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Willingness to use telemedicine during COVID-19 among health professionals in a low income country

Mohammedjud Hassen Ahmed [a,*], Shekur Mohammed Awol [b], Shuma Gosha Kanfe [a], Samuel Hailegebreal [c], Gebiso Roba Debele [d], Geleta Nenko Dube [a], Habtamu Alganeh Guadie [e], Habtamu Setegn Ngusie [a], Jorn Klein [f]

[a] Department of Health Informatics, College of Health Sciences, Mettu University, Mettu, Ethiopia
[b] Department of Health Informatics, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia
[c] Department of Health Informatics, College of Medicine and Health Sciences, Arbaminch University, Arbaminch, Ethiopia
[d] Department of Public Health, College of Health Sciences, Mettu University, Mettu, Ethiopia
[e] School of Public Health, College of Health Sciences, Bahir dar University, Bahir dar, Ethiopia
[f] University of South-Eastern Norway, Porsgrunn, Norway

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ABSTRACT

Introduction: The coronavirus disease 2019 pandemic has prompted rapid restructuring of the health-care system in an effort to stop the spread of the pandemic. Thus, telemedicine is more preferable in order to prevent the COVID-19 pandemic when face to face meeting is forbidden, allowing provision of health service over a distance. This study aimed to assess willingness to use telemedicine and factors that will determine their extent of willingness during COIVID-19 among healthcare providers working in south west of Ethiopia.

Methods: Institutional based cross-sectional study design was applied to assess willingness to use telemedicine among healthcare providers working at public health hospitals in south west of Ethiopia. Self-administered questionnaires were used. We have used Epi-info for data entry and Analysis of Moment Structure (AMOS) for analysis. A structural equation modeling was performed to identify factors associated with willingness to use telemedicine at 95% confidence interval (CI).

Result: In this study, less than half of respondents had high willingness to use telemedicine. Ease of use ($\beta = 0.79$, 95% CI: [0.72, 0.86], $p < 0.01$), attitude ($\beta = 0.91$, 95% CI: [0.87, 0.95], $p < 0.01$) and patient-physician relationships ($\beta = 0.67$, 95% CI: [0.54, 0.70], $p < 0.01$) were variables associated with willingness to use telemedicine. Anxiety towards technology ($\beta = 0.74$, 95% CI: [0.69, 0.79], $p < 0.01$) and patient-physician relationships ($\beta = 0.87$, 95% CI: [0.81, 0.92], $p < 0.01$) were determinant factors of attitude to use telemedicine.

Conclusions: The overall willingness to use telemedicine during COVID-19 in this setting is 46.5%. Addressing the problem related with ease of use, attitude and patient-physician relationships will help to increase the overall willingness to use telemedicine during COVID-19. An attempt to improving patient-physician relationship, provision of technical training for ease of use and working on healthcare providers' attitude will help to improve the willingness to use telemedicine.

1. Introduction

There is a communication in modern health care system fueled by the growth of powerful new health information technologies (HITs) that hold tremendous promise for enhancing the delivery of health care and the promotion of health [1]. The development, adoption, and implementation of a broad range of new e-Health applications, such as ubiquitous health information websites (such as Medline Plus, Health finder, and Web MD), online social support networks, interactive electronic medical records, clinical decision support systems, tailored health education programs, health care system web portals, mobile health communication devices, and advanced tele-health applications [2].

Abbreviations: α, Alpha; **CI**, Confidence Intervals; **ETB**, Ethiopian Birr; **HITs**, Health Information Technologies; **IT**, Information Technology; **USA**, United States of America; **TM**, Telemedicine.

* Corresponding author. Mettu University, College of health sciences, Department of health informatics, Ethiopia.
E-mail address: judhassen423@gmail.com (M.H. Ahmed).

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Digitizing health systems are considered as a potential to improve healthcare services or possibly as an alternative in some healthcare areas such as patient management in Ethiopia.

Health care technology has the potential to reduce the impact of the gap in health care that is found between urban and rural areas. In order to better coordinate and improve health care services, health care technology provide the tools to capture, store, process, analyze and communicate health care information [3]. The proliferation of health information technology (HIT) in supporting highly specialized tasks and services have made it increasingly important to understand the predictors essential to technology acceptance of health care technology by individuals [4].

Telemedicine uses different technologies to help patients and has historically been used to provide care for patients in resource limited settings [5]. Telemedicine has been recognized as a way to improve accessibility, quality, and efficiency of care in a distance. Telemedicine involves a range of technologies, including "smartphones," computer tablets, mobile applications, and video conferencing, to allow health care providers to evaluate, diagnose, monitor, treat, and educate patients virtually [6]. Telemedicine is currently the fastest growing sector of health care and much of this growth is attributable to the benefits of telemedicine, including shorter wait times, avoidance of travel, and fewer missed appointments [7]. We have found it a useful tool especially in the management of chronic disorders, like diabetes, high blood pressure and some long-term lung diseases during COVID 19.

Telemedicine is the use of information technology to support healthcare services and activities via electronic transmission of information or expertise among geographically dispersed parties [2]. As the population ages, medical expenses due to chronic diseases are drastically increasing, it is very important to implement and adopt telemedicine in Ethiopia. This rapid cost increase is a serious issue that must be fixed in the near future. As a result, telemedicine service has been proposed as a promising solution to this problem with the potential to improve patient care, especially for those with chronic medical conditions, such as diabetes, hypertension, and even cancer [8]. Even after the Covid-19 emergency, telemedicine will be needed to streamline outpatient visits, reduce overcrowding and the costs of healthcare which would make them more affordable and thus more sustainable, with significant benefits for Ethiopia.

The aim of telemedicine in the developing countries are to deliver healthcare to population in remote areas and ensure equality in delivery of care and treatment [9]. Recent advances in telemedicine technology are an important form of IT-enabled delivery and decision support for healthcare professionals in Ethiopia. Persistent problems harassing contemporary health care, including access, quality, resource distribution, and cost containment, have contributed to telemedicine economic and social, and appeal to implement in Ethiopia.

A fast-growing number of telemedicine programs have been established (or are under way) around the world [10]. In a fairly comprehensive review of telemedicine and its clinical applications, researchers suggest that the ultimate success of telemedicine requires that an adopting organization address not only technological but also managerial challenges, including user technology acceptance [11–13].

Information and Communication Technology (ICT) has been seen incredible growth in the last decades in Ethiopia. Delivering healthcare services is a remaining issue in the country even though Ethiopia is still under development in all terms. Some of these issues are transform scarce resources to meet healthcare needs, financial, human resources and the ability to manage. Telemedicine service in Ethiopia initially began as a pilot project at some places in Ethiopia. Nevertheless, although telemedicine service has been accepted by few health professionals in Ethiopia, telemedicine service is making slow progress due to health professional's resistance about acceptance and implementation of telemedicine [14].

Health care systems globally are likely to fight to the ever-increasing number of victims with chronic diseases. Patients with chronic diseases use a large portion of health care providers [9]. Therefore, exploring alternative ways of delivering care, supporting health professionals and managing chronic diseases is needed, particularly in light of the financial pressures currently facing health care systems.

To control spread of this pandemic, many centers have boosted telemedicine capability to care for patients who would typically be seen in person in outpatient settings. To slow the spread of COVID-19, Centers for Disease Control and Prevention (CDC), has implemented social distancing and quarantine rules and also they advise to "reduce unnecessary health-care visits" and "explore alternatives to face-to-face triage and visits [2]. A major challenge during this crisis is to keep patients and the health-care team safely distant while providing patients with effective and efficient care. Telemedicine is a logical solution to help address these challenges.

To implement telemedicine, willingness of health professionals towards telemedicine needs to be studied before actual utilization of telemedicine in Ethiopia. Without understanding willingness of telemedicine among health professionals, patients and health professionals will face difficulties to obtaining quality care from distance.

Telemedicine has the potential to improve care for patients with difficulty accessing traditional services, such as those who are housebound or live in rural areas in Ethiopia. Additionally, since telemedicine can enable a patient to monitor their own vital signs at home (eg, blood pressure), it may be more convenient and comfortable, enhance independence, and empower patients. To realize the benefits of telemedicine, health professionals must engage with and make use of it. Telemedicine is to make an important contribution to the health care system for managing chronic diseases and address to patients in remote areas. Problems related to lack of careful planning, increased provider time, computer down time, lack of standards to interchange information, user resistance and threats to confidentiality negatively contribute for the successful implementation of telemedicine [15]. Even though there is a high expectation and interest in telemedicine as great prospect for improving quality, continuity, safety, and efficiency in healthcare worldwide, the overall adoption rate is relatively low [16,17]. In middle and lower income countries including Ethiopia, increasing potential for research about telemedicine is a mandatory way to cover uncovered healthcare services. The result of this study hoped to solve problems related with provision of health service. This is because most of the country's populations living in rural areas. Telemedicine helps to fill the gap between unequal provisions of health service. Thus this study will help to play a crucial role in helping expected stakeholders including target audiences to promote their healthy life. However, to do this, it is strictly recommended to know the willingness of those who provide services.

1.1. *Willingness to use telemedicine*

According to Werner model, motivational factors, such as the intention to perform a task, is the main determinants of health behaviour [18]. Intention is the individual's motivation and commitment to engage in a specific behaviour. It shows how much effort an individual is willing to invest to perform such behaviour. On the basis of these conceptual assumptions, willingness to use telemedicine is considered as a behavioural intention. In general, attitude towards telemedicine is defined as psychological tendencies expressed by evaluating a particular entity with some degree of favour or disfavour. Technology anxiety is the tendency to be uneasy, apprehensive, or anxious about the use of any technology [18]. An attitude towards patient-physician relationship is the use of telemedicine changes the nature of the patient-physician relationship. From a review of different literature, three Types of attitudes were included as direct determinants of willingness to use telemedicine. In previous models: attitudes toward telemedicine, attitudes toward the patient-physician relationship, and satisfaction with current healthcare are the main determinants factors to willingness of telemedicine. In general, the aim of the present study was to examine factors

associated with willingness to use telemedicine during COVID-19 among selected health professionals as shown in Fig. 1.

2. Materials and methods

2.1. Study area and period

Institutional based cross-sectional study design was conducted from January to May 2021 at public hospitals in Ilu aba bor and Buno bedele zones, Oromia Regional state, south west Ethiopia. According to the 2019 district finance and economic development office annual statistical report, Illu Aba Bor Zone had one town administration and fourteen rural districts with a total population of 1,606,502. One referral and one primary hospital are found in the zone.

2.2. Study design and population

Institution based cross sectional study design was used. The study populations were all healthcare providers working at public hospitals of the two zones. All health professionals working at selected public health hospitals of Ilu aba bore and Buno bedelle zones and available during data collection time were included in the study. Health professionals who have working experience of less than 6 Months from the two zones were excluded from the study.

2.3. Sample size and sampling

The sample size was calculated using single population proportion formula by considering different assumptions.

$$n = \frac{(Z\alpha/2)^2 x\ p(1-P)}{d^2},\ n = = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} = 384 + (384(0.1)) = 422$$

Where;

- ✓ n = estimated sample size
- ✓ p = single population proportion (50%) => proportion of health professional's willingness to use Telemedicine (50%) due to unavailability of study conducted in Ethiopia.
- ✓ $Z_{\alpha/2}$ = is value of standard normal distribution (Z-statistic) at the 95% confidence level (α = 0.05) which is 1.96.
- ✓ d = is the margin of error 5% (0.05) and 10% non-response.

All five [5] hospitals located within the selected zones were approached and used for this study. Sample size was calculated using the population proportion allocation formula, by considering 50% digital health literacy skills, 95% level of confidence, 5% of margin of error and 10% of non-response rate. Four hundred twenty three participants were assessed for this study.

2.4. Sampling procedure

Study participants were selected from five hospitals found in south-west, Ethiopia. The study participants for quantitative data were selected using population proportion allocation for each hospital namely Mettu Karl referral hospital, Dembi hospital, Bedelle hospital, Darimu hospital and Chora hospital. The numbers of health care providers found by calculating population proportion allocation were selected using simple random sampling from the five hospitals, south-west Ethiopia.

2.5. Data collection tools, data quality control and procedure

The design and development of self-administered structured questionnaires for this study were guided by literature reviews. The questionnaires were gathered information about the participants' socio-

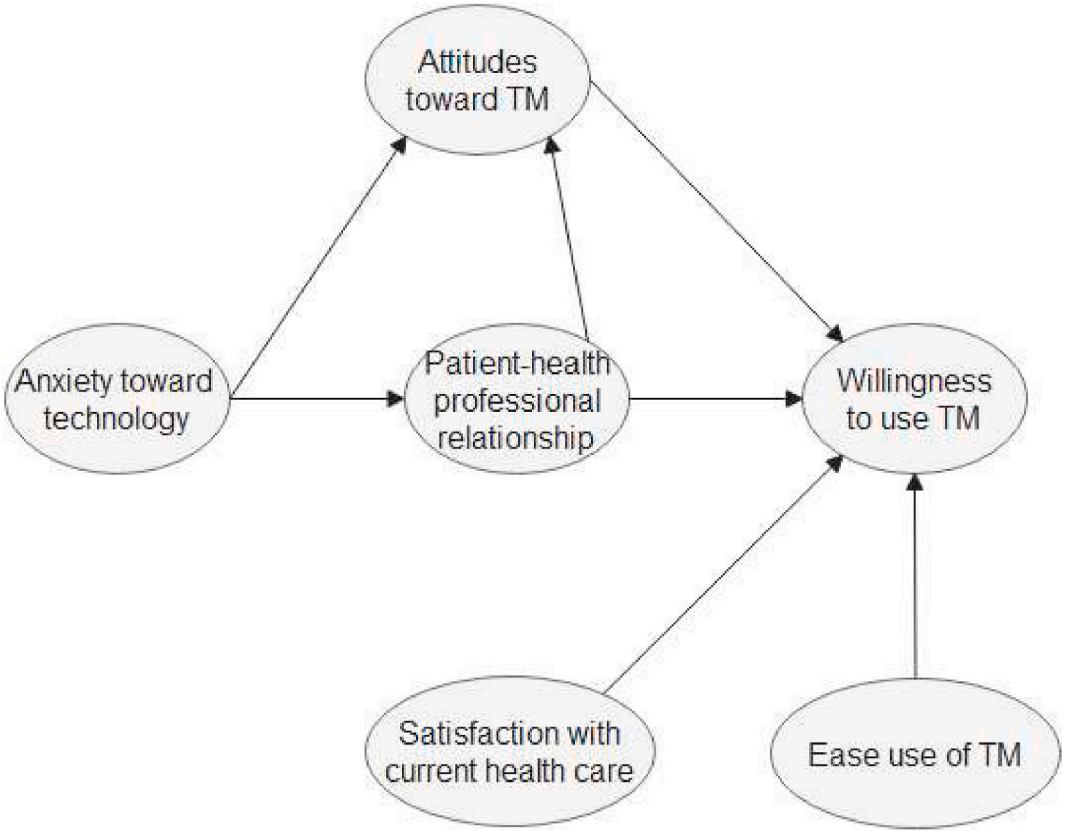

Fig. 1. Modified theoretical model.

demographic characteristics, anxiety toward technology, attitude toward telemedicine, patient-physician relationship and satisfaction with current health care. Data was collected using self-administered questionnaires that are prepared in English. A total of four degree holder health professionals as supervisors and eight health professionals as data collectors were participated in data collection process.

To ensure the quality of data, a pre-test was done at Jimma, which has similar population to our study setting, by taking 10% of respondents from the total sample size. Then necessary correction was done based on the pretest finding. The validity of the questionnaire was determined based on the view of experts and the reliability was obtained by calculating the value of Cronbach's alpha ($\alpha > 0.7$). The scale evidenced high internal consistency (Overall Cronbach alpha = 0.82). Data collection materials were checked for free of spelling errors and its completeness and code before actual data collection date.

The data was also checked daily by the supervisors and investigators for its consistency and completeness.

A two days training were given for data collectors about the purpose of studies, the content of the questionnaires and all the study protocols to be followed throughout the course of the data collection. Health facilities were assigned for each data collectors so as to increase the response rate. Frequent supervisions were done by supervisors. Data back-up activities such as storing data in different places and duplicating hard and soft copies of data was performed to prevent data loss. Before running structural equation model, assumptions were checked for outliers, multi-collinearity and independent error terms. Multi-collinearity was tested by running a false linear regression iterating the independent variables as independent variable and the result showed the entire variance inflation factor (VIF) value less than two and tolerance greater than 0.78 which demonstrated the absence of multi-collinearity. The data was also checked for outliers and no outshining outlier effect was observed in the study. The goodness of fit of the model was also tested in the study.

2.6. Data processing and analysis

Quantitative data were entered using epi-info 7, and all descriptive statistics was analyzed using Statistical Package for Social Science (SPSS) version 20 software and predictors was analyzed using structure equation model (SEM) software is called analysis of moment structure (AMOS) version 23. Standardized path coefficients were used to identify association between predictors and dependent variable. Descriptive analyses and univariable were computed for demographic variables and magnitude of willingness to use telemedicine respectively. Multiple SEM analyses were used to assess association between willingness to use telemedicine and predictors. All variables at p-value less than 0.2 in simple SEM were entered in to multiple SEM analysis after checking all assumption of SEM. Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Chi-square, Goodness of Fit Index (GFI) and Normal Fit Index (NFI) were used for checking fitness of the model. Critical ratio and standardized path coefficients were used to measure the association of dependent and predictors, 95% confidence intervals and P-value were calculated to identify statistical significance predictors (p-value<0.05).

3. Reliability and validity of variables

Cronbach's alpha was computed to determine the internal consistency of all research constructs. Cronbach's alpha of 0.7 or above indicates high reliability, between 0.5 and 0.7 indicates moderate reliability and less than 0.5 indicates low reliability [19]. Anxiety technology ($\alpha = 0.72$), satisfaction with current health care ($\alpha = 0.81$), attitude towards telemedicine ($\alpha = 0.71$), patient-physician relationship ($\alpha = 0.81$), ease use of telemedicine ($\alpha = 0.77$) and willingness to use telemedicine ($\alpha = 0.79$).

4. Ethics approval and consent to participate

The study protocol was reviewed and approved by the ethical review board of Mettu University with approval number ARCSV/161/13 and informed consent was obtained from each study participant. Permission letter was obtained from each hospital. After the objective of the study was explained, written consent was obtained from each study participant. Moreover, privacy and confidentiality of information was strictly guaranteed by all data collectors and investigators. The information retrieved was used only for the study. Thus, names of participants and other personal identifiers were not included in the data collection tool.

5. Result

In total, 422 study subjects were approached and included in the study from January to May; 2021. The response rate was 372(88.2%). The mean age of the study participants were 30.21 ± 11.2 year. From the total, 189(50.8%) of participants were in the age group of <30 years and 233 (62.6%) were males. Two hundred participants (53.8%) had <5000 ETB and only 50 (13.4%) had 10000-15000 ETB. Two hundred ten (56.5%) of the participants were Degree and only 46 (12.4%) were MSc and above MSc. Two hundred twenty (59.1%) health professionals had <5 years working experience and only 39(11.1%) had >10 years working experience. Among the participants, 150(40.3%) were nurses and 96(25.8) were physicians as shown in Table 1.

6. Magnitude of willingness to use telemedicine

In this study, 173 (46.5% [95.0%: CI 39.40–49.21)] of study participants scored above the mean. Willingness to use telemedicine also measured using three likert questions and the mean score of willingness to use telemedicine was 11.5 with standard deviation of 2.8. The maximum and minimum score was 15 and 3 respectively.

6.1. Predictors associated with attitude

Multiple SEM analysis found that attitude is predicted by patient-physician relationship ($\beta = 0.87$, 95% CI: [0.81, 0.92], $p < 0.01$) and anxiety toward technology ($\beta = 0.74$, 95% CI: [0.69, 0.79], $p < 0.01$). The result of this study revealed that attitude was influenced by patient-physician relationship. One standard deviation additional change in patient-physician relationship increases attitude by 0.87 standard deviations keeping other variables constant. Anxiety toward technology

Table 1
Socio-demographic characteristics of health professionals.

Variable	Category	Frequency (#)	Percent (%)
Age(years)	<30	189	50.8%
	30–39	94	25.3%
	40–49	48	12.9%
	>49	41	11.0%
Gender	Female	139	37.4%
	Male	233	62.6%
Monthly income	<5000	200	53.8%
	5000–10000	85	22.8%
	10000–15000	50	13.4%
	>15000	37	10.0%
Educational Status	Diploma	116	31.2%
	Degree	210	56.4%
	MSc and Above	46	12.4%
	<5	220	59.1%
Experience in Years	5–10	113	30.4%
	>10	39	11.1%
	Nurse	150	40.3
	Physician	96	25.8
Professional Category	Midwifery	97	26.1
	Laboratory	22	5.9
	Others	7	1.9

also influences attitude. One standard deviation additional change in anxiety toward technology increases attitude by 0.74 standard deviations keeping other variables constant.

6.2. Predictors associated with willingness to use telemedicine

Multiple SEM analysis found that willingness to use telemedicine is predicted by ease of use ($\beta = 0.79$, 95% CI: [0.72, 0.86], $p < 0.01$), attitude ($\beta = 0.91$, 95% CI: [0.87, 0.95],$p < 0.01$) and patient-physician relationship ($\beta = 0.67$, 95% CI: [0.54, 0.70],$p < 0.01$). The result of this study revealed that willingness to use telemedicine was influenced by ease of use. One standard deviation additional change in ease of use increases willingness to use telemedicine by 0.79 standard deviations keeping other variables constant. Attitude also influences willingness to use telemedicine. One standard deviation additional change in attitude increases willingness to use telemedicine by 0.91 standard deviations keeping other variables constant. Another predictor that influences willingness to use telemedicine was patient-physician relationship as shown in Fig. 2.

7. Discussion

The purpose of this study was to determine willingness to use telemedicine and associated factors during COVID-19 among healthcare providers working in the south west of Ethiopia. This is because telemedicine services can be advantageous to those who have limited access to healthcare services or have limited healthcare facilities in rural areas compared to urban cities. Healthcare service and vital information is crucial during this pandemic, COVID-19. The result showed that willingness to use telemedicine during COVID-19 was relatively low with 173 (46.5% [95% CI: 39.40, 49.21]) of the participants reporting above mean values. Healthcare professionals' willingness to use telemedicine during COVID-19 in this study was lower than a study conducted in Kuwait where majority of respondents (93.8%) in Kuwait were happy to use tele-rehabilitation systems to obtain consultations from other medical centers/hospitals and (89%) were willing to deliver physiotherapy via tele-rehabilitation [20] and China [21]. The difference could be due to the advancement and expansion of technology in Kuwait is more developed than in Ethiopia. The other reason could be the extent of telemedicine in Ethiopian is not well known as in Kuwait. This is to mean that, telemedicine is not yet universally available for all health care needs and has not been used frequently by healthcare providers. Moreover, extent of COVID-19 could be possible factors for these variations. The other possible explanations for variations with study conducted in china were, china is economically more developed than Ethiopia. The technology in China is very far from Ethiopia where china is advanced in technology. Another possible explanation might be the study design applied in the two studies.

The study has found that attitude of healthcare providers could affect telemedicine use during COVID-19. Patient-physician relationship and Anxiety toward technology has direct associations with attitudes to use telemedicine during COVID-19. Thus one standard deviation additional change in patient-physician relationship increases attitude by 0.87 standard deviations keeping other variables constant. When patients and physicians relationship increased, patients could be informed of using telemedicine while physicians also motivated to use telemedicine just to care patients. The study conducted in India was in line with the result of this study [22]. Similarly the study conducted in USA was consistent with this study revealed that Provider concerns were influenced by patient care experiences. Targeted training and quality improvement strategies are needed to sustain a robust post-pandemic telemedicine program [23]. Anxiety toward technology also influences attitude

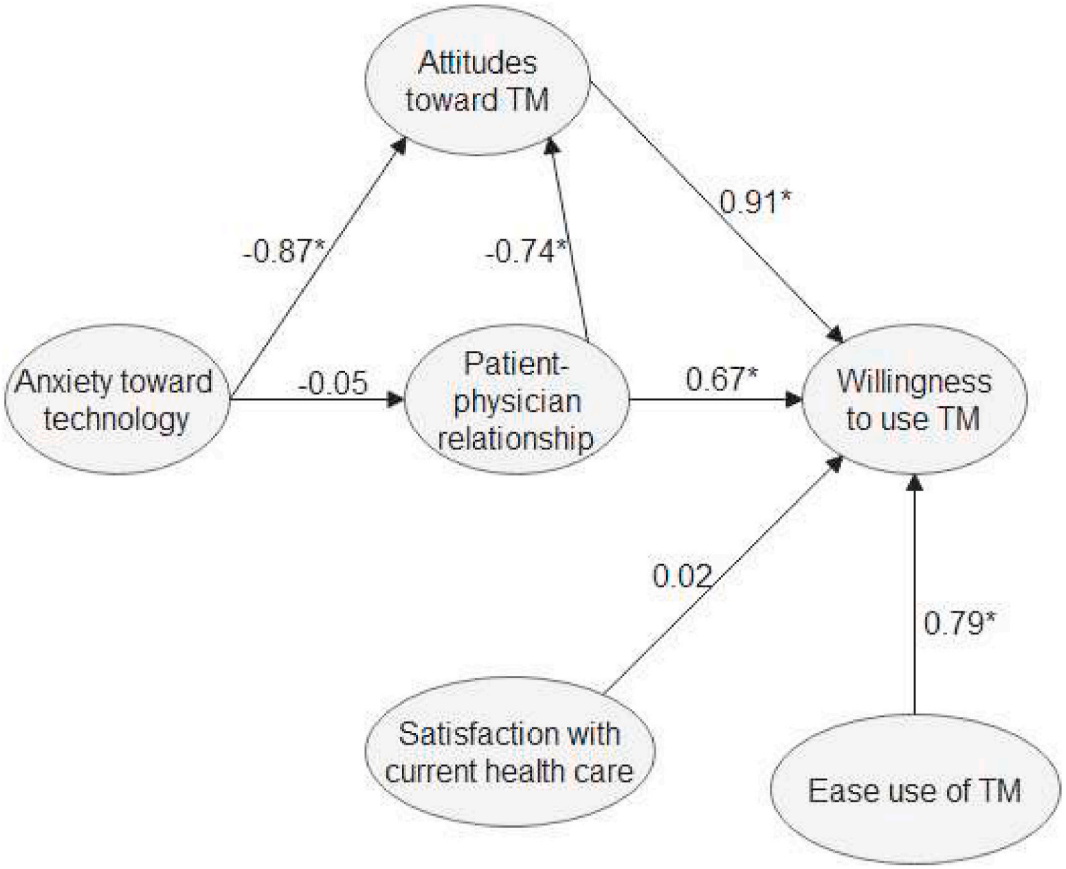

Fig. 2. Result of theoretical model.

towards using telemedicine during COVID-19. One standard deviation additional change in anxiety toward technology increases attitude by 0.74 standard deviations keeping other variables constant. This result was supported by study conducted in India [22], Egypt [24] and USA [23]. This is because complexity of using and applying telemedicine hinders their positive attitudes to use telemedicine during COVID-19.

This study found that ease of use; attitude and patient-physician relationship were associated with willingness to use telemedicine during COVID-19. Thus one standard deviation additional change in ease of use increases willingness to use telemedicine by 0.79 standard deviations keeping other variables constant. Sufficient training and familiarity with the technology are major ways to adopt and encourage use of telemedicine. Easiness of use could increase healthcare provider's willingness to use telemedicine. For the growing utility and complexity of telemedicine, medical education curricula that integrate telemedicine training concepts early during medical training may help to increase trainees' familiarity with telemedicine systems in the future. This result was consistent with study conducted in USA [5], Ethiopia [25], Saudi Arabia [26] and China [21].

Similarly, attitude also influences willingness to use telemedicine where one standard deviation additional change in attitude increases willingness to use telemedicine by 0.91 standard deviations keeping other variables constant. This is because attitude related with behavioral intention to use telemedicine which may influence performance expectancy. More than this, attitude influences acceptance of telemedicine. In addition to this, health professionals with favorable attitude towards using of telemedicine could amplify and resulted in higher intention to use telemedicine systems. This result was similar with study conducted in Ethiopia [25], China [21] and Saudi Arabia [27].

Patient-physician relationship was also found to be associated with willingness to use telemedicine. One standard deviation additional change in Patient-physician relationship increases willingness to use telemedicine by 0.91 standard deviations. The study conducted in Saudi Arabia [27], USA [28] and Israel [29] were consistent with the result of this study. The possible explanations for these findings were improved trust between health care professionals and patients, increased quality of communication between health care professionals and patients will help to increase the extent of willingness to use telemedicine.

8. Conclusion

This study found that ease of use, attitude and patient-physician relationship all significantly impact healthcare providers' willingness to use telemedicine. The overall willingness to use telemedicine among healthcare providers in our study area is relatively low. The willingness to use telemedicine needs to be encouraged especially in this COVID-19 pandemic period. In addition, attitude towards telemedicine was determined by the factors patient-physician relationship and anxiety towards technology. An attempt to improving patient-physician relationship, provision of technical training for ease of use and working on healthcare providers' attitude will help to improve the willingness to use telemedicine. Further research will be applicable to assess the overall knowledge and attitudes of healthcare providers towards telemedicine.

Ethics approval and consent to participate

Mettu University reviewed and approved the ethical protocol and each study participant gave informed consent to participate in the study. Permission letter also obtained from each health facilities. Names of participants and other personal identifiers were not included in the data collection tool.

Consent for publication

Not applicable.

Availability of data and materials

All data are available based on request.

Funding

Not applicable.

Authors' contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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