

# Knowledge, Awareness and Associated Factors Of Telemedicine Services Among Health Professionals At Amhara Region Referral Hospitals, Northwest Ethiopia, 2020.

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## Abstract

**Background:** -Telemedicine is the delivery of healthcare services at a distance. Despite it is an emerging and infancy technology in a developing country, utilizing the technology for delivering healthcare services is low in Ethiopia. To maximize and facilitate Telemedicine adoption it prominently requires information about the knowledge and awareness of telemedicine services among health professionals.

**Methods:** - An institution-based cross-sectional study design was conducted among 423 health professionals working at Amhara Region Referral Hospitals from February 12-March 20/2020. The data were collected using self-administered structured questionnaire. Desk review was done to assure the data quality and then data was entered into EPI INFO version 7 and exported into SPSS version 20 for statistical analysis. Descriptive statistics, bivariable and multivariable logistic regression analysis were done. Odds ratio with 95% confidence interval (95% CI) was used to identify associated factors.

**Result:** About 56% of health professionals had good knowledge and 57.4% had high awareness towards telemedicine services with 411 (97.2%) response rate. Information sharing culture [AOR=3.01, 95% CI: 1.89, 4.80], having IT support staff [AOR=1.87, 95%CI: 1.06, 3.29], internet as information source [AOR=1.80, 95%CI:1.1, 2.94], awareness [AOR=1.35,95% CI: 1.03, 2.40], being male [AOR=1.73,95% CI:1.06, 2.81] were significantly associated with the knowledge of the respondents towards telemedicine services and telemedicine training [AOR= 2.33, 95% CI: 1.15, 4.72] and computer accessibility in their hospitals [AOR= 1.54, 95% CI: 1.01, 2.35] were significantly associated with the awareness of the respondents towards telemedicine services.

**Conclusion:** More than half of the respondents had good knowledge and high awareness of telemedicine services. Information source, having IT support staff, information sharing culture, gender and awareness were significant factors for the knowledge of telemedicine service and telemedicine training and computer access were significant factors of awareness of health professionals towards telemedicine services. Therefore Appropriate and regular awareness creation training of telemedicine systems should be given to the health professional.

**Keywords:** *Knowledge, Awareness, Telemedicine, Health Professionals, Amhara Region, Ethiopia*

## **Background**

Electronic health (eHealth) services are expanding rapidly and have a potential to improve the health of the community, enhance scientific understanding of health issues and facilitating the communication between health care providers and patients (1-6). Telemedicine is an important tool for the amplification of healthcare delivery using smartphones, email, video conferencing and especially in rural areas, use electronic information and communication technology to provide and support clinical care remotely

(7). It ranges from a simple telephone conversation between providers up to a real-time videoconferencing involving doctors and patients (8-10).

Exchanging healthcare information and providing health care services across a geographic area and time has been considered as a potential solution to alleviate the current health care problem, revolutionize the health care system, and delivering to the rural and remote areas for disease control and prevention (11, 12). The diffusion and implementation of telemedicine services will ultimately depend on the knowledge and awareness on its application (13).

Accessing the modern health care, getting specialty services is low and still limited due to different factors like poor infrastructures, individual ICT exposure's and information sharing cultures between health professionals or healthcare organizations, and there are further challenges for delivering health service due to rising communicable and non-communicable disease, the scarcity of medical specialists will not be overturned in a short time, inadequate transportation infrastructure makes it even more difficult to provide healthcare services in remote and rural areas where more than 80% of the population lives (14-16). But integrating healthcare service delivery with information communication technology are challenges in Ethiopia health system (9, 17-19).

The telemedicine system is an initiative and encouraging, by WHO in health system digitization and it is essential for Ethiopia as the country experiences with a heavy burden of disease and shortage of trained health professionals (12, 20-22).

The potential of telemedicine services in health care delivery were known, but particularly in developing countries, failed to sustain and integrate with the health care system. As the different studies indicated widely mentioned cause of failure is the level of knowledge and awareness of health professionals towards telemedicine services and

understanding of health professionals, towards telemedicine is indeed critical to its sustainable development for health system digitization (1, 11, 18, 23-25).

To maximize the adoption of telemedicine services and sustainable development of health system digitization, user-oriented development of advanced systems integrating knowledge and awareness of telemedicine services among health professionals is necessary.

## **Methods and Materials**

### **Study Design, period and setting**

Institution based cross-sectional study design was conducted at Amhara Region Referral Hospitals from February 12-March 20/2020. The State of Amhara consists of 13 administrative zones and the capital city is Bahir-Dar. It is the 2nd populous region in Ethiopia having about thirty Million people which accounts 27% of the Ethiopian population. More than 85% of the Amhara population lives in rural areas. It is bordered by the Sudan to the west and northwest, Benishangul-Gumuz to the west and southwest, Tigray to the north, Afar to the east and Oromia to the south. There are six Referral Hospitals in Amhara region and 4234 health professionals working on this Referral Hospitals.

All health professionals working at Amhara Region referral hospitals were included. Those Health professionals who were seriously ill and those who had less than six-months working experience in clinical practices were excluded from the study.

### **Sample size and sampling procedures**

#### **Sample size determination**

The sample size was determined by using single population proportion formula,  $P= 50\%$  of the health professionals to determine knowledge of telemedicine service and  $52.6\%$  of health professionals for had high awareness telemedicine services (11),  $95\%$  CI,  $5\%$  margin of error and  $10\%$  non-response rate, the calculated sample size for knowledge  $n_1 = 423$  and for awareness  $n_2 = 422$ . So, the maximum sample 423 was taken as the final sample size.

#### **Sampling procedures**

Study participants were selected using stratified sampling method followed by proportional allocation from Amhara Region Referral Hospitals Northwest Ethiopia. First

for each referral Hospitals and department proportional allocations were done and then participants were selected using a simple random sampling method (Figure 1)

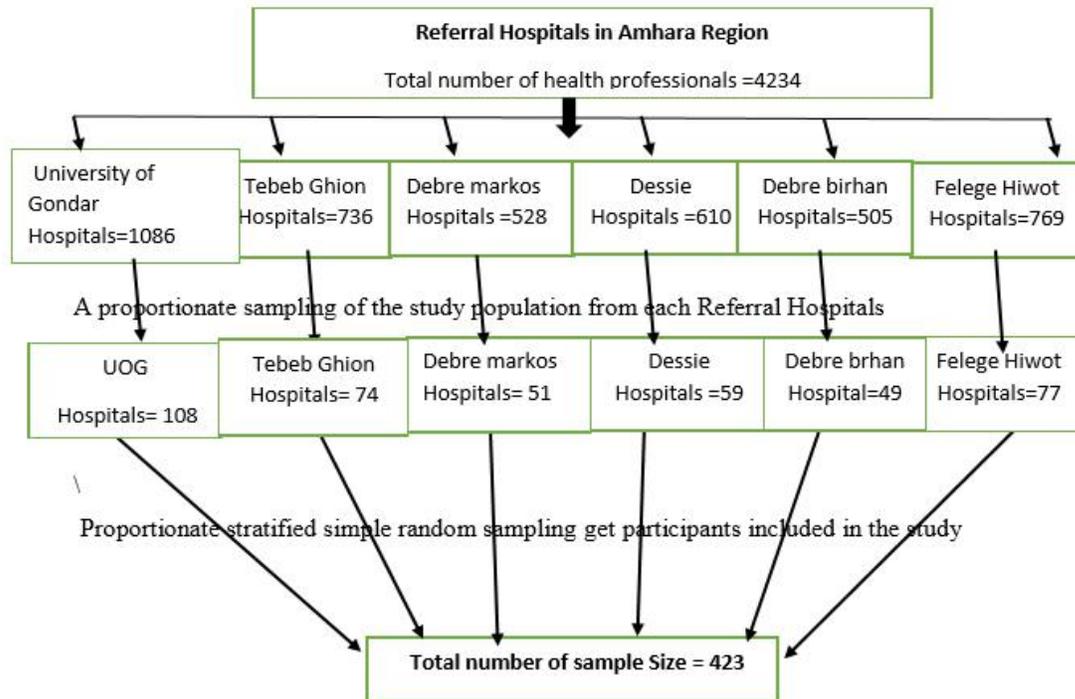


Figure 1: Sampling procedure for Health Professionals at Amhara Region Referral Hospitals, 2020

**Operational definition**

**Good Knowledge:** good knowledge of telemedicine service was defined as for those study participants who scored more than or equal to 9 (50%) of knowledge (18 items yes or No) questions(26).

**High awareness towards telemedicine services:** was defined as for those study participants who scored more than or equal to 2.2 of 5 or 44% of awareness questions (five points Likert scale) that involves perceiving ,feeling, opinion and overview towards telemedicine services (27).

**Data Collection Procedures and Data Quality assurance Data**

**collection procedures**

A self-administered structured questionnaire was used. The questionnaire was prepared in English. The questionnaire consists of socio-demographic characteristics, related to ICT exposures, organizational related questions, 18 items either ‘yes’ or ‘No ‘ was used to measure the health professionals’ knowledge towards telemedicine services. Ten

items with five-point Likert scale ranging from 1-5 i.e. '1' for very little,'2' for little,'3' for some '4' for enough, and '5' for very enough was used. One can score a minimum of '10' and the maximum of '50' related to measure the awareness of the study participant and telemedicine services related questions.

### **Data quality assurance**

Before the actual data collection, a pre-test was done on 5% of the study participants outside of the actual study area, the Cronbach alpha value of (0.81) knowledge and (0.76) awareness and modifications were done based on the pre-test.

The data collectors and the supervisor were given one day training before participating in the data collection process to create awareness about respondents, the purpose of study, their rights, and confidentiality issues. Sufficient time was given to respondents for reading and filling materials carefully. There was continuous supervision up to the end of data collection. After collecting the data, the supervisor and the investigator checked its consistency and completeness.

### **Data Processing and Analysis**

Data were entered using Epi-info version 7 and analyzed using Statistical Package for Social Science (SPSS) version 20. Descriptive analyses were performed to describe the study population in relation to relevant variables. The adjusted odds ratio with 95% confidence interval was used to measure the association of dependent and independent variables. Bivariable logistic regression was conducted and those factors with p-value <0.2 were fitted into multivariable logistic regression analysis and variables with P.value <0.05 were considered as statistically significant in the multivariable logistic regression model. The Hosmer-Lemeshow test was used to test the model fitness and also multicollinearity was checked between independent variables.

### **Ethical consideration**

Ethical clearance was obtained from University of Gondar Institute of Public Health ethical review board and support letter from Amhara Region Referral Hospitals. Written consent was obtained from each participant.

## **Results**

### **Socio-demographic characteristics**

A total of 423 study participants were selected from six Amhara Region Referral Hospitals for the assessment of knowledge and awareness of telemedicine services among health professionals working in the Amhara region. Four hundred eleven (97.2% response rate) of them were written consented and responded to complete all the questionnaires. Among the study participants, 258(62.8%) of the respondents were male, the mean age of the participants was 29.65+\_4.5 SD years and the majority of the respondents were within the age group of 20-29 years. In terms of the educational status, most of the respondents were bachelor degree 268 (65.2%). Regarding the professional category's the respondent 78 (19.0%) medical doctors and 137 (33.3%) were nurses. The mean working experience was 5+\_3.3 SD years and more than half 242 (58.9%) of the respondents were within the range of 1-5 years (Table 1).

#### **Exposure of ICT on the knowledge and awareness of telemedicine services**

About 249 (60.6%) of the respondent just had an introductory level of ICT exposure, 334 (81.3%) use computer or laptop or smartphone for their work and from those 306 (91.6%) used for internet access. Almost half 198 (48.2%) of the participants sometimes search information for health care digitations, but 148 (36.0%) of the respondent had not used internet application for telemedicine service at all (Table 2).

#### **Frequency of organization factors on the knowledge and awareness of telemedicine services**

According to this study majority of the respondents 262 (64.0%) had no sufficient computers for their work, 260 (63.3%) of the respondent had internet access within their hospitals and 152 (58.2%) of them has Wi-Fi types of internet access. Similarly 219 (53.3%) of the respondent of health professionals had an information-sharing culture with other health care provider or patient and only 47 (11.4%) of the study participant was attend training on telemedicine system (Figure 2).

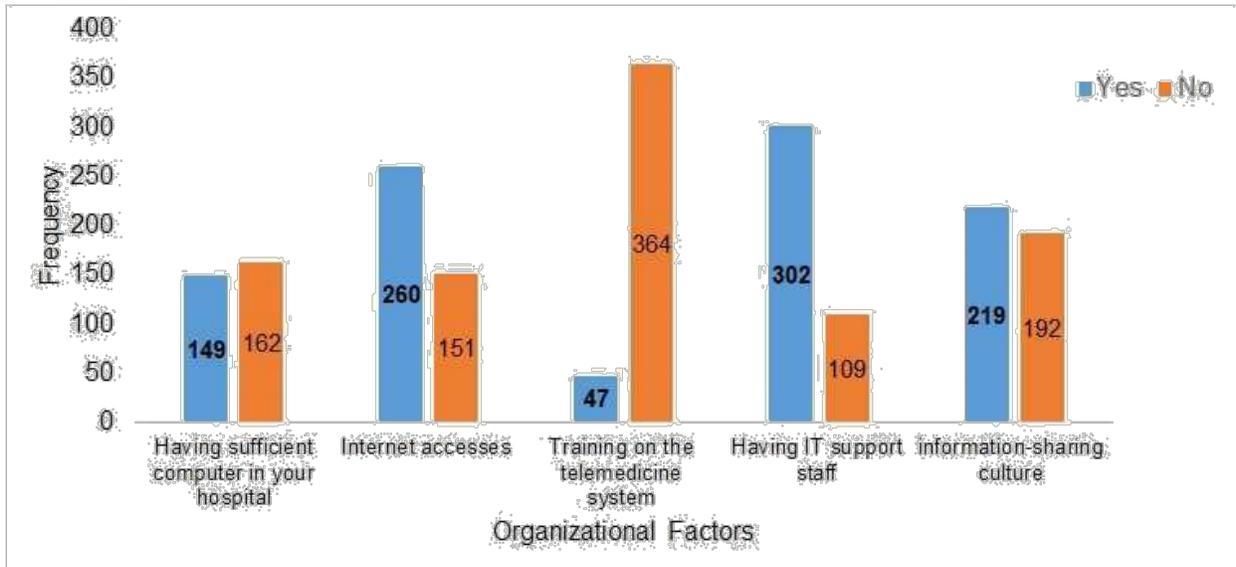


Figure 2: Organizational factors on the knowledge and awareness of telemedicine services among health professionals at Amhara Region Referral Hospitals northwest Ethiopia, 2020.

### Knowledge of health professionals by the types of telemedicine services

Among study participants on the types of telemedicine services 151 (36.7%) of the respondent knew of communication via telephone, 117 (28.47%) of Store and forward, 104 (25.3%) Remote monitoring, and 63 (15.33%) Online/live (Figure 3).

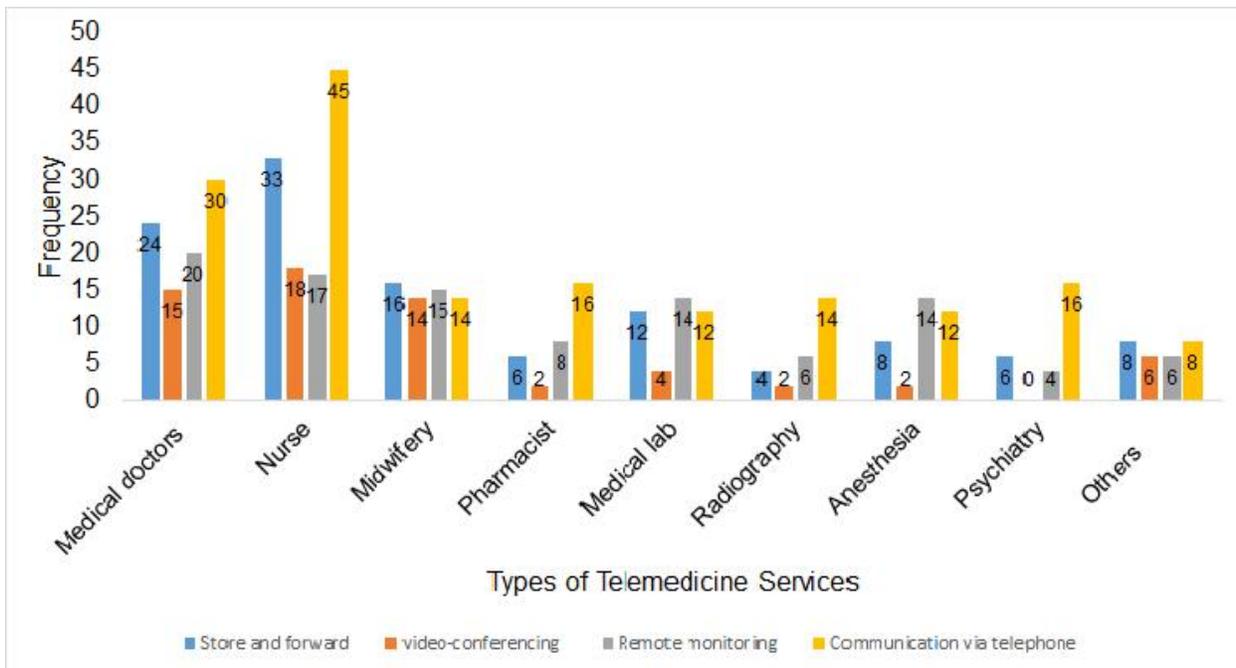


Figure 3: Knowledge of health professionals by the types of telemedicine services among the health professional at Amhara Region referral Hospitals, northwest 2020.

### **Clinical application area, common public health area, benefits, and Barriers to the knowledge and awareness of telemedicine services**

From the total study participants, majority 317 (77.1%) had awareness on telemedicine clinical application for Radiology and 212 (51.6%) had awareness on common public health application area of telemedicine services was for school-based health centers.

In this study, the knowledge of telemedicine services among health professional at referral hospitals 286 (69.6%) of them knew the benefits of telemedicine system to improve the quality of healthcare system and 229 (55.7%) of the respondent to send the patient for better treatment to another hospital (Table 3).

#### **Factors associated with the knowledge of telemedicine services among health professionals.**

The variables including gender, Having IT support staff, Information sharing culture, Information source and the awareness of telemedicine services were positively associated with knowledge of telemedicine services among health professionals working at Amhara Region Referral Hospitals.

According to this study, gender was significantly associated with the knowledge of telemedicine services among health professionals. Being male were 1.73 times more likely to have a knowledge of telemedicine services than female (AOR=1.73, 95% CI: [1.06-2.81]). Similarly, health professionals who have IT support staff in their hospitals were 1.87 times more likely knowledgeable on telemedicine services than those health professionals who had no IT support staff (AOR=1.87, 95%CI: [1.06-3.29]).

Information sharing culture was another factor for the knowledge of telemedicine services among health professionals. Health professional having information-sharing culture were 3 times more likely to have good knowledge of telemedicine services than those with no information sharing culture (AOR=3.01, 95% CI: [1.89-4.80]).

Information source was one of the factors that positively associated with knowledge of telemedicine services. Health professionals with using internet as information source was were 1.80 times more likely than the counterpart (AOR=1.80, 95%CI: [1.10-2.94]). Additionally, Health professional's awareness of telemedicine services was strongly associated with the knowledge of telemedicine services. Health professionals who had

awareness of telemedicine were 1.35 times more likely knowledgeable than those who had (AOR=1.35, 95% CI [1.03-2.40]) (Table 4).

**Factors associated with the awareness of telemedicine services among health professionals**  
In this study, training on the telemedicine system was significantly associated with the awareness of telemedicine services. Those who attended training on the telemedicine system had 2.33 times more likely to have the awareness of telemedicine services than those who did not attend the training (AOR= 2.33, 95% CI: [1.15-4.72]).

Similarly, the accessibility of computers in their hospitals was another factor affecting the awareness of telemedicine services. Health professionals who had computer access in their hospitals were 1.42 times more likely aware than those who had no computer access in their hospitals (AOR= 1.42, 95% CI: [1.01-2.35]) (Table 5).

## **Discussion**

To maximize the adoption of telemedicine services, the user-oriented development of advanced systems integrating knowledge and awareness of telemedicine services among health professionals is necessary (5, 28-32).

The study was conducted at six Amhara Region referral hospitals and assessed the knowledge, awareness and associated factors of telemedicine services among health professionals. From this study, 56% (95% CI: [50.6, 59.9]) of health professionals had a good knowledge of telemedicine services. This study is in line with the study done in Saudi Arabia 53.9% (7); however this study result is higher than the study conducted in Nigeria 34.1% (20) and India (41%) (30). The possible explanation for this might be due to sample size difference (the sample size of the study in Nigeria was 110 and in India 124), the study period. In addition, currently the Ethiopian ministry of health has been given great attention for health care digitization to be one of the main priority areas.

The study indicated that, gender was significantly associated with the knowledge level; males were more likely knowledgeable than females. This study is in line with a descriptive study conducted in Bangladesh (30). The possible explanation might be: males have higher exposure to use internet access (33) and to new technology due to their literacy level compared to females (34).

Health professionals who have IT support staff in their hospitals were 1.9 times more likely to be knowledgeable on telemedicine services than those who didn't (AOR=1.87,

95% CI: [1.06-3.29]). This finding is supported with the study conducted in Kenya (35) and Ethiopia (36). The possible reasons might be due the existing technology which can be realized by motivation and support by the end-users' and the proper understanding of telemedicine technology is a way to scale-up the healthcare system.

The finding of the study indicated that 38.7% of health professionals had health information sharing culture and were 3 times more likely knowledgeable towards telemedicine services than those who had no health information sharing culture. This result was comparable with the study done in Austria (31). This could be due to telemedicine needs the willingness of the two ends (sender and receiver). This study also revealed that the majority (88.4%) of respondents said that they have never attended any formal training on telemedicine. This finding was supported with the study done in Bangladesh (82.5% of the them never attended any formal training on telemedicine) (30). Whereas study done in India found that none of the respondents had any formal training on telemedicine (32).

Information source was another statistical significant factor for knowledge of telemedicine services. Using internet as an information source was about 1.8 times more likely to be knowledgeable than other sources. This study shows that the majority of the respondent reported that internet (33.1%) and different medical literature (21.6%) were the main sources of information about telemedicine, followed by 15% of the respondent from colleagues and 9.9% from TV/Radio. This finding is contrasted with the study conducted in Bangladesh. In Bangladesh, the source for information for telemedicine was colleagues (38%) and internet (17.5%) (30). The possible explanation might be due to the accessibility of the internet, healthcare digitization and availability of different information technology and software applications.

Awareness was also the associated factor with knowledge of telemedicine services. In this study, health professionals who had awareness on telemedicine services were 1.35 times more likely to be knowledgeable than those who had no awareness. This finding indicated that more than half of the respondents (57.4%) were aware about the benefits telemedicine in terms of improving quality of care, access and convenience, cost reduction and ensuring safety. Clinical application areas such as: dermatology, radiology and cardiology were priority areas identified by study participants.

The majority (65.2%) of them had knowledge of Store-and-forward telemedicine, and communication via telephone about the types of telemedicine service deliveries, related to telemedicine application. Radiology, cardiology and dermatology were indicated by 13.5 %, 11.8% and 11.4 % of the respondents respectively. Similarly, the option was given to respondents to choose among benefits of telemedicine systems; 69.6% of them identified that the system improves the quality of care, 58.2% indicated that it improves the healthcare access and 54.3% of the respondents indicated the system benefits in ensuring safety and security of patient information.

About 229 (55.7%) of respondents replied that they would prefer sending the patient for better treatment to another hospital when encountered difficulties in their clinical work, 175 (42.6%) of the respondents prefer to give patients appointments to come back when better physicians will be available and 162 (39.4%) prefer to refer medical literature and/ or similar previous cases. This result is higher than the study conducted in Addis Ababa (11). Almost half (49.5%) of the respondents were aware of the benefit of Telemedicine application, Radiology is indicated by 12.7 % dermatology by 8.3% and Cardiology is chosen by 8.3% of the respondents. Similarly 24.4% of the respondents recognized that the system improves the quality of care and 5.1% indicated that it only improve access and convenience.

Regarding the awareness level of health professionals, 57.4% (95% CI: [53.0, 63.5]) of study participants had a high awareness of telemedicine services. This study is in line with the study conducted in Nigeria 58.5% (20), India 63% (32) but lower than the study conducted in Uganda (70%) (37). The probable reason could be due to infrastructure difference, shortage of health professionals trained with health care digitization as compared to the study area. Moreover basic computer ICT skills of health professionals might also contribute for the difference.

Health professionals who have sufficient access computer in their institution relatively have had high telemedicine service awareness. This Study is in line with study conducted in Addis Ababa (38). Health professionals who trained telemedicine system had high awareness towards telemedicine services, this study is lower than the study conducted In India (32).

The finding of this study revealed that, more than 80% of the study participant had the awareness of telemedicine clinical application area which is higher than the study done in Tikur Anbesa hospital (52.6%) (11).

### **Conclusion**

More than half of the respondents had good knowledge and high awareness of telemedicine services. The Information source, having IT support staff, information sharing culture, gender and awareness were the most significant factors for the knowledge of telemedicine service. Telemedicine training and computer access were factors affecting the awareness of health professionals towards telemedicine services. Therefore Appropriate and regular awareness creation training of telemedicine systems, should be given to the health professional.

### **Abbreviations**

BSC : Bachelor of Science; E-Health :Electronic Health ; Epi-info : Epidemiological Information; ETB : Ethiopian Birr; FMOH :Federal Ministry of Health; GP : General Practitioners ; HI : Health Informatics; HIT : Health Information Technician ;HP : Health professionals; MPH: Master of Public Health; ICT: Information communication technology; IT :Information technology; SPSS: Statistical Package for Social Science; TGSRH : Tibebe Ghion Specialized Referral Hospitals; UGSRH: University of Gondar Specialized Referral hospital; WHO : World Health Organization ;

### **Declarations**

#### **Ethics approval and consent to participate**

Ethical clearance was obtained from the University of Gondar institute of public health ethical review committee. Official letters of support were obtained from the University of Gondar institute of public health and Communicate with the different official administrators of the referral hospitals. Written consent was obtained from each study participant after telling the objective of the study. The data collection procedure was anonymous.

#### **Consent for publication**

Not applicable

#### **Availability of data and materials**

All major data have been presented in the manuscript.

#### **Conflicts of Interest**

Authors declare that they have no conflicts of interest.

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University of Gondar funded the study. The funding body has no any role in the design of the study and collection, analysis, interpretation of the data, in writing the manuscript and publication as well.

## **Authors' Contributions**

BT substantially contributed in the conception and design, analysis and interpretation of the study. AT and AM involved in the analysis, interpretation and all authors participated in write-up of the article. All authors approved the manuscript for publication

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Table 1: Sociodemographic characteristics of the health professional at Amhara Region referral Hospitals, northwest 2020 (N=411).

<b>Sociodemographic characteristics</b>		<b>Frequency(#)</b>	<b>Percentages (%)</b>
Gender	Male	258	62.8
	Female	153	37.2
Age	20-29	277	67.4
	30-39	118	28.7
	40 and above	16	3.9
Educational status	Medical doctors	75	18.2
	Master's degree	50	12.2
	Bachelor degree	268	65.2
	Diploma	18	4.4
Professions category's	Medical doctors	78	19.0
	Nurse	137	33.3
	Midwifery	48	11.7
	Pharmacist	38	9.2
	Medical lab	32	7.8
	Radiography	18	4.4
	Anesthesia	20	4.9
	Psychiatry	24	5.8
Working unit/department	Others1	16	3.9
	Internal medicine	68	16.5
	Radiology	35	8.5
	Gynecology/obstetrics	64	15.6
	Medical Laboratory	30	7.3
	Pharmacy	48	11.7
	Ophthalmology	32	7.8
	Surgery	47	11.4
	Pediatrics	33	8.0
	Psychiatry	44	10.7
Others2	10	2.5	

Work experience	1-5	242	58.9
(in years)	6-10	141	34.3
	11-15	20	4.9
	16 and above	8	1.9

\* Other1=Optometry, HIT \*Other2=Dental, Orthopedics

Table 2: Exposure of ICT on the knowledge and awareness of telemedicine services among health professionals at Amhara Region Referral Hospitals northwest Ethiopia, 2020 (N=411)

Variables	Categories	Frequency (#)	Percentages (%)
Training on basic computer system	Never attended training	87	21.2
	Just an introductory level	249	60.6
	having a certificate	24	5.8
	Diploma in ICT	36	8.8
	BSC in ICT	15	3.6
Computer/laptop/smartphone use in work place	Yes	334	81.3
	No	77	18.7
Activity perform with your computer /laptop/ smartphone (N=334)	Internet accesses	306	91.6
	Entertainment	107	32.0
	Microsoft office	128	38.3
Have you ever visited the medical field on the internet	Yes	329	80.0
	No	82	20.0
How often do you search info for health care digitations	Always	37	9.0
	Often	25	6.1
	Sometimes	198	48.2
	Rarely	75	18.2
	Never	76	18.5
How often do you use internet application for telemedicine service	Everyday	39	9.5
	Every week	45	10.9
	Twice a week	46	11.2
	Every month	39	9.5
	Less than once in a month	52	12.7
	Every other day	42	10.2
	Not at all	148	36.0
Which purpose do you use the internet	Obtaining information to give patients	119	28.9
	Patient consultation	87	21.2
	For Literature search	124	30.2
	For knowledge and Skills development	233	56.7
	Always	31	7.5
How often do you interact with patient via	Often	11	2.7

email	Sometimes	94	22.9
	Rarely	83	20.2
	Never	192	46.7
Knowledge on Components of telemedicine technology	Hardware	156	40.0
	Software	179	43.6
	Human resources	85	20.7
	Medical data	97	23.6
	Internet connections	121	29.4

**Note:** Participants could select more than 1 option, so totals do not add up to 100%

*Table 3: clinical application area, common public health area, benefits, and Barriers to the knowledge and awareness of telemedicine services among health professionals at Amhara Region Referral Hospitals northwest Ethiopia, 2020 (N=411)*

Variables	Categories	Frequency (#)	Percentage (%)	
Awareness of Clinical application area of the telemedicine system	Radiology	317	77.1	
	Surgery	254	61.8	
	Dermatology	265	64.5	
	cardiology	274	66.4	
	pathology	310	75.4	
	Pediatrics	214	52.1	
	Gynecology/obstetrics	237	57.7	
	Laboratory	236	57.4	
	Pharmacy	218	53.0	
	I don't know	44	10.7	
Awareness of Common public health application area of telemedicine services	Prison facility's	120	29.2	
	Rural health	114	27.7	
	School-based health centers	212	51.6	
	Disaster relief	88	21.4	
	Shipping and transportation	114	27.7	
	Industrial health	104	25.3	
Knowledge on Benefits of the telemedicine system	Improve the quality of healthcare	286	69.6	
	Improve the healthcare Access	239	58.2	
	Reduced healthcare cost	175	42.6	
	Reduce Isolation	114	27.7	
	Ensure Safety and security of Patient information	223	54.3	
		I don't know	27	6.6

Alternatives supposed to do during a difficulty case	Sending the patient for better treatment to another hospital.	229	55.7
	Give an appointment to the patient to come back another time when there will be a better physician.	175	42.6
	Refer to medical literature and or similar previous cases.	162	39.4
Barriers to improving telemedicine services knowledge	Lack of time	64	15.6
	Lack of training	252	61.3
	Lack of exposure to telemedicine technology	191	46.5
	Lack of professionals related to telemedicine technology	151	36.7
	Lack of awareness towards telemedicine application	241	58.6
	Lack of direction and guidance	173	42.1

**Note:** Participants could select more than 1 option, so totals do not add up to 100%

*Table 4: Bivariate and multivariable analysis of factors with knowledge on telemedicine services among health professionals working at Amhara Region referral Hospitals, North West Ethiopia, 2020(N=411)*

Variables	Categories	Knowledge of telemedicine services		COR (95%CI)	AOR (95%CI)
		Good (%)	poor (%)		
Educational status	Medical doctors	44 (10.7)	31 (7.5)	0.95 (0.46-1.96)	0.934 (0.41-2.13)
	Master's degree	30 (7.3)	20 (4.9)	1.16 (0.61-1.85)	0.69 (0.38-1.26)
	Bachelor degree	151 (36.7)	117 (28.5)	3.36 (1.19-11.42)	2.03 (0.55-7.40)
	Diploma	5 (1.2)	13 (3.2)	1	1
Gender	Male	158 (38.4)	100 (24.3)	1.78 (1.19-2.66)	<b>1.73 (1.06-2.81)*</b>
	Female	72 (17.5%)	81 (19.7)	1	1
Having IT support staff	Yes	190 (46.2)	112 (27.3)	2.93 (1.86-4.61)	<b>1.87 (1.06-3.29)*</b>
	No	40 (9.7)	69 (16.8)	1	1
Information sharing culture	Yes	159 (38.7)	60 (14.6)	4.52 (2.98-6.85)	<b>3.01 (1.89-4.80)*</b>
	No	71 (17.3)	121 (29.4)	1	1
Accessibility of computer in hospital	Yes	96 (23.4)	53 (12.9)	1.73 (1.14-2.62)	1.27 (0.78-2.07)
	No	134 (32.6)	128 (31.7)	1	1

Medical literature as Information source	Yes	161 (39.2)	106 (25.8)	1.63 (1.09-7.45)	
	No	69 (16.8)	75 (18.2)	1	
Internet as Information source	Yes	136 (33.1)	94 (22.9)	2.14 (1.44-3.18)	<b>1.80 (1.10-2.94)*</b>
	No	73 (17.8)	108 (26.3)	1	1
Computer use for internet access	Yes	180 (43.8)	126 (30.7)	1.57 (1.01-2.45)	0.80 (0.37-1.74)
	No	50 (12.2)	55 (13.4)	1	1
Computer use for Entertainment	Yes	73 (17.8)	34 (8.3)	2.01 (1.26-3.20)	1.63 (0.93-2.86)
	No	157 (38.2)	147 (35.8)	1	1
Computer use for Microsoft office	Yes	78 (19.0)	50 (12.2)	1.34 (0.88-2.06)	1.38 (0.80-2.35)
	No	152 (37)	131 (31.9)	1	1
Awareness of Telemedicine services	High	109(26.5)	66(16.1)	1.57 (1.05-2.34)	<b>1.35 (1.03-2.40)*</b>
	Low	121(29.4)	115(28.0)	1	1

Note: 1=reference \* P-value  $\leq 0.05$

Table 5: Bivariate and multivariable analysis of factors with awareness on telemedicine services among health professionals working at Amhara Region referral Hospitals, North West Ethiopia, 2020 (N=411)

Variables	Categories	Awareness of telemedicine services		COR(95%CI)	AOR(95%CI)
		High (%)	Low (%)		
Educational status					
	Medical doctors	52(12.7)	23(5.6)	1.17 (.054-2.50)	1.12 (0.52-2.42)
	Master's degree	33(8.0)	17(4.1)	1.72 (1.16-3.36)	1.46 (0.15-1.44)
	Bachelor degree	142(34.5)	126(30.7)	1.13 (0.79-6.44)	0.78 (0.29-7.40)
	Diploma	9(2.2)	9(2.2)	1	1
Training on Telemedicine Service					
	Yes	35(8.5)	12(2.9)	2.36 (1.18-4.70)	<b>2.33 (1.15-4.72)*</b>
	No	203(49.4)	161(39.2)	1	1
Accessibility of computer					
	Yes	96(23.5)	53(12.9)	1.53 (1.04-2.39)	<b>1.42 (1.01-2.35)*</b>
	No	142 (34.5)	120(29.2)	1	1
Computer use for Internet accesses					
	Yes	164(39.9)	142(34.55)	1.01 (0.65-1.58)	

	No	56(13.63)	49(11.9)	1	
Computer use for Entertainment					
	Yes	52(12.65)	55(13.38)	0.77 (0.49-1.19)	0.67(0.42-1.06)
	No	168(40.88)	136(33.09)	1	1
Computer use for Microsoft office					
	Yes	69(16.79)	59(14.36)	1.02 (0.67-1.55)	
	No	151(36.74)	132(32.12)	1	
Source of information					
Colleague	Yes	58(14.11)	42(10.22)	1.27 (0.81-2.00)	
s	No	162(39.40)	149(36.25)	1	
Medical	Yes	82(19.95)	62(15.09)	1.24 (0.82-1.86)	1.12 (0.99-2.95)
literature	No	138(33.57)	129(31.39)	1	1
Seminar	Yes	43(10.36)	22(5.35)	1.87(1.07-3.25)	
workshop	No	177(43.06)	169(41.12)	1	
Internet	Yes	118(28.71)		1.27 (0.86-1.88)	
	No	91(22.14)		1	
		102(24.82)	100(24.31)		
Radio or	Yes	191(46.47)	154(37.47)	1.58 (0.93-2.69)	
TV	No	29(7.06)	37(9.00)	1	

**Note:** \* P-value  $\leq 0.05$ , 1=reference