

Knowledge and awareness of health professionals towards telemedicine services in Northwest, Ethiopia

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Abstract

Background: Understanding telemedicine technology is significantly important for the implementation of a telemedicine system in resource-limited areas. Specifically, in Ethiopia, the doctor-to-patient ratio was 0.003. This has made it difficult to access healthcare services remotely. Therefore, to maximize and facilitate telemedicine adoption, it is critical to have information about health professionals' knowledge and awareness of telemedicine services. This study aimed to determine the Knowledge and Awareness of Health Professionals towards Telemedicine Services in Northwest, Ethiopia.

Methods: An institution-based cross-sectional study design was conducted among 423 health professionals working at referral hospitals from 12 February to 20 March 2020. Descriptive statistics, bivariable and multivariable logistic regression analysis were done. To identify associated factors, an odds ratio with a 95% confidence interval (CI) was used.

Result: With a response rate of 411 (97.2%), approximately 56.4% of professionals had good knowledge and 57.4% had high awareness of telemedicine services. Information sharing culture [AOR = 3.01, 95% CI: 1.89, 4.80], IT support staff [AOR = 1.87, 95% CI: 1.06, 3.29], internet as a source of information [AOR = 1.80, 95% CI: 1.1, 2.94], awareness [AOR = 1.35, 95% CI: 1.03, 2.40], and being male [AOR = 1.73, 95% CI: 1.06], 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 respondents' awareness of telemedicine services.

Conclusion: More than half of the participants were well-versed in and aware of telemedicine applications. Information sources, having IT support staff, information sharing culture, gender, and awareness were significant for telemedicine service knowledge, and telemedicine training and computer access were significant factors for health professionals' awareness of telemedicine services. As a result, health professionals should receive appropriate and ongoing awareness-raising training on telemedicine systems.

Keywords

Awareness, cross-sectional study, knowledge, telemedicine services, health professionals, Ethiopia

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Introduction

The combination of technology and in-person services can help to address some of the disparities in the era of COVID-19, even if internet access affects the delivery of health services across the facility.¹ The COVID-19 pandemic will alter the way we deliver health care, and we anticipate greater reliance on and integration of technology in the future.^{1,2}

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E-health is expanding rapidly to improve the health of the community, enhance scientific understanding of health issues, and facilitate communication between healthcare providers and patients in developing countries.³ Specifically, telemedicine is an important tool for the amplification of healthcare delivery using smartphones and advanced technology via email or video conferencing, especially for providing and supporting clinical care remotely.⁴ Starting from a simple telephone conversation between providers up to real-time video conferencing involving doctors and patients.^{5,6}

The exchange of healthcare information is viewed as a potential solution to the current healthcare problem. However, revolutionizing the healthcare system and implementing telemedicine services will ultimately be dependent on user knowledge and awareness of telemedicine systems.^{3,7,8}

But integrating healthcare service delivery with information and communication technology is a challenge in Ethiopia's health system. Accessing modern health care and getting specialty services is low and still limited due to the scarcity of medical specialists. That situation will not be overturned in a short time. Inadequate transportation in restructuring makes it even more difficult to provide healthcare services in remote and rural areas where more than 80% of the population lives.⁹⁻¹⁴

The telemedicine system is an initiative encouraged by WHO in health system digitization, and it is essential for the country's experience with a heavy burden of disease and a shortage of trained health professionals.^{15,16} It failed to sustain and integrate with the healthcare system, particularly in developing countries. According to various studies, the most commonly mentioned cause of failure is health professionals' lack of knowledge and awareness of telemedicine services. Understanding telemedicine is critical to its long-term development for healthcare system digitization.^{3,17} However, in Ethiopia, the doctor-to-patient ratio was 0.003. This has made it difficult to access healthcare services remotely. The finding of the study is vital for health professionals, and governmental and non-governmental healthcare organizations that enable them to update healthcare strategies, plan appropriate training, and insights a linking among medical institutions. Therefore, the sustainable integration of the telemedicine system within clinical practice depends on the constant evaluation of health professionals' level of telemedicine use during the COVID-19 pandemic. Therefore, to maximize the adoption of telemedicine and sustainable digitization, user-oriented development of telemedicine, integrating with the knowledge and awareness of health professionals, is necessary.^{17,18} This study aimed to determine the Knowledge and Awareness of Health Professionals towards Telemedicine Services in Northwest, Ethiopia.

Methods and materials

Study design, period, and setting

The institution-based cross-sectional study was carried out at Ethiopian referral hospitals from 12 February to 20 March 2020. All health professionals who work in referral hospitals were included in the study. The study excluded health professionals who were seriously ill and those with less than six months of clinical practice experience.

Sample size determination and sampling procedures

The sample size was calculated using a single population proportion formula, $P=50\%$ of health professionals to determine knowledge of telemedicine services, and 52.6% of professionals had awareness of telemedicine services.¹⁵ With a 95% confidence interval (CI), a 5% margin of error, and a 10% non-response rate, the calculated sample size for knowledge $n1=423$ and awareness $n2=422$. As a result, the maximum sample size of 423 was selected as the final sample size.

Participants in the study were chosen through a stratified sampling method, followed by a proportional allocation from referral hospitals. First, department proportional allocations were made for each referral hospital, and then participants were chosen using a simple random sampling method.

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.^{3,19,20}

High awareness towards telemedicine services: It 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.²¹

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, and 18 items either "yes" or "no." It was used to measure the health professionals' knowledge of telemedicine services. Ten items with a five-point Likert scale ranging from 1 to 5 were used, that is, "1" for very little, "2" for little, "3" for some, "4" for enough, and "5" for very enough. One can score a minimum of "10" and a maximum of "50"

related to measuring the awareness of the study participant and telemedicine services-related questions.

Data quality assurance

A pre-test was conducted on 5% of the study participants outside of the actual study area before data collection. Based on the pre-test, the Cronbach alpha values of (0.81) knowledge and (0.76) awareness were determined.

Before beginning the data collection process, the data collectors and supervisor received a one-day training to raise awareness about the respondents, the purpose of the study, their rights, and confidentiality concerns. Respondents were given enough time to read and fill out materials carefully. Up until the end of data collection, there was constant supervision. After gathering the information, the supervisor and investigator double-checked its consistency and completeness.

Data processing and analysis

Epi-info version 7 was used to enter data, and the Statistical Package for Social Science (SPSS) version 20 was used to analyze it. Descriptive analyses were performed to describe the study population's relevant variables. The adjusted odds ratio with a 95% CI was used to measure the association of dependent and independent variables. Bivariable logistic regression was conducted and those factors with a *P*-value of 0.2 were fitted into the multivariable logistic regression analysis. A *P*-value equal to or less than 0.05 was considered statistically significant. The final model

was calibrated using the Hosmer-Lemeshow test and multicollinearity was checked between independent variables (Figure 1).

Results

Socio-demographic characteristics

Four hundred eleven (97.2%) of them gave written consent, and they responded by completing all the questionnaires. Among the study participants, 258 (62.8%) 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 educational status, most of the respondents had a bachelor's degree (268, 65.2%). Regarding the professional category, of the respondents, 78 (19.0%) were 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 respondents had only basic ICT exposure, 334 (81.3%) used a computer, laptop, or Smartphone for work, and 306 (91.1%) used it for internet access. Almost half of the participants (48.2%) search for healthcare digitization on occasion, but 148 (36.0%) have never used internet applications for telemedicine service (Table 2).

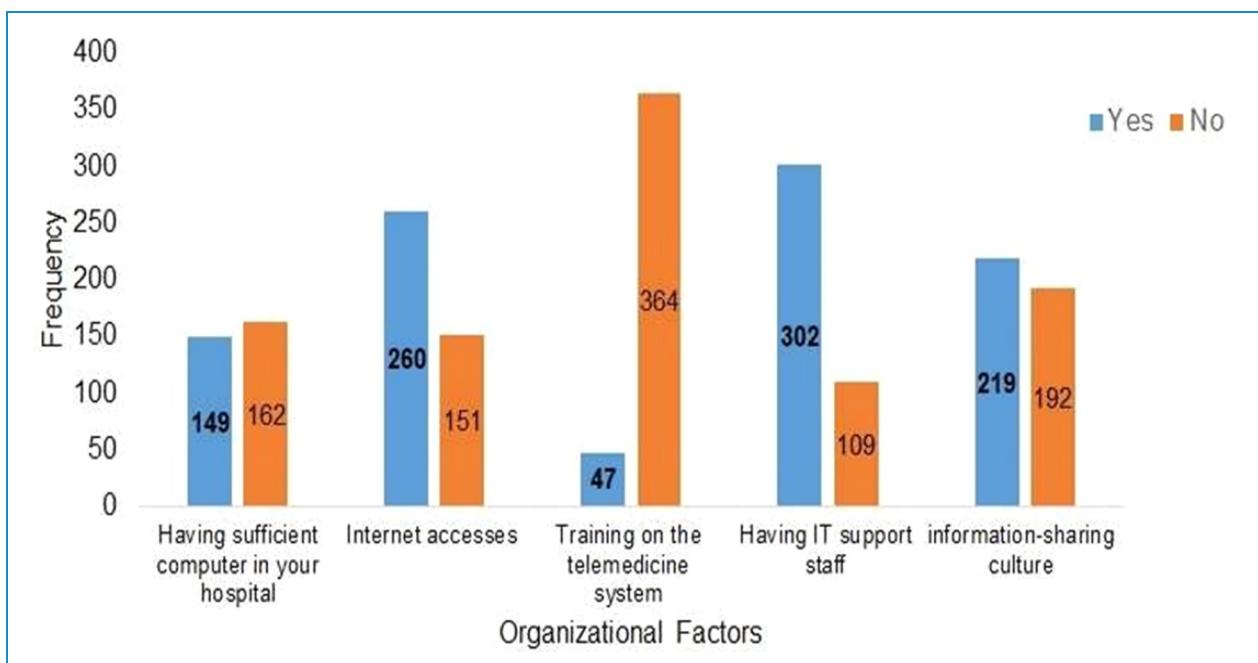


Figure 1. Organization factors on the knowledge and awareness of telemedicine services.

Table 1. Socio-demographic characteristics of the health professional at referral hospitals, Northwest 2020 (N=411).

Variables	Categories	Frequency (#)	Percentages (%)
Gender	Male	258	62.8
	Female	153	37.2
Age	20-29	277	67.4
	30-39	118	28.7
	>40	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 Nursing	24	5.8
	Pediatrics Nursing	33	8.0
	Others1	16	3.9
Work experience (in years)	1-5	242	58.9
	6-10	141	34.3
	11-15	20	4.9
	>16	8	1.9

Other1 = BSC degree in Optometry, Health informatics.

Knowledge of health professionals by the types of telemedicine services

The types of telemedicine services used by study participants: 151 (36.7%) of the respondents knew of communication via telephone, 117 (28.47%) of the store and forward,

104 (25.3%) of remote monitoring, and 63 (15.33%) online/live (Figure 2).

Clinical and public, application, benefits, and barriers of telemedicine services

The majority 317 (77.1%) of study participants were aware of telemedicine clinical applications for radiology, and 212 (51.6%) were aware of the common public health application area of telemedicine services for school-based health centers.

The knowledge of telemedicine services among health professionals at referral hospitals was assessed in this study, 286 (69.6%) were aware of the benefits of telemedicine systems in improving the quality of the healthcare system, and 229 (55.7%) were willing to refer a patient to another hospital for better treatment (Table 3).

Factors associated with the knowledge of telemedicine services

Gender, having IT support staff, information sharing culture, information sources, and awareness of telemedicine services were all found to be positively associated with knowledge of telemedicine services among health professionals working at referral hospitals.

Gender was found to be significantly associated with health professionals' knowledge of telemedicine services in this study. Males were 1.73 times more likely than females to be aware of telemedicine services (AOR = 1.73, 95% CI: [1.06–2.81]). Similarly, health professionals in hospitals with IT support staff were 1.87 times more likely to be knowledgeable about telemedicine services than those in hospitals without IT support staff (AOR = 1.87, 95%CI: [1.06–3.29]).

Another factor influencing health professionals' knowledge of telemedicine services was a culture of information sharing. Health professionals with an information-sharing culture were three times more likely than those without an information-sharing culture to have good knowledge of telemedicine services (AOR = 3.01, 95% CI: [1.89–4.80]). The source of information was one of the factors associated with knowledge of telemedicine services. Health professionals who used the internet as a source of information were 1.80 times more likely than their peers (AOR = 1.80, 95% CI: [1.10–2.94]). Furthermore, awareness of telemedicine services was strongly related to knowledge of telemedicine services among health professionals. Health professionals who were aware of telemedicine were 1.35 times more likely to be knowledgeable than those who were not (AOR = 1.35, 95% CI [1.03–2.40]) (Table 4).

Table 2. Exposure of ICT on the knowledge and awareness of telemedicine services among health professionals at referral hospitals in Northwest Ethiopia, 2020 ($N=411$).

Variables	Categories	Frequency (#)	Percentages (%)
Training in a 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 use	Yes	334	81.3
	No	77	18.7
Activity performed with your computer	Internet accesses	200	60.1
	Entertainment	60	18.3
	Microsoft Office	74	21.6
Have you ever visited the medical field on the internet	Yes	329	80.0
	No	82	20.0
How often do you search information for health care digitization	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 applications 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 a month	52	12.7
	Every other day	42	10.2
	Not at all	148	36.0

(continued)

Table 2. Continued.

Variables	Categories	Frequency (#)	Percentages (%)
How often do you interact with a patient via email	Always	31	7.5
	Often	11	2.7
	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 one option, so totals do not add up to 100%.

Factors associated with the awareness of telemedicine services

Training on the telemedicine system was found to be significantly associated with awareness of telemedicine services in this study. Those who received telemedicine system training were 2.33 times more likely to be aware of telemedicine services than those who did not ($AOR = 2.33$, 95% CI: [1.15–4.72]). Similarly, another factor influencing awareness of telemedicine services was the availability of computers in their hospitals. Health professionals with computer access in their hospitals were 1.42 times more likely to be aware than those without computer access ($AOR = 1.42$, 95% CI: [1.01–2.35]) (Table 5).

Discussion

Adopting a telemedicine system requires the user-oriented development of advanced systems that integrate knowledge and awareness of telemedicine services among health professionals.^{21–25}

The study was conducted at six referral hospitals and assessed health professionals' knowledge, awareness, and associated factors of telemedicine services. According to the findings of this study, 56% (95% CI: [50.6, 59.9]) of health professionals had a good understanding of telemedicine services. This study agrees with the Saudi study, 53.9%²⁶; however, the result of this study is higher than the Nigerian study, 34.1%¹⁹ and India (41%).²⁷ One

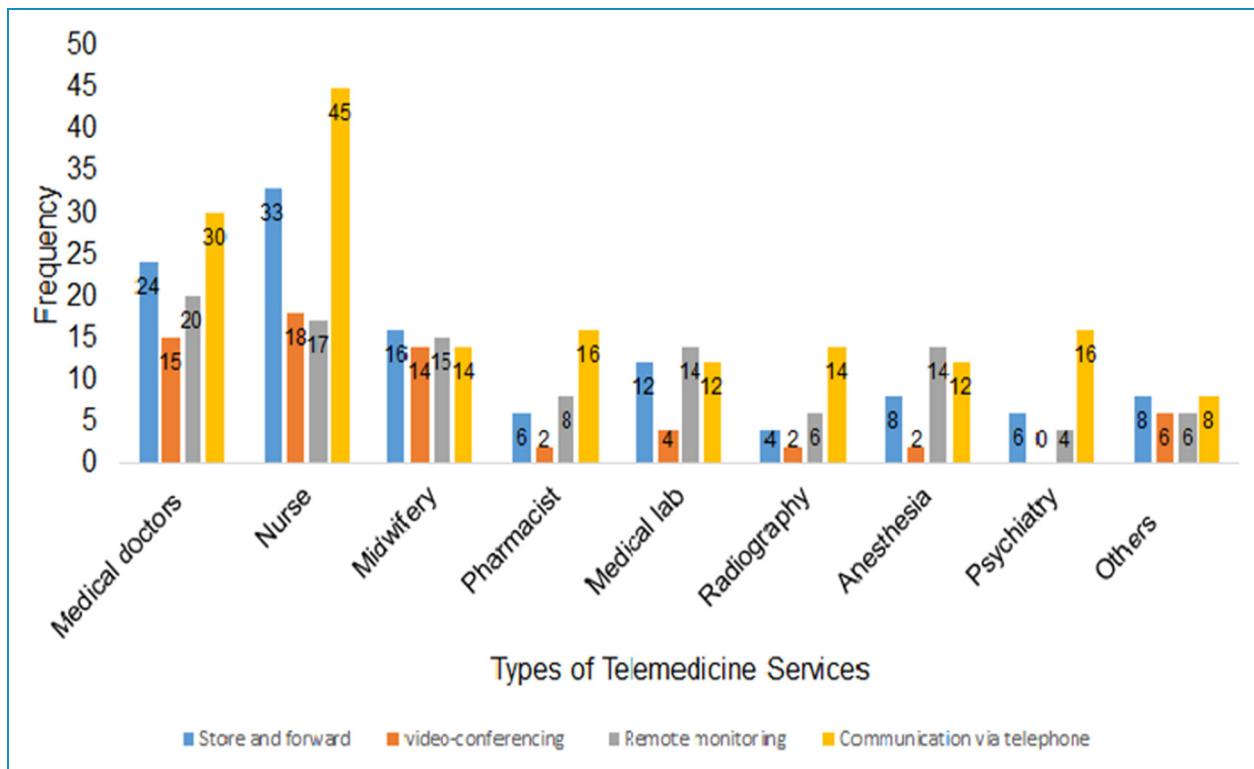


Figure 2. Knowledge of health professionals by the types of telemedicine services.

possible explanation for this is a difference in sample size. Furthermore, the Ethiopian Ministry of Health is currently focusing heavily on healthcare digitization as one of its top priorities.

As different scholars indicated that the implementation telemedicine system is challenged by a lack of adequate resources to practice telemedicine in rural areas to consult patients and deliver healthcare services remotely.¹ Our finding indicated that poor exposure to information communication Technology had affected the practice of telemedicine and health information sharing between patients and healthcare providers across a distance. This is supported by the study conducted in France.²⁸

Gender was found to be significantly related to knowledge level in the study. Males were more likely than females to be knowledgeable. This research is consistent with a descriptive study conducted in Bangladesh.²⁹ The possible explanation is that males have more exposure to internet access³⁰ and new technology than females due to their literacy level.²⁴ Health professionals who worked in hospitals with IT support were 1.9 times more likely to know about telemedicine services than those who did not (AOR = 1.87, 95% CI: [1.06–3.29]). This finding is supported by research from Kenya³¹ and Ethiopia.²³ Existing technology, which can be realized through end-user motivation and support, as well as a proper understanding of telemedicine technology as a way to scale up the healthcare system, are possible reasons.

The study discovered that 38.7% of health professionals had a health information-sharing culture and were three times more likely to be aware of telemedicine services than those who did not. This result was comparable to the Austrian study.²⁵ This could be because telemedicine necessitates the willingness of both ends (sender and receiver). According to the findings of this study, the vast majority (88.4%) of respondents have never received formal telemedicine training. This finding was supported by a study conducted in Bangladesh, where 82.5% of the participants had never received formal telemedicine training.²⁷ Whereas study done in India found that none of the respondents had any formal training on telemedicine.¹⁹

Another statistically significant factor for knowledge of telemedicine services was the information source. Using the 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 respondents reported that the internet (33.1%) and different medical literature (21.6%) were the main sources of information about telemedicine, followed by 15% of the respondents from colleagues and 9.9% from TV/radio. This finding is contrasted with the study conducted in Bangladesh; the source for information for telemedicine was colleagues (38%) and the internet (17.5%).²⁷ The possible explanation might be due to the accessibility of the internet, healthcare

Table 3. Clinical application area, common public health area, benefits, and barriers to the knowledge and awareness of telemedicine services among health professionals at referral hospitals Northwest Ethiopia, 2020 (N=411).

Variables	Categories	Frequency (#)	Percentage (%)
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 the Safety and security of Patient information	223	54.3
	Don't know	27	6.6
Alternatives supposed to do during a difficult 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 to previous cases.	162	39.4

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

digitization, and the availability of different information technology and software applications.

Knowledge of telemedicine services was also linked to awareness. In this study, health professionals who knew about telemedicine services were 1.35 times more likely to be knowledgeable than those who didn't. According to this finding, more than half of the respondents (57.4%) were aware of the benefits of telemedicine in terms of improving quality of care, access and convenience, cost reduction, and safety. Dermatology, radiology, and cardiology were identified as priority clinical application areas by study participants.

The majority (65.2%) were aware of store-and-forward telemedicine and telephone communication about the various types of telemedicine service delivery related to telemedicine applications.²⁵ Radiology, cardiology, and dermatology were chosen by 13.5%, 11.8%, and 11.4%

of those polled, respectively. Similarly, respondents were given the option of selecting among the benefits of telemedicine systems; 69.6% indicated that the system improves the quality of care, 58.2% indicated that it improves healthcare access, and 54.3% indicated that the system benefits in ensuring the safety and security of patient information.

When faced with difficulties in their clinical work, approximately 229 (55.7%) of respondents stated that they would prefer to refer the patient to another hospital for better treatment. Around 175 (42.6%) of respondents prefer to schedule patients for follow-up visits when better physicians are available, while 162 (39.4%) prefer to refer to medical literature and/or similar previous cases. This is a better result than the one obtained in Addis Ababa.¹⁵ Almost half of the respondents (49.5%) were aware of the benefits of telemedicine application, with

Table 4. Bivariate and multivariable analysis of factors with knowledge of telemedicine services among health professionals working at referral hospitals, North West Ethiopia, 2020 (N=411).

Variables	Categories	Knowledge of telemedicine		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)	1.73 (1.06-2.81)*
	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)	1.87 (1.06-3.29)*
	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)	3.01 (1.89-4.80)***
	No	71 (17.3)	121 (29.4)	1	1
Computer Access	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	Yes	161 (39.2)	106 (25.8)	1.63 (1.09-7.45)	1.17(0.68-1.83)
	No	69 (16.8)	75 (18.2)	1	1
Internet as an information source	Yes	136 (33.1)	94 (22.9)	2.14 (1.44-3.18)	1.80 (1.10-2.94)*
	No	73 (17.8)	108 (26.3)	1	1
Awareness of telemedicine services	High	109(26.5)	66(16.1)	1.34 (0.88-2.06)	1.38 (0.80-2.35)
	Low	121(29.4)	115(28.0)	1	1

Note: 1 = reference; *** P-value = 0.01, ** P-value = 0.03, * P-value \leq 0.05.

12.7% indicating radiology, 8.3% indicating dermatology, and 8.3% indicating cardiology. Similarly, 24.4% said the system improves care quality, while 5.1% said it only improves access and convenience.

In terms of health professionals' awareness of telemedicine services, 57.4% (95% CI: [53.0, 63.5]) of study participants had a high level of awareness. This study concurs with those conducted in Nigeria 58.5%,¹⁸ and India 63%¹⁹ but falls short of those conducted in Uganda (70%).³² Reasons for this could include infrastructure differences and a shortage of health professionals caused by healthcare digitization in the study area. Moreover, health

professionals' basic computer ICT skills may contribute to the difference. Health professionals who have easy access to a computer at their workplace are more aware of telemedicine services. This study is consistent with one conducted in Addis Ababa.¹⁷ Health professionals who had received training in telemedicine systems had a high level of awareness of telemedicine services. This study is less comprehensive than the one conducted in India.¹⁹

This study's findings revealed that more than 80% of study participants were aware of the telemedicine clinical application area, which is higher than the study done at Tikur Anbessa hospital (52.6%).¹⁵ Nowadays, implementing

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

Variables	Categories	Awareness of telemedicine		COR (95%CI)	AOR (95%CI)
		High (%)	Low (%)		
Educational status	Medical doctors	52 (12.7)	23 (5.6)	1.17 (0.054–2.50)	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)	2.33 (1.15–4.72)***
	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)	1.42 (1.01–2.35)*
	No	142 (34.5)	120 (29.2)	1	1
Source of information	Colleagues	Yes	58 (14.11)	42 (10.22)	1.27 (0.81–2.00)
		No	162 (39.40)	149 (36.25)	1
	Medical literature	Yes	82 (19.95)	62 (15.09)	1.24 (0.82–1.86)
		No	138 (33.57)	129 (31.39)	1
	Seminar or workshop	Yes	43 (10.36)	22 (5.35)	1.87(1.07–3.25)
		No	177 (43.06)	169 (41.12)	1
	Internet	Yes	118 (28.71)	102 (24.82)	1.27 (0.86–1.88)
		No	91 (22.14)	100 (24.31)	1
	Radio or TV	Yes	191 (46.47)	154 (37.47)	1.58 (0.93–2.69)
		No	29 (7.06)	37 (9.00)	1

1 = reference; *** P-value = 0.01, ** P-value = 0.03, * P-value ≤ 0.05.

and practicing telemedicine systems across the health healthcare facility help to minimize the spread of COVID-19 and improve the health of the community.³³

Conclusion

More than half of the study's participants had a good understanding and awareness of telemedicine services. The information source, IT support staff, information sharing culture, gender, and awareness were the most important factors for telemedicine service knowledge. Two factors influence health professionals' awareness of telemedicine services:

telemedicine training and computer access. As a result, health professionals should receive appropriate and consistent awareness-creating training on telemedicine systems, and computer access in healthcare facilities should be improved.

Strengths and limitations of the study

This study is based on cross-sectional data, with a large sample size and a relatively good response rate, which contributes to the representativeness of the study sample. The cross-sectional study design prevented the establishment

of causation, and the outcomes could be influenced by confounding variables that were not examined additionally; there is still a possibility of recall bias, which may affect the results.

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
WHO	World Health Organization

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Availability of data and materials: All major data have been presented in the manuscript.

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

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