



Drivers and barriers in adoption of telemedicine services: Evidence from Haryana

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Abstract

Telemedicine technology is of more considerable significance for assisting remotely based health assistance to the medically needy population. This study aims to determine the drivers and barriers influencing the expectation to use telemedicine services. A conceptual research model was formulated regarding a set of hypotheses that were developed and tested by using partial least squares structural equation modelling. The survey was conducted among 286 valid users of telemedicine services in Kurukshetra of Haryana. The findings of the study revealed that the factors like optimism perceived ease of use, and perceived usefulness influence behavioral intention, whereas innovation has a negative impact on usefulness which determines it as a barrier to the behavioral intention of telemedicine services. The study's conclusion states that telemedicine has excellent potential to serve the health care system, and for future research scope, more additional constructs must be used to get brighter and specific results.

Keywords: telemedicine services, TAM, optimism, behavioural intention

Introduction

Telemedicine can be defined as a distant delivery of healthcare services by transferring audio-visual and graphical health information by telecommunication networks. These services are used more and more in different clinical settings. In India, the healthcare delivery system cartwheels far little of its requirement in terms of human resources and infrastructure for taking care of the disease burden (Chandwani and Dwivedi, 2015) ^[1]. Information and communication technologies (ICTs) are helping to expand knowledge across social, economic, and geographic hindrances. Maximum profit, quality improvement, effective cost-saving, rise in the number of patient's engagement in their healthcare, and attainment of a unified healthcare range are some uses of information technology in the healthcare sector. Also, it is contended that ICTs for health initiatives by the electronic medium, like telemedicine, can possibly allow the addition of medical knowledge to lesser-explored areas, thus improving the comprehensibility, quality, and modest reach of healthcare-related services (Chandwani and Dwivedi, 2015) ^[1]. In India, several telemedicine programs were initiated with the involvement of both the public and private sectors. Mainly, Apollo Hospitals, in collaboration with the Indian Space Research Organization (ISRO), designed and introduces a telemedicine system in a small village Argonda of Andhra Pradesh, India. Furthermore, with the help of various central government departments and state governments, the telemedicine system has expanded all over the country with more than 400 platforms. ISRO's telemedicine programs link nearly 245 hospitals, 205 district or rural hospitals, and 40 super-specialist hospitals all over India (Chandwani & Dwivedi, 2015) ^[1].

The ICT industry is growing very widely in India. Therefore, telemedicine technology allows customers to take charge of their treatment and prevention. The latest technology will enable them to make health care out of the hospitals and provide more power to the needy hands. The sheer size of the healthcare market suggests that there's a

massive opportunity for mobile applications and customized purpose-built devices. Maximum profit, quality improvement, effective cost-saving, rise in the number of patient's engagement in their healthcare, and attainment of a unified healthcare range are some uses of information technology in the healthcare sector. The sheer size of the healthcare market suggests that there's a massive opportunity for mobile applications and customized purpose-built devices. Some of the forms and methods used for telemedicine are given below. Let's discuss:

Skype

The world's most used prolific conferencing tool is the first software introduced in this technology. This application tool has also been used informally in the science & medical community for consultations with doctors.

Webcam MD

This upcoming technology makes use of a diagnostic handled USB camera/light-like device that consumers need to have with them that patients run over the part of their body they need a doctor to look at. The developers confirm that this will reduce the time between the doctor and patients.

Skype ER

Skype attendant test is an emergency tool for virtual access to doctors for dealing with their patients in remote areas. This application tool provides various services in the field of healthcare as- online medical support to remote users, telemedicine support, emergency services, and location-based telemedicine in specified regions of India and in keeping medical records of the patients.

Literature Review

Davis (1993) ^[2] stated that usefulness had a strong impact on attitude, whereas ease of use has a little but effective impact on usefulness.

Elliott. (2008) ^[3] the study found that Chinese student has low technology readiness in comparison to American student and culture was an essential factor in that.

Suki and Ramayah (2010) ^[16] The revealed that the intention to use e-Government services has been influenced by perceived usefulness, ease of use, compatibility, interpersonal influence, external influence, self-efficacy, facilitating conditions, attitude, subjective norms, and perceived behavioral control.

Rose and Fogarty (2010) ^[14] demonstrated that the mature consumer market was diverse and should no longer be viewed as one market.

Lin and Chang (2011) ^[8, 9, 10] reported that technology readiness enhances perceived usefulness, perceived ease of use, attitude toward use, and intention to use. Also, the study expressed that technology readiness positive relationship between perceived ease of use and attitude toward using SSTs.

Lin . (2012) ^[8, 9, 10] Results found that the 16-item TRI scale shows sound psychometric properties because of discoveries from different dependability and also scale replications utilizing a few examples.

Godoe and Johansen (2012) ^[4] found that optimism and innovativeness significantly influences perceived usefulness and perceived ease of use.

Kaba and Osei-Bryson (2013) ^[6] the result suggested that PEOU and PU were sensitive to cultural influence.

Mukherjee. (2018) revealed that respondents' TR was moderate with respect to mobile-based self-checkout technology in retail stores.

Zobair. (2019) ^[17] the findings of the study explained except for knowledge, four antecedents significantly contribute to patients' expectations of telemedicine health service adoption, explaining 66% of the variance (R²) in expectations.

Rafique. (2019) revealed a positive relationship between the variables of the study and the acceptance of mobile library applications.

Suzuki. (2020) ^[15] revealed that it is necessary to incorporate future medical needs as indicators to make a more appropriate assessment of the potential.

Kamal. (2020) ^[7] found that the usage intention of telemedicine services is a function of various variables and provides important healthcare information for policymakers as well as health service providers.

Research Methodology

Universe of the study and Sample Size

The study was conducted on the basis of a survey done with the help of a questionnaire carried out with a limited population in Kurukshetra. The responses were analyzed with statistical techniques to find relevant results. The population of Kurukshetra city was 9,64,655 as per the last census (Census, 2011). In literature, Israel (1992; 2003) ^[5] reported a population above 100,000 as an infinite population. Likewise, there is no proper record of the number of telemedicine users and non-user, also indicating an unknown population. Thus, in the case of infinite and unknown populations, researchers advocated considering Krejcie and Morgan (1970)'s to determine the minimum sample size. The target population was the users of telemedicine services in the age group of 18 and above. A total of 286 responses from different localities of Kurukshetra have been collected on the basis of a structured questionnaire.

Period of the Study

Primary data was collected through structured questionnaires. Few responses were collected physically, and the rest were obtained with the help of Google forms because of the lockdown situation in the country due to (COVID-19). A total of 286 valid responses were collected from the users of the telemedicine services with a minimum age of 18. The period of the study was from November 2022 to January 2023.

Sources of Constructs

The construct related to TAM was measured through a statement given by Davis (1989) ^[2]. Expectation to use was measured in the line of Lankton and Wilson (2007) ^[12]. Insecure, innovation, optimism, and nervousness were assessed in the line of Parashuraman (2000).

Analysis and interpretation

Demographic Analysis

Demographic analysis is done on the basis of the demographic characteristics of the sample selected for the study. In the context of this study, gender and age are the two major characteristics used. These are found to be the most valid and effective characteristics, which help to analyze the proper equation of which gender category and what age group is more likely to use or expect telemedicine services in Shimla. The importance of these demographic characteristics can be understood easily as these were commonly used in prior studies (Kamal., 2020; Zobair., 2019) ^[7, 17]. Data shows that there are 63% of males and 37% of females out of the total population of 286. The results indicated that there are more males in comparison to females who responded to the questionnaire. Furthermore, it shows the demographic analysis based on age. This depicts that out of 286 respondents, 83.80% are from the age group 18-30, which shows that the results are preferable for this age group.

Measurement Model

In Table 1, the measurement model was evaluated by testing composite reliability, and convergent and discriminant validity. First, we assessed the reliability and validity of the measurement Instrument using content reliability and convergent validity criteria. For the reliability of the scale, Cronbach's alpha, which is a common method used to measure the reliability and internal consistency of scales, was used (Cronbach, 1970). The tables show the reliability of all the variables used in the study. Cronbach alpha helps in determining the reliability of the variables with their statements used in the questionnaire. PLS (SMART) is used to find the values, and the result shows that all the variables used in the study are reliable. Factor Loading indicates the extent of relevance of variables in explaining the constructs. The value of loading indicates which item is effective or not an effective measure of its construct. The items having values (0.6) and above are said to be valid, and below (0.6) are not effective to their constructs. Convergent validity was verified through the t-statistics for each factor loading. All factor loadings are greater than 0.6. In this study, we have used variables such as anxiety (INS) with the highest value INS1 (0.892) and lowest INS4 (0.813), Expectation to use (EXP) with the highest value EXP3 (0.882) and lowest (0.846), Innovation (INN) with highest value INN1 (0.818) and lowest INN4 (0.681), Nervousness (DIS) with highest DIS2 (0.9) and lowest DIS1 (0.699), Optimism (OPT) with highest OPT4 (0.792) and lowest OPT1 (0.72), Perceived ease of use (PEOU) with highest PEOU3 (0.844) and lowest

PEOU2 (0.821) and Perceived usefulness with having (0.88) to its all items PU1, PU2, and PU3. These values of factor loading show that all the items of the various constructs are reliable to their constructs as every item has a value of more than 0.6, which indicates the relevance of the variables. The factor loadings in the given table show that all the items are relevant to the constructs used in this study.

Cronbach’s alpha is a measure of scale reliability or internal consistency that is closely related to a set of items as a group. If the average correlation between the items is low, that means the alpha is low and vice-versa. The Cronbach’s alpha or reliability coefficient of 0.70 or higher is said to be acceptable. The correlation between the constructs used in the study is INS (0.866), EXP (0.89), INN (0.773), OPT (0.741), DIS (0.862), PEOU (0.785), and PU (0.859), which shows the reliability of the constructs as all the variables show reliability coefficient more than 0.70 which is said to be acceptable. The result shows that all the constructs in the study are acceptable and reliable as can be seen in the table1 below. Composite reliability is the internal consistency of a scale that assesses the degree to which the items are homogeneous. Composite reliability measures the overall reliability of a group of items loaded on a latent construct. The value of composite reliability ranges between 0-1 where

0.7 and above shows good reliability, and between 0.6 - 0.70 is also acceptable. In this study, INS (0.908), EXP (0.924), INN (0.855), OPT (0.836), DIS (0.898), PEOU (0.874), and PU (0.914) shows that all the constructs of the study are accepted as they show good reliability which is indicated above 0.70. The items of EXP are seen to be the most reliable as they show the highest reliability with 0.924, and composite reliability is shown in Table 1 for all the constructs used in the study. The average variance extracted is the average amount of variance that any construct is managed to explain. It is used as a measure to assess convergent validity. The AVE is said to be acceptable if its value is 0.5 or more. The AVE shows the reliability of the items to the variables. In this study, the constructs showing Average variance extracted as INS (0.713), EXP (0.751), INN (0.597), OPT (0.567), DIS (0.69), PEOU (0.699), and PU (0.779) which are indicating the reliability of the study as all the variable having AVE value higher than 0.5 which shows the acceptability of the constructs. The result shows that Perceived usefulness is the most reliable of all the other variables with the highest AVE value (0.779). The convergent validity and reliability of the variables of the study can be seen in table1 below.

Table 1: Convergent Validity and Reliability Statistics

Latent Constructs	Indicators	Factor loading	Cronbach's alpha	Composite reliability	(AVE)
Insecure	INS1	0.892	0.866	0.908	0.713
	INS2	0.819			
	INS3	0.851			
	INS4	0.813			
Expectations to use	EXP1	0.846	0.89	0.924	0.751
	EXP2	0.868			
	EXP3	0.87			
	EXP4	0.882			
Innovation	INN1	0.818	0.773	0.855	0.597
	INN2	0.783			
	INN3	0.801			
	INN4	0.681			
Optimism	OPT1	0.72	0.741	0.836	0.561
	OPT2	0.738			
	OPT3	0.743			
	OPT4	0.792			
Nervousness	DIS1	0.699	0.862	0.898	0.69
	DIS2	0.912			
	DIS3	0.876			
	DIS4	0.834			
Perceived ease of use	PEOU1	0.842	0.785	0.874	0.699
	PEOU2	0.821			
	PEOU3	0.844			
Perceived usefulness	PU1	0.88	0.859	0.914	0.779
	PU2	0.888			
	PU3	0.881			

Source: Primary data and Smart PLS Result

The measurement model was evaluated by testing convergent validity and reliability (J. Hair, 2017). Table 1 shows the average variance extracted (AVE) values of each construct exceeding the threshold limit of > 0.5, which indicates significant convergent validity and reliability of the variables by Cronbach’s alpha. Discriminant validity is the extent to which a construct is truly distinct from other constructs which means a latent variable should explain the better variance of its indicators than the variance of the other variables. To examine the Discriminant validity, the shared variances between the factors were compared to the

AVE of the individual factors (Fornell and Larcker, 1981). The variables are said to be acceptable only if the square root of each construct’s AVE is higher than the correlation with other constructs. In this study, the Discriminant reliability of the constructs is DI (0.831), EXP (0.867), INS (0.844), OPT (0.749), PEOU (0.836), PU (0.8830), and INN (0.773). Table 2 shows the values of different constructs which indicates that all the variables in this study are valid as the square root of each construct’s AVE is larger than its correlation with the other variables. There, the all variable's Discriminant validity is acceptable.

Table: 2 Discriminant Validity

	Nervousness	Expectations to Use	Insecure	Optimism	Perceived Ease of Use	Perceived Usefulness	Innovation
Nervousness	0.831						
Expectations to Use	0.057	0.867					
Insecure	-0.105	0.219	0.844				
Optimism	-0.055	0.385	0.281	0.749			
Perceived Ease of Use	0.171	0.647	0.311	0.337	0.836		
Perceived Usefulness	0.244	0.632	0.255	0.29	0.739	0.883	
Innovation	-0.194	0.22	0.629	0.257	0.255	0.102	0.773

Source: Primary data and Smart PLS Result

The results in Table 2 confirms that the square root of each construct's AVE was higher than the correlation with the other constructs, which confirms construct's acceptable Discriminant validity.

Structural Model

The Structural Model is developed to describe the relationships between the constructs and to examine their significance. The constructs or variables are tested by a standardized path coefficient (β) and (t) statistics. The structural model revealed that almost all the hypotheses is supporting relationships except one. Our findings show that

how major variables had a significant effect on user expectations. The relationship between PEOU and EXP ($\beta=0.391$; $t=5.236$) whereas PU and EXP ($\beta=0.343$; $t=4.348$) shows that perceived ease of use and perceived usefulness have a significant positive impact on the user expectations to use. The relationship between INN and PU ($\beta=-0.148$; $t=2.395$) shows a negative impact which indicates that innovation is a barrier for influencing the users' expectations to use. Therefore, the findings state that DIS, INS, OPT, PU and PEOU are the factors influencing the user expectations to use telemedicine services.

Table: 3 Structural Estimation of t-values and p-values for the Structural Model

Sr. No	Hypotheses	Beta	T Statistics	Decision
1	Optimism -> Perceived Usefulness	0.071	0.82	Reject
2	Optimism -> Perceived Ease of Use	0.275	4.337	Supported
3	Innovation -> Perceived Usefulness	-0.148	2.395	Supported
4	Innovation -> Perceived Ease of Use	0.121	1.418	Reject
5	Nervousness -> Perceived Ease of Use	0.241	3.111	Supported
6	Nervousness -> Perceived Usefulness	0.119	2.106	Supported
7	Anxiety -> Perceived Ease of Use	0.186	1.952	Reject
8	Anxiety -> Perceived Usefulness	0.125	2.101	Supported
9	Perceived Ease of Use -> Expectations To Use	0.391	5.236	Supported
10	Perceived Ease of Use -> Perceived Usefulness	0.691	10.298	Supported
11	Perceived Usefulness -> Expectations To Use	0.343	4.348	Supported

Perceived ease of use ($t=5.236$, $\beta=0.391$) and perceived usefulness ($t=4.348$, $\beta=0.343$) are major variables indicating the expectation to use telemedicine services by the people. Many studies earlier, (Toherdost, 2017; Kamal , 2020; Hu , 1999) [7] have confirmed that these factors are significant in the context of the expectation to use telemedicine services among people. Telemedicine services must be designed accordingly to the people's expectations and acceptance level. As people will be motivated more and more towards telemedicine, they will be accepting this technology easily. Therefore, the service providers must focus on the expectations of the people for proper and effective utilization of the technology.

Perceived ease of use is supported by the factors such as Nervousness ($t=3.111$, $\beta=0.241$) and optimism ($t=4.337$, $\beta=0.275$) which shows the positive influence of the ease of use the telemedicine services by the people, whereas innovation ($t=1.418$, $\beta=0.121$) and Insecure ($t=1.952$, $\beta=0.186$) does not support the ease of use to the telemedicine services which is also confirmed in the previous studies, (Suzuki , 2018 [15]; Son , 2011). Nervousness and optimism positively influence the ease of use as people feel more comfortable dealing with and have a very positive perception of telemedicine technology. Thus, innovation and Insecure negatively influence the ease of use because people have a fear of new innovations in such

technology because it makes it more complex and they lose their confidence towards the telemedicine health care system.

Perceived usefulness has got major support by Nervousness ($t=2.106$, $\beta=0.121$), innovation ($t=2.395$, $\beta=-0.148$), and anxiety ($t=2.101$, $\beta=0.125$) whereas optimism ($t=0.82$, $\beta=0.071$) shows negatively influence the perceived usefulness of telemedicine services which is proved in the earlier study, Mukherjee, (2019). Nervousness, innovation, and anxiety positively influence the usefulness of such technologies as people are very comfortable and found telemedicine technology understandable and practicable much more secure for sharing their medical information. Whereas, optimism is negatively influencing the usefulness of telemedicine services because some people feel that such technologies are more complex to use and not be used by an ordinary person (Lankton and Wilson, 2007) [12].

This is very important to note that Nervousness shows positive support with perceived ease of use (PEOU) and perceived usefulness (PU) of telemedicine services. Innovation supports perceived usefulness (PU) but rejects perceived ease of use (PEOU). But rejects the usefulness (PU), whereas optimism rejected the perceived ease of use (PEOU) and supported the usefulness (PU) of telemedicine services. The findings of the study indicate that all the variables of the study have a great impact on influencing the

expectation to use telemedicine services among people in Himachal Pradesh.

This technology can act as a block to the existing health setup. The research study developed a theoretical model based on TAM and TR to investigate the expectations for to use of telemedicine services. The main objective of TAM is to forecast the acceptance and adoption of new technologies among users and to highlight the problems of the information system before its applicability. The study constructed the constructs of TR with two major constraints of TAM which are perceived ease of use and perceived usefulness. Therefore, the integrated TRAM (Technology Readiness and Acceptance Model) is developed to investigate the issue of user expectations to use telemedicine technology.

Discussion

This research study developed a theoretical model based on TAM to determine the expectation to use telemedicine among people. This research model only explained 47 % of the variance in the expectation to use telemedicine services. The aim of this research study is to determine the drivers & barriers influencing the expectation to use telemedicine services among people. The findings of the study indicate that the constructs such as Nervousness, optimism, perceived ease of use, and anxiety represent the drivers influencing the expectation to use telemedicine services. The findings of the study also indicate that innovation over perceived usefulness represents the barriers influencing the expectation to use telemedicine services among the people

Limitations and Scope for Future Research

This study adopted the purposive sampling technique as the survey instrument, and this is mainly because the above-mentioned technique is cost-effective and has been collectively used in IS research. There are also many socio-cultural barriers based on societal norms and cultural beliefs or a trend that determines the behavior towards the expectations and acceptance of telemedicine services among people. For future research, the use of a more representative survey population to explore the expectation to use and acceptance of telemedicine services.

References

- Chandwani RK, Dwivedi YK. Telemedicine in India: current state, challenges and opportunities. *Transforming Government*,2015;9:393-400. <https://doi.org/10.1108/TG-07-2015-0029>
- Davis FD. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*,1993;38:475-487. <https://doi.org/10.1006/imms.1993.1022>
- Elliott K, Meng G, Hall M. The Influence of Technology Readiness on the Evaluation of Self-Service Technology Attributes and Resulting Attitude Toward Technology Usage. *Services Marketing Quarterly*,2012;33:311-329. <https://doi.org/10.1080/15332969.2012.715049>
- Godoe P, Johansen TS. Understanding adoption of new technologies: *Journal of European Psychology Students*,2012;3:16.
- Israel GD. Determining sample size. Institute of Food and Agricultural Sciences (IFAS), Fact Sheet PEOD-6, University of Florida, Gainesville, FL, 1992.
- Kaba B, Osei-Bryson KM. Examining influence of national culture on individuals' attitude and use of information and communication technology: Assessment of moderating effect of culture through cross countries study. *International Journal of Information Management*,2013;33:441-452. <https://doi.org/10.1016/j.ijinfomgt.2013.01.010>
- Kamal SA, Shafiq M, Kakria P. Investigating acceptance of telemedicine services through an extended technology acceptance model (TAM). *Technology in Society*,2020;60:101212. <https://doi.org/10.1016/j.techsoc.2019.101212>
- Lin JC, Chang H. The role of technology readiness in self-service technology acceptance. *Managing Service Quality*,2011;21:424-444. <https://doi.org/10.1108/09604521111146289>
- Lin JSC, Hsieh PL. The influence of technology readiness on satisfaction and behavioral intentions toward self-service technologies. *Computers in Human Behavior*,2007;23:1597-1615. <https://doi.org/10.1016/j.chb.2005.07.006>
- Lin JC, Hsieh P. Refinement of the technology readiness index scale: A replication and cross-validation in the self-service technology context. *Journal of Service Management*,2012;23:34-53.
- Mukerjee HS, Deshmukh GK, Prasad UD. Technology Readiness and Likelihood to Use Self-Checkout Services Using Smartphone in Retail Grocery Stores: Empirical Evidences from Hyderabad, India. *Business Perspectives and Research*,2019;7:1-15. <https://doi.org/10.1177/2278533718800118>
- Lankton NK, Wilson EV. Factors Influencing Expectations of e-Health Services within a Direct-Effects Model of User Satisfaction. *e-Service Journal*, 2007;5:85-112. <https://doi.org/10.2979/esj.2007.5.2.85>
- Parasuraman A. Technology Readiness Index (Tri): A Multiple-Item Scale to Measure Readiness to Embrace New Technologies. *Journal of Service Research*,2000; 2:307-320. <https://doi.org/10.1177/109467050024001>
- Rose J, Fogarty G. TECHNOLOGY READINESS AND SEGMENTATION PROFILE OF MATURE CONSUMERS. *Conference Proceedings*, 2010:4:9.
- Suzuki T, Hotta J, Kuwabara T, Yamashina H, Ishikawa T, Tani Y, Ogasawara K. Possibility of introducing telemedicine services in Asian and African countries. *Health Policy and Technology*,2020;9:13-22. <https://doi.org/10.1016/j.hlpt.2020.01.006>
- Suki NM, Ramayah T. User acceptance of the e-government services in Malaysia: structural equation modelling approach. *Interdisciplinary Journal of Information, Knowledge, and Management*, 2010;5(1):395-413.
- Zobair KM, Sanzogni L, Sandhu K. Expectations of telemedicine health service adoption in rural Bangladesh. *Social Science & Medicine*,2019;238:112485. <https://doi.org/10.1016/j.socscimed.2019.112485>