A Study of User Perception and Adoption of Telemedicine

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Abstract

The purpose of the study is to inspect the variables influencing the level of acceptance and adoption of telemedicine among users in India. Data was collected from the Gen X and Gen Y. SmartPLS was used to ascertain the dominant constructs by employing extended TAM influencing the user's intent to use telemedicine. The results show that telemedicine is influenced by perceived ease of use, perceived risk, technology and social influence.

***Keywords*— Telemedicine, perception, trust, perceived ease of use, perceived usefulness, user acceptance, social influence**

1. INTRODUCTION

Telemedicine has transformed the healthcare sector and is rapidly growing with technological advancement. Telemedicine refers to the use of various information and communication tools (ICT) in providing healthcare and allied services by creating a virtual space for patients and healthcare professionals. According to American Telemedicine Association, Telemedicine is defined as the use of ICT such as the Internet, wireless networks, intranets, and worldwide webs in the delivery of healthcare services. Healthcare sector has been facing challenges in India with rising costs, out of pocket expenses, demands of patients and universal access [1]. Telehealth is considered to be the suitable alternative solution to deal the problems of access to healthcare in emerging nations to provide health care support where the availability of health care professionals is a challenge [2]. This study aims to help understand factors such as user's behavior in adopting telemedicine, inclination to use it as an alternative medium and the perceived risk in the adoption of telemedicine. The available research in the past few years highlight that, the market size of telemedicine in 20 countries (Italy, Poland, Netherlands, U.S., Canada, Germany, UK, France, Spain, Belgium, Switzerland, Sweden, China, Japan, India, Australia, Brazil, Mexico, South Africa and Saudi Arabia) for the year 2019 was estimated to be $45.5 billion [3] [4]. According to Statista report, by August 2022 the level of usage of telemedicine by Indian consumers has upsurge by 22% for physical health and 33% for mental health [5]. In view of this, Ministry of Health and Family Welfare (MoHFW) in association with Department of Information Technology (DIT) introduced the Telemedicine Practice Guidelines (TPG) in March 2020 [6] [7]. But its wide spread adoption has impeded due to several challenges like administrative and legal policy, lack of adequate regulatory framework to implement telemedicine modalities to healthcare service delivery, resulting in underprivileged and heterogeneous acceptance and integration of telemedicine services across India [8]. The Indian telemedicine market is forecasted to exhibit a CAGR of 30.20% by 2027, impelled by rapid digitization of health care industry. The telemedicine industry is projected to create a $5.4 billion market with a CAGR of 31 per cent. India attained the World Health Organization (WHO) requirement of doctor to population ratio of 1:1000, despite this fact several issues persist in India concerning the unmet urban rural divide w.r.t ICT infrastructure, unmet rural health are inequalities [9] [10]. Telemedicine can help reduce the time of consultation and shall also help in improving healthcare services by extending the

reach to rural areas. The study aims to identify the dominant constructs that promote the use of telemedicine among the population. Also, it entails in identifying the relationship amongst the selected constructs. This study intent to assess the perception level of acceptance of telemedicine services in India using TAM and tries to fill the existing gap found in the previous literature. The study would help the policy makers, health care service providers and Information Technology (IT) vendors to understand the significant factors that influence the user in adopting telemedicine.

2. LITERATURE REVIEW

Telemedicine services include health examinations, hospital procedures, and location-based services. This can all be availed by technology-based platforms. A study by Nancy E and Brown-Connolly [11] [12] demonstrated that telemedicine service using mHealth is highly cost-effective. Telehealth has helped in the early detection of health hazards and facilitated in bringing productive modifications to users' health habits. Due to their benefits like effortless agility, portability, and omnipresence, health associated technologies have received worldwide attention [13]. However, empirical studies about users' adoption behaviours of Telemedicine services remain circumscribed as a newly emerging phenomenon. Technology acceptance Model (TAM) proposed by [14] [15] is considered as the initial model in assessing and measuring the user acceptance in adopting new technology. The acceptance by the users has been a major concern in the process of using and adopting the advanced technologies in consumer research [16]. Extended TAM has been used in the study to understand the impact of new technologies. TAM is extensively used model to gauge the adoption, impact of technology and related factors in various fields, including healthcare [17]. The original TAM model uses perceived ease of usefulness (PEOU) and perceived ease of use (PEO) as the primary constructs. However, the usage intention by a specific user cannot only be explained by the mentioned constructs. Mohd.Alam et al, in their study[18] confirmed the acceptability of Unified Theory of Acceptance and Use of Technology (UTAUT) model in the context of mhealth services among generation Y in the developing nations. Rahi 2022 [19] emphasised on the factors influencing the individual behaviour towards the adoption of telemedicine by incorporating UTAUT model. Bhataacharjee [20] studied the phenomenon of telemedicine and explored the various aspects of healthcare technology awareness adoption and practice in India. To develop the model, factors of basic TAM and other noted constructs, social and behavioral factors, risk-associated factors, and resistance towards technology etc., have been used to assess the association of users' perception level of acceptance and adoption behavior. Based on previous research conducted in this field where the popular two variables of TAM such as PEOU, PU, have been identified as major factors influencing the user’s bias towards using telemedicine services[21] and other significant factors like privacy & trust, social influence, perceived utility, technology acceptance and resistance and intention to use were considered as response variables in extended TAM. [22]

3. RESEARCH METHODOLOGY

The purpose of the study is to assess the variables that influence the telemedicine user`s perception level of adoption. To achieve the objective, a questionnaire as a primary survey tool was designed which was organized into two sections; the first section is about the demographic factors of the respondent and the second part of the questionnaire is about users' perception of their comfort using telemedicine and the risk associated with it. The purposive sampling technique was used to identify the sample population. Generation X and Generation Y having minimum educational qualifications as graduation and knowing technology usage, was selected as a sample population. The questionnaire was administered

to the people falling between the age group 20-60. The questionnaire was circulated online to approximately 272 respondents out of which 196 responses were received, 188 were considered after removing duplicates and inappropriate responses for data analysis. The data was analyzed using SmartPLS method. PLS model in this research facilitated in determining the user's acceptance of telemedicine by considering Privacy & Trust (PAT), Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Perceived Risk (PR), Social Influence (SI), Technology (T) as the latent variables. The PLS model calculated t- value and path values based on the responses to validate the hypothesis. The parameters were measured on a 5-point Likert scale, with one measuring as "Strongly Disagree" and 5 "Strongly Agree". The following hypotheses are developed to assess the users' perception of the determining factor of behavioral intent and usage that influences the adoption of telemedicine.

3.1 Perceived ease of use

Perceived ease of use (PEOU) is the most common significant determinant of technology acceptance in the TAM model [23]. If a user believes that telemedicine would help reduce the cost of healthcare expenditure, the users will swiftly adopt this method. Former literature reveals that a person would find adopting telemedicine services useful only if they receive speedy delivery of health care services with affordable health inspection and reduced service time of health care. Davis. F [24] defined PEOU as a person's belief that employing technology will require the least effort on his/her part. As a result, it is anticipated that people will only receive and employ telemedicine services if they believe doing so would result in improved outcomes [25].

3.2 Perceived usefulness

Perceived usefulness (PU) is also the most common significant determinant of technology acceptance [26]. PU is defined as the extent to which a person believes that using a structure would benefit in enhancing his/her performance [27]. In the context of present study, the definition of PU is referred to the use and the acceptance of telemedicine would help faster delivery of healthcare services without unnecessary health examination and with reduced time of healthcare service. According to Badea et al, [28] it was observed that home care (52.86 % of the total group) followed by emergency care (42.14 % of the total group) were the most directed area for the application of telemedicine [2].

3.3 Perceived risk

This hypothesis suggests that the user may be reluctant to use telemedicine, perceiving that the same may not be useful in addressing their concern and may lead to mental dissatisfaction. This may lead to the disinclination of users to adopt telemedicine services. Perceived risk is a person's assessment of the risk involved in taking a specific action or activity [29]. The consequences of risk and uncertainty associated with healthcare and ICT, cannot be curtailed. However, the sources of risk and uncertainty about ICT usage vary considerably across the users [30]. Risk perception about the security and reliability are considered to be the important antecedents of the behavioral intention to use telemedicine and its acceptance [31]. Previous research has identified six different categories of risk: performance, financial, social, psychological, safety, social, and opportunity/time [32]. Considering these as foundation, we define perceived user risk as psychological, financial, and performance in this study.

3.4 Social influence

Social influence represents the magnitude at which a person believes that her/his acquaintances and friends have faith that he/she would use the system/new technology confidently [33]. The opinion of people plays an important factor in user acceptance of

telemedicine. Existing literature highlights that social influence significantly impacts people's willingness to embrace new technologies [34]. Word of mouth in a society with access to telemedicine technology gives people the confidence to move towards the same. Rahi.S [19] projected that, social influence as a major influencing factor in determining the user behavior towards adoption of telemedicine application. Nevertheless, their thoughts and experiences would also encourage them to practice telehealth facilities.

3.5 Technology based services

People's resistance to adapting to new technology can result in technology failure in telemedicine applications. Though technology has endless potential, if it is entirely rejected by the users or remains unutilized, then technology resistance by the user may limit the use of telemedicine. In an interview-based study by Jarosławski & Saberwal, technology was not the only limiting factor for the use of telemedicine; factors like unavailability of health personnel, financial stability and absence of business model also played a significant role [35].

3.6 Privacy and trust

The user may believe that the data being captured in the process may not be secure and may have a possibility of being disclosed publicly. This would build avoidance inclination in the minds of the user towards the telemedicine services. Several researches have supported the inclusion of risk and trust in TAM models to explain the adoption and integration of ICT-based healthcare technologies over time [36]. Trust has been considered as a significant determining factor in the assessment of acceptance of innovative ehealth services [37]. Trust is perceived as faith in embracing novel technology that end-user`s place in the services it offers [38].

4. DATA ANALYSIS & DISCUSSION

The details of the demographic characteristics of the respondents are as follows. Out of the 188 observations, 46.81 per cent represents Generation X, born after 1960. Of the participants, males constituted 69.15% and the rest 30.85% are females. About the education qualification, majority of the respondents i.e., 50.79% are post graduates and 46.37% are graduates and only 5.29% are undergraduates. The proposed model presented a variance of 61.3% demonstrating the fact that 61.3% of usage intention could be explained using this research model. To validate and ensure reliability of the responses received from the survey items, Cronbach's alpha was applied using SPSS software, and it was found to be 0.742 for the 26 items. Average Variance Extracted (AVR) & Composite Reliability (CR) was calculated to find the convergent validity of the items loading. The CR for all the constructs was calculated and found to be above 0.7 for all constructs suggesting that the criteria for convergent validity are fulfilled. The following graph No. 1 is representing as measurement model depicting the loadings of individual items and how each variable is contributing to the constructs. From the following graph no.1 presented below, we observe a value of 0.822 PU1, 0.814 PU2 as factor loadings contributing from Perceived Usefulness (PU) and similarly, factor loadings of other variables are observed. In the technology(T), we find T1 with 0.855 and T3 with 0.877 factor loading. In perceived risk (PR) PR5 carries the maximum factor loading of 0.819, in social influence (SI) SI1 & SI3 carry factor loading of 0.844 & 0.894. similarly, in perceived ease of use (PEOU), PEOU 2 has a factor loading of 0.851. And finally, in privacy and trust (PAT), PAT2 with 0.864 represents the highest factor loading effect. Factor loadings entails, how much a factor explains a variable. The value between various constructs and Intention to Use is the standardized regression value or the effect of each construct towards acceptance and intention to use.

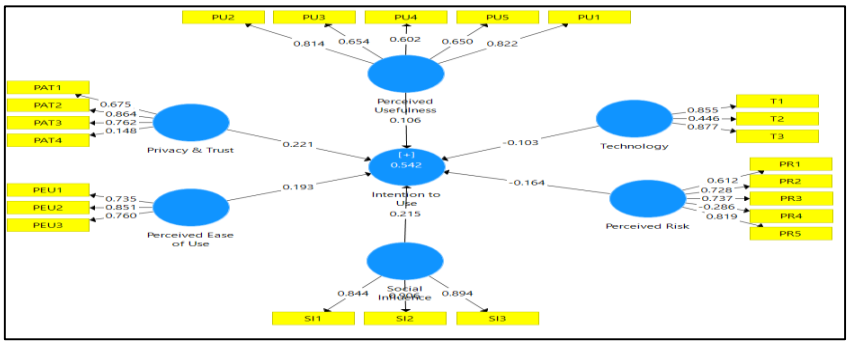

Figure no. 1 T-statistics value calculated using SmartPLS

To determine whether the regression values are significant or not, bootstrapping is performed. Bootstrapping is a statistical process for resampling a single dataset to create multiple simulated samples. The results after performing bootstrapping are observed in table no.1.

Variables	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values
Privacy & Trust-> Intention to use	0.221	0.220	0.064	3.44	0.001
Social Influence -> Intention to Use	0.215	0.210	0.071	3.03	0.002
Perceived Ease of Use -> Intention to Use	0.193	0.198	0.063	3.057	0.002
Perceived Usefulness -> Intention to Use	0.106	0.122	0.102	1.039	0.299
Technology -> Intention to Use	-0.103	-0.095	0.077	1.33	0.184
Perceived Risk -> Intention to Use	-0.164	-0.162	0.081	2.023	0.043

Table no.1: T-value of various constructs calculated using SmartPLS

From the T statistics value, it can be observed that Perceived Ease of Use (t=3.057, β=0.193), Privacy and Trust (t=3.440, β=0.221), Social Influence (t=3.030, β=0.215), and Perceived Usefulness (t=1.039, β=0.106) have a positive relationship with the intention to use. A T-value above 1.96 suggest that the hypothesis is supported. Lower t-value are observed for Perceived Usefulness and Technology, suggesting that people are not confident about the benefits of telemedicine and are not sure whether adopting telemedicine would help them reduce healthcare expenses or improve health care quality. A lower t-value in the case of technology suggests that the hypothesis related to technology remains unsupported; this could be possible as most respondents are under the age of 40. This age group are more familiar with technology and hence may not find difficulty in adopting new tools. At the same time, a negative β suggests that if some threat due to technology is observed, it may hinder telemedicine's usage as a service.

5. CONCLUSION

The study presents majorly four dominant constructs' comprising, PEOU, PR, SI and PAT that are evidently demonstrating to be influential in adapting the telemedicine services. In India, telemedicine would be essential in overcoming the healthcare problems. Moreover, to utilize it to its full potential, it is required that the population needs to be educated about the practices of telemedicine. From the responses, it is evident that people are willing to use and accept telemedicine in their life but are not quite sure whether its application would help them reduce their healthcare expenses or even save time. Perceived Risk and Technology are crucial in setting the example for telemedicine applications. Awareness of the use of telemedicine is to be developed among the people through education support programs. Privacy and Trust played the highest role in user acceptance of telemedicine, suggesting that there should not be any area of confusion in the mind of users related to data security. Telemedicine service providers and policymakers can use the research findings to design campaigns for expanding telemedicine services. The factors identified can help detect the barriers and drivers of promoting telemedicine. Lastly, the scope of the study can be increased by including several other independent constructs and examine the impact on the adoption of telemedicine. Also, a cross reference study using demographic factors would be more beneficial to understand the perception level of the users and adoption of telemedicine.

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