no complaints, with asthma (12.5%) and hypertension (25%) being the two most reported illnesses.

3.1 Research Sample

The focus of the study will be on the elderly in rural locations, where telemedicine will have the greatest impact. Anyone aged 50 and up, regardless of health, will be considered for participation in the study. A brief medical history will be obtained to create a patient profile. (Reasoning for 50 and above, most patients that suffer with heart failure are on average 65 years and older, so understanding patients before they are at the high-risk zone is beneficial to the patient) In this research the role of the elderly and their adoption of technology will be analyzed. Through the theory of technology acceptance model and acceptance of telemedicine by elderly in rural areas. The introductory text focuses on gathering medical demographics of the respondent to understand their experiences with the healthcare system. Two short videos explaining wearable health technology and its benefits and a video of how a telemedicine platform will work is used to provide a better understanding of how a health management system would work. Understanding how the respondents perceive technology and what leads to the acceptance of technology will assist service providers to build a platform dedicated to the elderly.

3.2 Survey and operationalization

To better understand the acceptance of technology by the elderly, a questionnaire will be used as a data gathering approach. The questions in the second part of the survey were concerning the variables PEU, PU, AT and BIU of WHT worn by patients for communication and patient monitoring. Using 7-point Likert scales with 1-3 representing the negative spectrum ("strongly disagree"), 4 representing neutrality, and 5-7 representing the positive spectrum ("strongly agree"), a questionnaire will be developed based on existing validated scales, constructs, and determinants of technology acceptance. To ensure that the questions remain thorough and applicable in the study environment, the questions will be specifically adapted to the sample group of patients. The data is gathered using google forms which can be easily transferred to the SPSS database. Among this, key characteristics of the research sample will be analysed and a Cronbach alpha will be given to measure reliability.

This survey was set up using google forms, a survey construction tool made by google for the collection of surveys and questionnaires. The survey form was distributed using social network sites such as LinkedIn , Facebook groups for elderly people and personal connections. The survey was dedicated towards elderly in rural areas in the Netherlands but due to language barriers and accessibility of respondents the target group was then focused to anyone of the age 50 and over regardless of geographical location.

3.3 Reliabilities

To ensure that the measures consistently measure what the construct has intended to measure, the reliability of the scales were assessed. Using Cronbach Alpha which is one of the most common methods to measure reliability. In table 3., we can see an overview of the reliability scores of all constructs:

Reliability analysis was performed to determine the consistency of the questionnaire dimensions, where a Cronbach's alpha pf >0.7 is indicative of high reliability (Peterson,1994) The Cronbach Alpha's for all the constructs indicate high reliability as it should be above 0.70, thereby confirming the excellent reliability of the dimensions.

3.4 Data Analysis

The SPPS software, which is a predictive analytics software utilized in research investigations, will be used to analyze the data. Once the data has been entered into SPSS, it can be analysed for a variety of statistical analyses. Once in SPSS the data will undergo several statistical analyses. A descriptive analysis will be done for an overview of the sample size, means, standard deviations and correlations of the constructs will be given. A principal component analysis with oblimin rotation will be performed. Finally, multiple linear regressions will be used in answering the research question how acceptance of technology can be used and if its factors really affect behavioral intention to use.

Constructs	Items	Mean	STD Dev	Beta	Scales	Source
Perceived Usefulness	PU1	5.530	0.960	0.361	Telehealth can provide useful infromation about hospital and doctor information	Cimperman et al., 2016
	PU2	5.350	1.167	0.439	Telehealth can provide useful infromation about common disease prevention	Cimperman et al., 2016
	PU3	5.580	1.130	0.425	Telehealth can provide useful information about first aid measure	Cimperman et al., 2016
Perceived Ease of Use	PEU1	4.870	1.418	0.379	It is easey to record my health condition by telehealth	Cimperman et al., 2016
	PEU2	4.770	1.349	0.361	It is easy to use the telehealth service	Cimperman et al., 2016
	PEU3	4.630	1.480	0.395	it is easy to learn how to use a new APP for telehealth	Cimperman et al., 2016
Acceptance of Technology	AT1	5.200	1.244	0.299	I think using telehealth will help monitor my health	Cimperman et al., 2016
	AT2	5.350	1.075	0.258	I think using telehealth can improve the convenience of medical services	Cimperman et al., 2016
	AT3	4.680	1.607	0.386	I think telehealth is protected for my privacy	Cimperman et al., 2016
	AT4	5.430	1.430	0.343	I think teleheath is a good idea to provide medical assitance	Cimperman et al., 2016
Behavioral Intention to Use	BIU1	4.530	1.754	0.360	I will use telehealth services in the future	K.F. Chiang et al., 2015
	BIU2	3.950	1.739	0.356	I will get medial advice from telehealth services	K.F. Chiang et al., 2015
	BIU3	4.020	1.609	0.330	I will consider telehealth as the first choice	K.F. Chiang et al., 2015

Table 2. *Scales*

Construct	Items	Factor Loading	α	AVE
Perceived Usefulness	PU1	0.8090	0.745	0.8166
	PU2	0.7740		
	PU3	0.8670		
Perceived Ease of Use	PEU1	0.8960	0.855	0.8810
	PEU2	0.8710		
	PEU3	0.8760		
Acceptance of Technology	AT1	0.7110	0.770	0.7763
	AT2	0.7830		
	AT3	0.7640		
	AT4	0.8470		
Behavioral Intention to Use	BIU1	0.9520	0.952	0.956
	BIU2	0.9550		
	BIU3	0.9620		

Table 3. *Factor Loadings*

	N	Mean	Std. Dev	Perceived Usefulness	Perceived Ease of Use	Acceptance of Technology	Behavioral Intention to Use
Perceived Usefulness	40	5.483	0.887	1.000			
Perceived Ease of Use	40	4.758	1.247	0.430**	1.000		
Acceptance of Technology	40	5.163	1.042	0.790**	0.337*	1.000	
Behavioral Intention to Use	40	4.167	1.626	0.650**	0.511**	0.704**	1.000

Table4. *Descriptive Statistics and Pearson's Correlation*

H#	Variable		Coefficient	t	P	Result
	Acceptance of Technology					
H1		Perceived Usefulness (PU)	0.791	7.080	<0.001	Supported
H2		Perceived Ease of Use (PEU)	(0.004)	(0.032)	0.974	Not supported
	Behavioral Intention to Use					
H3		Acceptance of Technology (AT)	0.704	6.110	<0.001	Supported

Table 5. *Multiple Regressions Analysis Results*

4. RESULT

4.2Descriptive Statistics

In table 3. The correlation matrix for Perceived Ease of Use, Perceived Usefulness, Acceptance of Technology and Behavioral Intention to Use was constructed. The table displayed the sample size, the means, the standard deviations, as well as Pearson's correlation coefficient (r) and significant levels of the variable.

The mean of perceived usefulness is seen to be 5.483 where 5-7 represents a positive view, perceived ease of use scores a mean of 4.758 representing neutrality with a slight positive influence.

Looking at table 3. We can see that there is a correlation between perceived usefulness and perceived ease of use. There is a correlation ($p < .01$, one-tailed) for perceived ease of use and perceived usefulness shown by $r = .430$. There is a stronger correlation ($p < 0.01$, one-tailed) for perceived usefulness and acceptance of technology that is shown by $r = .790$.

The mean of acceptance of technology is positive with a score of 5.163 with behavioral intention to use being neutral with 4.167.

For acceptance of technology and behavioral intention to use. There is high correlation ($p < 0.01$, one-tailed) between acceptance of technology and behavioral intention to use with $r = 0.704$.

4.3 Principal component analysis

In the study of social sciences, it is important to conduct an exploratory factor analysis due to the fact that constructs cannot be measured in a direct fashion (Field,2009). In order to uncover the variables and their items, a principal component analysis with direct oblimin rotation was performed on the 13 items.

The Kaiser-Meyer-Olkin Measure (KMO) was observed to check the proportion of variance in the variables. The KMO measurement states that the sampling adequacy is 0.823, which is considered to be a good value (Kaiser, 1974) and states that the identified factors are unique and reliable. The Bartlett's test of sphericity indicates a highly significant difference ($p<.001$) with a Chi-Square of 392.463 and 78 degrees of freedom, which means that the identified correlations are significantly different from zero (field,2009) According to the scree plot there are points of inflexion that occur at 4 or 6 components.

4.3 Multiple Regression

In Table 5. A multiple regression analysis was done showing that $R^2 = 0.603$ which means that 60.3% of the variance of the acceptance of technology can be predicted by perceived ease of use and perceived usefulness. By looking at the standardized coefficients, the variable perceived usefulness has a bigger effect of 0.131 compared to that of the perceived ease of use variable 0.093 on acceptance of technology.

For the effect of perceived ease of use ($t= -0.032$, $df = 37$, P-Value = 0.974) which shows that it is not significant, and the elderly probably do not find it easy to use technology and for the effect of perceived usefulness ($t= 7.080$, $df = 37$, P-value < 0.001) which is significant hence the elderly does perceive it to be useful.

In Table 5. The adjusted $R^2 = 0.482$ which means that 48.2% of the variance of behavioral intention to use technology can be explained by acceptance of technology. The effect of acceptance of technology is ($t=6.110$, $df= 38$, P-Value = <0.001) which is significant.

The reliability-adjusted correlations were regressed on several moderator variables. The moderators were dummy coded included Age (1=60andabove, 0=below 60), Gender (1 = Female , 0 = male) , new technology frequency (1= Frequent , 0 = non-frequent) and smart phone usage (1= uses , 0= no)

Regarding the moderating role of age, gender, smart phone, previously ill and new technology frequency, analysis was done see if it has an effect on the perceived usefulness, the perceived ease of use , the acceptance of technology and also the behavioral intent to use.

The dummy variables show that smart phone usage and frequent new technology usage has a significant effect on perceived ease of use and being previously ill has a negative significant event. The only other variable that shows a significant effect is perceived usefulness and frequent new technology usage.

Predictor	Gender (Female)	Age (60andabove)	Smart phone (Uses)	Previosuly Ill	New Technology Frequency (Frequent)
n	23	25	34	22	14
Perceived Usefulness	0.186	0.034	0.179	-0.055	0.273*
Perceived Ease of Use	-0.018	-0.04	.316*	(-)0.286*	0.513**
Acceptance of Technology	-0.036	-0.078	-0.053	0.082	0.19
Behavioral Intent to Use	0.058	-0.252	0.174	-0.25	0.218

4.5 Hypothesis testing:

For the effect of perceived usefulness (t= 7.080 , df = 37 , P-value < 0.001), P-value < 0.05 which proves that perceived usefulness is significant hence the elderly do perceive the technology to be useful. We can then accept the hypothesis and based on our research n-=40, we have enough evidence to say that there is a positive effect of perceived usefulness on acceptance of technology. The regression effect of the variable "perceived usefulness" is 0.131. That means if the value of the variable goes up by one, the average acceptance of technology increases by 0.131, if also the variable perceived ease of use is considered in the model.

- ✓ H1: Perceived Usefulness of telehealth has a positive effect on acceptance of technology.

For the effect of perceived ease of use (t= -0.032, df = 37, P-Value = 0.974), P-value > 0.05 which proves that perceived ease of use is not significant hence the elderly does not perceive the technology easy to use. We can then reject the hypothesis and based on our research n=40, we have enough evidence to say that there is a negative effect of perceived ease of use on acceptance of technology. The regression effect of the variable "perceived ease of use" is 0.093. That means if the value of the variable goes up by one, the average acceptance of technology increases by 0.093, if also the variable perceived usefulness is considered in the model.

- × H2: Perceived ease of use of telehealth has a positive effect on acceptance of technology.

For the effect of acceptance of technology to (t=6.110 , df= 38 , P-Value = <0.001), P-value <0.05 and a R^2 = .482 **p<.001 (one-tailed) which proves that acceptance of technology is significant and positive hence the elderly acceptance of technology effects behavioral intention to use. We can then accept the hypothesis and based on our research n=40, we have enough evidence to say that there is a positive effect of acceptance of technology on behavioral intention to use telehealth. The regression effect of the variable "acceptance of technology" is 0.180. That means if the value of the variable goes up by one, the average of behavioral intention to use goes up by 0.180.

- ✓ H3: Acceptance of technology has a positive effect on behavioral intent to use telehealth services

5. DISCUSSION

5.1 THEORETICAL CONTRIBUTION

This study was set out to investigate the factors that affect elderly patients' acceptance of wearable health technology and their behavioral intentions to use telehealth using the TAM model specifically by investigating the factors of perceived usefulness and perceived ease of use. The findings provide a new insight into the TAM model such that the model should be adjusted to that of its intended target group, in this case the elderly. Attitudes such as perceived ease of use (PEU) and perceived usefulness (PU) do not entirely explain acceptance of wearable health technology. There are other factors that influence these important variables in the TAM Model (PEU & PU) and the adoption of wearable health technology. The variable perceived ease of use was strongly insignificant to the acceptance of technology and in further investigation as to why it was understood that the elderly did use smart phones but were more reluctant to use new innovative technologies. New technology , smart phone usage and previously ill are variables that influence the effect of perceived ease of use amongst the elderly and social aspects such as the elderly's attitude toward Wearable Health Technology (WHT), as well as the positive influence of and interaction between the old, are extremely relevant to the acceptance and use of WHT in the context of this study. Similarly, favorable environments such as training programs, organizational and technological infrastructures, and the availability of necessary resources for the use of WHT are other characteristics that a manufacturer can employ to positively affect senior users' attitudes about and use of WHT (Ahmad and Khalid 2017; Talukder et al., 2019a).

5.2 MANAGERIAL IMPLICATION

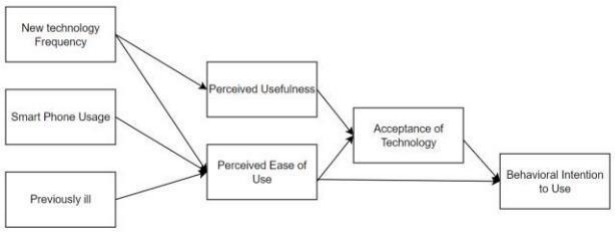
Understanding the elderly's behavioral intention to use technology would greatly benefit healthcare providers and the advancements of telehealth, promoting the willingness of the elderly to accept and adopt telehealth. For technology developers, they need to inspect the elderly's intentions and demands of telehealth from cognitive, mobility, and psychosocial views not just from perspective of technology acceptance such as perceived ease of use. For hospital administrators and medical service providers, they need to accept the advancements of IoT and its capabilities and implement telemedicine as an additional service that they can provide to their patients, ultimately increasing the satisfaction with medical services and quality of life of the elderly. For governments and investors, they should take measures to improve the quality of life of the elderly and support them in the acceptance of telemedicine services and technology.

6. CONCLUSION

Wearable medical devices are a powerful and effective alternative to continuous health monitoring in hospitals. They should be designed to monitor health while being comfortable to wear. (Papa et al., 2020) The aim of this study was to answer the research question *"How can acceptance of wearable health technology affect behavioral intent to use telehealth services by elderly patients."* To answer the research question, the perceived ease of use and perceived usefulness of wearable health technology by elderly people was investigated. Furthermore, the relationship between perceived ease of use and perceived usefulness of wearable health technology in order to better understand the elderly's acceptance toward these technologies and what leads to the behavioral intention to use technology and, ideally, actual adoption of telehealth services. We can see that perceived usefulness and ease of use influence acceptance of technology. For example, in the case of wearable health technology, the elderly finds it difficult to adopt new technologies due to a lack of perceived ease of use, but they find the technology very beneficial. With an R^2 of 0.624, other factors must be present to explain behavioral intent to use. We see dummy variables such as new technology, smart phone usage and previously ill that influence the effect of perceived ease of use amongst the elderly. With New technology frequency usage also effecting

perceived usefulness. It was seen that the relationship between perceived ease of use and acceptance of technology was mediated by behavioral intention to use, which proves that perceived ease of use has an effect on behavioral intention to use more than on acceptance of technology. In other research papers it was also found that factors, such as technological anxiety, can influence the elderly's perception of ease of use (TA). Self-imposed hurdles, low self-efficacy in IT abilities leading to technological fear, lack of interest, and motivation are all linked to TA (Marquié et al., 2002; Turner et al., 2007). The variables of new technology frequency and smart phone usage are tied to TA. Even though TA has been extensively studied in psychology, there has been very little research on its role as a determinant of individual attitudes in the context of WHT adoption. As a result of the high TA, elderly people may have little interest in using WHT. If the elderly's attitudes toward wearable health technology improve by increasing the rate at which they perceive the ease of use of these technologies and decreasing their technological anxiety, it will have a positive impact on their acceptance of technology, leading them to adopt wearable health technology and telehealth services.

An extended model of TAM was constructed demonstrating the results found and how it can be adapted to the elderly.



7. Limitations

During the study all limitations were attempted to be minimized as much as possible. The greatest limitation to this paper was the number of respondents (n=40) , as it was difficult to reach elderly who were willing to respond to the survey as most older adults are not tech-savvy which made it difficult to fully complete the survey with the utmost reliability. The time it took to fulfil and collect necessary data was much more than anticipated.

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Appendix:

Demographics:

Age:

_____
_____

Sex/gender:

_____
_____

City:

_____
_____

Ethnicity:

_____
_____

Religion:

_____
_____

Any present complaints:

complaints:

_____
_____

History of presented complaints:

_____
_____

Any chronic illness:

_____
_____

Previously ill with:

oHypertension
o Asthma
o Blood disorders
o Cancer
o Diabetes
o Epilepsy

Living arrangement:

O with family
o living alone
o in nursing home

Source of income:

o Salary
o Pension
o Property income
o Family/relative support o Government support

New Technology usage frequency:

o Frequent user o Occasional user o Non-user

Smart phone:

o Yes o No

Description of Telemedicine and how it will work

Perceived Ease of Use

Q1: It is easy to record my health condition by telehealth

Q2: It is easy to use the telehealth service

Q3: It is easy to learn how to use a new APP for telehealth

Usefulness

Q1: Telehealth can provide useful information about hospital and doctor information.

Q2: Telehealth can provide useful information about common disease prevention

Q3: Telehealth can provide useful information about first aid measures

Behavioral intention to use:

Q1: I think using telehealth will help monitor my health

Q2: I Think using telehealth can improve the convenience of medical services.

Q3: I think telehealth is protected for my privacy

Q4: I think telehealth is a good idea to provide medical assistance.

Acceptance of technology.

Q5:I will use telehealth services in the future

Q6:I will get medical advice from telehealth services

Q7: I will consider telehealth as the first choice.

Assumption Checking

Multicollinearity

Correlations

		Behavioral_Intent_to_Use	Perceived_Usefulness	Perceived_ease_of_use	Acceptance_of_Technology
Pearson Correlation	Behavioral_Intent_to_Use	1.000	.650	.511	.704
	Perceived_Usefulness	.650	1.000	.430	.790
	Perceived_ease_of_use	.511	.430	1.000	.337
	Acceptance_of_Technology	.704	.790	.337	1.000
Sig. (1-tailed)	Behavioral_Intent_to_Use	.	<,001	<,001	<,001
	Perceived_Usefulness	.000	.	.003	.000
	Perceived_ease_of_use	.000	.003	.	.017
	Acceptance_of_Technology	.000	.000	.017	.
N	Behavioral_Intent_to_Use	40	40	40	40
	Perceived_Usefulness	40	40	40	40
	Perceived_ease_of_use	40	40	40	40
	Acceptance_of_Technology	40	40	40	40

Checking for multicollinearity we can see that non of the predictors correlate too highly with each other

(Below R>.9)

Durbin-Watson

The assumption of independent erros.

The value 1.548 is between 1 and 3, hence the assumption of independent errors are met

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.699[a]	.488	.460	1.19433	.488	17.643	2	37	<,001	
2	.765[b]	.585	.551	1.08971	.097	8.445	1	36	.006	1.548

a. Predictors: (Constant), Perceived_ease_of_use, Perceived_Usefulness
b. Predictors: (Constant), Perceived_ease_of_use, Perceived_Usefulness, Acceptance_of_Technology
c. Dependent Variable: Behavioral_Intent_to_Use

PEU and PUaccount for 48.8% of the variation of Behavioral intent to use

With AT included this than drops to 9.7% of the variation

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.334	2	25.167	17.643	<,001[b]
	Residual	52.777	37	1.426		
	Total	103.111	39			
2	Regression	60.362	3	20.121	16.944	<,001[c]
	Residual	42.749	36	1.187		
	Total	103.111	39			

a. Dependent Variable: Behavioral_Intent_to_Use
b. Predictors: (Constant), Perceived_ease_of_use, Perceived_Usefulness
c. Predictors: (Constant), Perceived_ease_of_use, Perceived_Usefulness, Acceptance_of_Technology

With sig figures below >.05, the anova tells us that the model is a significant fit of the data overal.

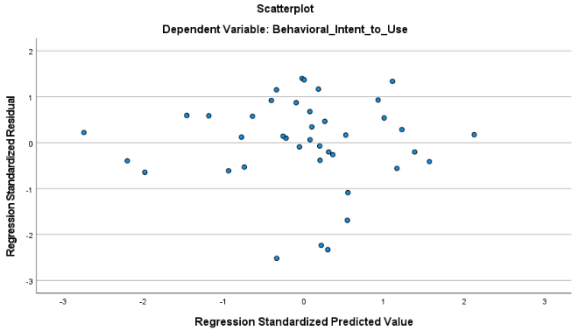
Coefficients[a]

Model		Unstandardized Coefficients: B	Unstandardized Coefficients: Std. Error	Standardized Coefficients: Beta	t	Sig.	95.0% Confidence Interval for B: Lower Bound	95.0% Confidence Interval for B: Upper Bound	Correlations: Zero-order	Correlations: Partial	Correlations: Part	Collinearity Statistics: Tolerance	Collinearity Statistics: VIF
1	(Constant)	-2.903	1.222		-2.375	.023	-5.380	-.426					
	Perceived_Usefulness	.969	.239	.528	4.054	<,001	.485	1.453	.650	.555	.477	.815	1.227
	Perceived_ease_of_use	.369	.170	.283	2.174	.036	.025	.714	.511	.337	.256	.815	1.227
2	(Constant)	-2.966	1.116		-2.659	.012	-5.229	-.704					
	Perceived_Usefulness	.231	.335	.126	.691	.494	-.447	.910	.650	.114	.074	.346	2.890
	Perceived_ease_of_use	.372	.155	.285	2.398	.022	.057	.686	.511	.371	.257	.815	1.227
	Acceptance_of_Technology	.793	.273	.508	2.906	.006	.240	1.347	.704	.436	.312	.376	2.656

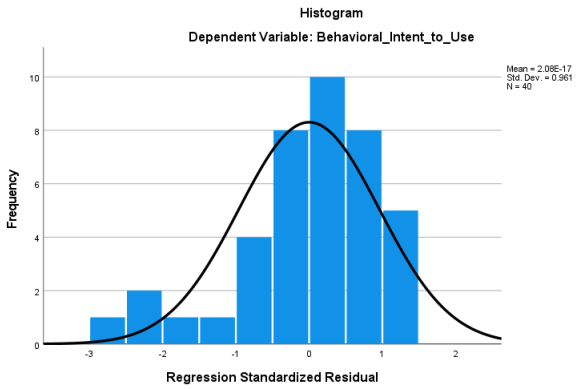
a. Dependent Variable: Behavioral_Intent_to_Use

The b-values explains that the relationship between the predictor and the dependant are positive.

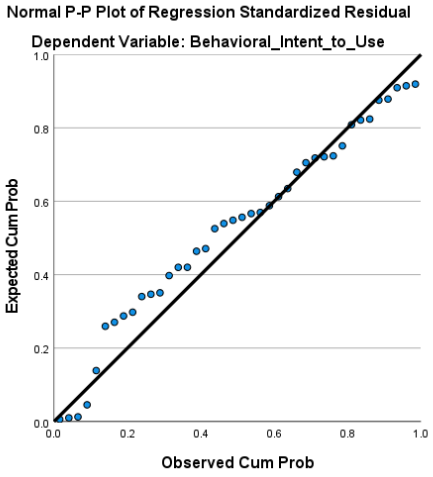
So as PU , PEU or AT increases so does BIU



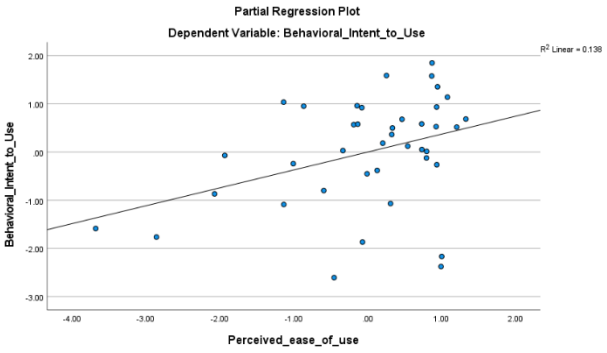
Randomly and even dispersed throughout the plot



Normal distribution

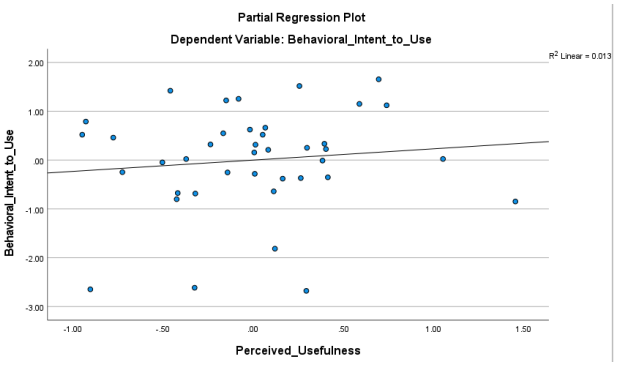


Linearity

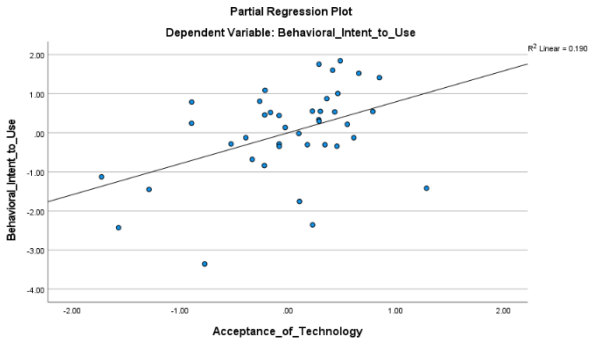


For Perceived Ease of Use the partial plot shows a positive relationship to behavioral intention to use.

The dots seem to funnel out, indifcating greater variance at high levels of PEU, there are no obvious outliers but the funnel-shape might indicate a violation of the assumption of homoscedacticity.



For Perceived Usefulness the dots are evenly spaces out around the line indicating homodescedascity but the relationship looks less linear tan th other predictors.



For Acceptance of Technology the partial plot sjpws the strong positive relationship to behavioral intent to use. There are no outliers and the dots are evenly spread out along the line , indicating homoscedacticity.

Multiple Regression of Perceived Usefulness, Perceived Ease of Use and Acceptance of Technology

	B	SE B	Beta (β)	Sig
Constant	0.08	0.672		
Perceived Usefulness	0.93	0.131	0.791	0
Perceived Ease of Use	-0.003	0.093	-0.004	0.974

Note: N=40. R^2 = .603. **p<.001 (one-tailed)

Multiple Regression of Perceived Usefulness, Perceived Ease of Use, Acceptance of Technology and Behavioral Intention to Use.

	B	SE B	Beta (β)	Sig
Constant	-2.966	1.116		
Perceived Usefulness	0.231	0.335	0.126	0.494
Perceived Ease of Use	0.372	0.115	0.285	0.022
Acceptance of Technology	0.793	0.273	0.508	0.006

Note: N=40. R^2 = .551 **p<.001 (one-tailed)

Simple Regression of Acceptance of Technology and Behavioral Intention to Use

	B	SE B	Beta (β)	Sig
Constant	-1.506	0.947		
Acceptance of Technology	1.099	0.18	0.704	0

Note: N=40. R^2 = .482 **p<.001 (one-tailed)