Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Digital health literacy to share COVID-19 related information and associated factors among healthcare providers worked at COVID-19 treatment centers in Amhara region, Ethiopia: A cross-sectional survey

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ABSTRACT

Background: Coronavirus (CoV) is a novel respiratory virus that can cause severe acute respiratory syndrome (SARS). It affects millions of people in the world and thousands of people in Ethiopia. In responding to this, digital health technologies help to reduce COVID-19 outbreaks by sharing accurate and timely COVID-19 related information. Additionally, digital solutions are used for remote consulting during the pandemic, in creating COVID-19 related awareness, for distribution of the vaccine, and so on. Therefore, this study aimed to assess digital health literacy to share COVID-19 related information and associated factors among healthcare providers who worked at COVID-19 treatment centers in the Amhara region, Northwest Ethiopia.

Method: An institutional-based cross-sectional survey was conducted from April 4 to May 4, 2021. The study included 476 healthcare providers who worked at COVID-19 treatment centers in the Amhara region. A pre-tested, structured self-administered questionnaire was used to collect data. EpiData 4.6 and SPSS version 26 were used for data entry and analysis respectively. Bi-variable and Multivariable logistic regression analysis was used to identify factors associated with the dependent variable. A *P*-value of less than 0.05 was used to declare statistical significance.

Result: A total of 456 respondents were participated in the study, with 95.8% response rate. Digital health literacy to share COVID-19 related information found to be 50.4% (95% CI: 46–55). Educational status [AOR = 4.37, 95% CI(2.08–9.17)], training [AOR = 3.00, 95% CI (1.80–5.00)], attitude [AOR = 1.99, 95% CI(1.18–3.36)], perceived usefulness [AOR = 2.01, 95% CI(1.22–3.32)], perceived ease of use [AOR = 2.00, 95% CI(1.25–3.21)] and smartphone access [AOR = 5.21, 95% CI(2.34–9.62)] were significantly associated with digital health literacy to sharing of COVID-19 related information at *P*-value less than 0.05.

Conclusion: This finding indicated that approximately half of the respondents had digital health literacy to share COVID-19 related information which was inadequate. Improving respondents' educational status, computer training, smartphone access, perceived usefulness, perceived ease of use, and attitude was necessary to measure digital health literacy to sharing of COVID-19 related information.

1. Background

Coronavirus (CoV) is a novel respiratory virus that can cause severe acute respiratory syndrome (SARS) [1]. It was first identified in Wuhan, China, in December 2019 and has quickly spread to every part of the globe [2]. The common sign and symptoms of this virus was fever, cough, and shortness of breath, vomiting, diarrhea, and abdominal pain [3,4]. The coronavirus disease (COVID-19) has a high rate of transmission, making it difficult to control the progress [5]. It affects more than 355.6 million people in the world, 10.8 million people in Africa, and 462,514 people in Ethiopia based on the world health organization (WHO) report of January 2022. The virus has no effective treatment worldwide. However, several vaccines are currently available that can help to decrease the spread and severity of the pandemic [6,7].

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Despite the discovery of effective vaccines, the Ethiopian populations don't have enough access, due to a resource scarcity [6]. This condition leads to the risk of illness, hospitalization, and death from the virus. In response to this tricky situation, the Ethiopian government was taking several preventive mechanisms to tackle the spread of the COVID-19 pandemic [8]. Case identification, contact tracing, isolation, public gathering restrictions, travel restrictions, enforcement of face mask mandates, health promotion using mass media, COVID-19 related information seeking and sharing using digital technologies, and quarantine for exposed persons were the main COVID-19 prevention efforts [6,9]. Moreover, the ministry of health(MOH) in Ethiopia with the collaboration of non-governmental organizations(NGOs) were made significant efforts in developing the COVID-19 surveillance platform and designing apps that do everything from virus tracing to sharing COVID-19 related information [10].

During the COVID-19 pandemic, information and communication technologies (ICTs) were considered as a tool to track the spread and share of health-related information to make public awareness for healthcare providers on reducing health problems [11–13]. It helps to access high-quality, cost-effective healthcare service delivery by increasing health professionals' communication [14–17]. This technology improves the skills to search, select, appraise, and apply online health information [18,19]. These skills are known as digital health literacy [20].

On the other hand, a critical challenge affecting the successful rollout and use of digital technology innovations in low-income countries (LMICs), and sub-Saharan Africa (SSA) in particular, are a reflection of the political, social, and culture. In the response to COVID-19, the digital divide was made even more obvious by the failure of information on some of the proposed measures to reach intended audiences. This phenomenon increases socioeconomic disparities and health inequities [21]. Several challenges in mainstreaming digital health during the COVID-19 pandemic are still observed. Before the crisis, targeted users of health technology products in various parts of Africa were reluctant to integrate the innovations into the healthcare system. This made social distancing rules and other infection prevention control protocols in Africa including Ethiopia difficult to implement [22–24].

During the time of COVID-19, managing the new cases and decreasing the number of healthcare professionals and patients with COVID-19 requires effective measures. Those measures include the sharing of COVID-19 related information through digital technologies among healthcare providers. This requires healthcare staff to be aware of the concept of digital health and to have the respective skill to share COVID-19 related information [25].

However, literature shows digital health literacy to share COVID-19 related information was inadequate in developing countries. A study conducted in Pakistan indicated that 54.3% [26] and 45.7% [27] and in Iran 45.6% [28] have low digital literacy to share health-related information. In Ethiopia, digital health literacy was limited to sharing health-related information [29]. Additionally, most of the literature conducted on digital health literacy was not specific to COVID-19 [30–32]. Hence, we argue that a study that specifically assesses the healthcare provider's digital literacy to sharing of COVID-19 related information is critical for addressing accurate and timely information regarding COVID-19 [31,33,34].

Studies indicated that digital health literacy is influenced by educational status, motivation toward using digital health solutions, frequent internet access, computer access, computer training, knowledge regarding the availability and importance of COVID-19 related information, perceived usefulness, perceived ease of use, attitude towards digital health literacy, and smartphone access among respondents [29,31,32,35–38].

In times of the pandemic, healthcare providers who worked in COVID-19 treatment centers are front-lines to share health information about disease nature to fight against it [5,39]. Digital health literacy may help to share relevant information regarding coronavirus disease prevention, control, and its sign and symptoms to their relatives, staff, and other health professionals in the healthcare organizations through social media, cellphone conversation, text message, news media, email, and others [40]. Therefore, the study aimed to assess digital health literacy to share COVID-19 related information and identify its associated factors among healthcare providers who worked at the COVID-19 treatment center in the Amhara region, Northwest Ethiopia.

2. Methods

2.1. Study design, period, and area

The study was conducted an institutional-based cross-sectional survey among healthcare providers who worked at COVID-19 treatment centers in the Amhara region. The study was conducted from April 04 to May 04, 2021, in the Amhara region COVID-19 treatment center hospitals. Amhara region is located in the Northwestern and North Central parts of Ethiopia. It has 85 hospitals (8 referral hospitals, 20 general hospitals, and 67 primary hospitals), 862 health centers, and 10 private hospitals, based on 2022 Amhara regional health bureau reports. It has eleven COVID-19 treatment centers, such as Bahirdar Tibebe-Gion, Bahirdar Felegehiwot, the University of Gondar, Debre-tabor, Debre-Markos, Debre-Birhan, Dessie, Fnote-Selam, Woldya, Metema and Sekota hospitals. Among those, the University of Gondar, and Bahirdar Tibebe-Gion are specialized teaching hospitals. Whereas, Bahirdar Felegehiwot, Debre-tabor, Debre-Markos, Debre-Birhan, Dessie, Fnote-Selam, and Woldya are specialized. Others are general hospitals.

2.2. Source and study populations

The source population was all healthcare providers who worked at COVID-19 treatment centers in the Amhara region. Additionally, all healthcare providers who worked in COVID-19 treatment centers at those COVID-19 treatment center hospitals that were available during the data collection period were study populations.

2.3. Inclusion and exclusion criteria

The inclusion criteria were all healthcare providers who worked in COVID-19 treatment centers and permanent employees in the COVID-19 treatment center hospitals, who worked six months and above at hospitals. However, all healthcare providers were not available during the data collection period due to some reasons. Such as illness, annual leave, and other cases were excluded from this study.

2.4. Sample size and sampling procedure

Sample size (n) was determined by single population proportion formula by using p = 50% because this study was new for a specific disease. With Standard deviation (Zα/2 = 1.96 for a 95% CI) and margin of error (d = 5%). With the formula:

$$n = (Z\alpha/2)2 \;\; P(1-P)/d2$$

$$n = (1.96)2 \times \frac{0.50(1-0.50)}{(0.05)2} = 384.16$$

A 10% non-response rate was used. Accordingly, the total sample size was $384.16 + 38.416 = 422.576 \approx 423$. whereas, there wasn't much difference between the calculated sample size (423) and the total number of the study population in the study setting (476). Due to this, we have conducted an institutional-based cross-sectional survey among healthcare providers who worked at COVID-19 treatment center hospitals in the Amhara region. We have taken lists and addresses of all healthcare providers who worked in COVID-19 treatment centers, from each health department administrative body.

2.5. Data collection tool and procedure

To check the consistency and validity, a pretested and structured self-administered questionnaire was used to collect the data with all necessary precautions for COVID-19 prevention during the data collection period. The tool was adapted and modified from different literature that previously studded with related to digital health literacy to sharing of COVID-19 related information [26,30,33,35,41,42]. Five data collectors (two data collectors were public health officers, two data collectors were laboratory professionals and one data collector was an anesthesia professional) and two supervisors were participating in the data collection.

A total of 56 item questioners within three parts such as socio-demographic characteristics, individual characteristics, organizational related characteristics, and digital health literacy to share COVID-19 related information. Pretest was conducted among 25 healthcare providers (5% of the total sample size) at Felegehiwot specialized hospital in a COVID-19 treatment center which was similar to our study setting. The correctness, consistency, and quality of the questionnaire were checked and seen in detail based on the pretest finding. The content validity of the questionnaire was determined based on the view of experts and the reliability was obtained by calculating the value of Cronbach alpha (overall Cronbach alpha = 0.89).

2.6. Data processing and analysis

To ensure completeness and consistency of the data, first, we coded and cleaned. Then, the data were entered by EpiData version 4.6 and exported to SPSS 26 for further analysis. Summary statistics of socio-demographic variables were presented using frequency tables. Bi-variable logistic regression analysis was computed to control confounding. All independent variables with *P*-value less than 0.2 in Bi-variable logistic regression were entered into multivariable logistic regression analysis. The strength of the association was described at 95% CI and the level of significance was determined at a *P*-value of less than 0.05 for multivariable regression analysis model.

The fitness of the model was checked by using Hosmer and Lemeshow test (χ 2/DF = 4.81; RMSEA = 0.05; CFI = 0.95; TLI = 0.93). A multi-collinearity test was conducted among the independent variables and all of the variables scored variance inflation factors (VIF) of between 1.0 and 2.1. Most researchers considered a VIF<10 an indicator of acceptable for multi-collinearity [43]. Accordingly, our result showed no correlation or moderate correlation between independent variables.

2.7. Measurements

2.7.1. Digital health literacy to share COVID-19 related knowledge

Defined as the level of technical knowledge to share COVID-19 related knowledge, information, and experiences with electronic resources. It was measured by nine closed-ended Likert scale questions in which ratings were made on a one to five scale where; 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Since digital literacy to share COVID-19 related knowledge was not normally distributed, we computed the median score. Respondents who scored with the median score and above were considered as they had a good digital literacy level to share COVID-19 related knowledge. Respondents who scored below the median score were considered as they had poor digital literacy levels to share COVID-19 related knowledge [26,27,30].

2.7.2. Perceived easiness

Researchers argued that perceived ease of use is the extent to which a person accepts as true that using an exacting technology would be at no cost to that individual. It is the term that represents the degree to which an innovation is perceived not to be difficult to understand, learn or operate. It was measured by six closed-end question items. Study participants who scored median and above the median in the five-point Likert scale of Perceived easiness question were categorized they thought eHealth was easy to use and those who scored below the median were categorized they thought tele monitoring technologies as not easy to use [44].

2.7.3. Perceived usefulness

Perceived usefulness is the degree to which an individual's perception that using the new technology will enhance or improve her/his performance. It was measured by fourteen closed-end question items. Study participants who scored median and above the median in the five-point Likert scale of perceived usefulness question were categorized as they thought ICT tools as useful for their patient management and those who scored below the median were categorized as they thought ICT tools as not useful for their patient management [44].

2.7.4. Computer skill

It is referred to the abilities of healthcare providers which allow using of computers and related technology. We used five items of Likert scale questions to measure basic computer skills of the healthcare providers which ranged from: "1 = strongly disagree to 5 = strongly agree". Respondents who scored mean and above were considered as they had good computer skills. Whereas respondents who scored below the mean were considered as they had poor computer skills [45,46].

2.7.5. Attitude toward digital health

In this study, an attitude refers to the feeling of healthcare providers toward the introduction of digital health technologies. It was measured by six items of Likert scale questions ranging from: "1 = strongly disagree to 5 = strongly agree". Respondents who scored mean and above were considered as they had a favorable attitude. Whereas respondents who scored below the mean were considered as they had unfavorable attitudes [47,48]. The detail about the tools used for measuring digital health literacy to share COVIS-19 related information is found in Annex 1.

3. Results

3.1. Socio-demographic characteristics

A total of 476, structured self-administered questionnaires were distributed to HCPs worked in COVID-19 treatment centers at Tibebe-Gion and the University of Gondar specialized and teaching referral hospitals, among those, 456 questionnaires were completed and returned with a response rate of 95.8%. Based on the demographics and other personal background information obtained, from the total respondents, 338(74.1%) of males, around half of respondents 225 (49.3%) were categorized under 21–30 years old, most of the respondents 353(77.4%) were BSc degree holders (Table 1).

3.2. Individual characteristics

From the total, 254(55.7%) of respondents had good computer skills, 267(58.6%) of respondents had a favorable attitude about digital literacy helps to share COVID-19 related information, 191(41.9%) of respondents said that digital literacy to share COVID-19 related information were easy, 212(46.5%) of respondents said that digital literacy to share COVID-19 related information were useful and 220 (48.2%) of the respondents had the good motivation towards digital literacy level (Table 2).

3.3. Organizational characteristics

From the total respondents, only 163(35.7%) respondents were got computer training opportunities. Among those, 71(43.6%) of respondents were gate training access at the workplace, 58(35.6%) of respondents were gate training access at home, 27 (16.6%) of

Table 1
Socio-demographic characteristics of healthcare providers who worked at COVID-19 treatment centers in Amhara region, North Ethiopia, 2022.

Variables(n = 454)	Frequency (n)	Percentage (%)
Sex		
Male	338	74.1
Female	118	25.9
Age		
21-30	225	49.3
31-40	185	40.6
41-50	46	10.1
Academic level		
Diploma	4	0.9
BSc degree	353	77.4
Masters and above	99	21.7
Marital status		
Single	255	55.9
Married	178	39.0
Divorced	23	5.1
Religion		
Christian orthodox	337	73.9
Muslim	57	12.5
Protestant	60	13.2
Others	2	0.4
Profession		
Medical doctor	85	18.6
Nurse	181	39.7
Medical laboratory	91	20.0
Midwifery	25	5.5
Anesthesia	11	2.4
Pharmacy	57	12.5
Radiology	6	1.3
Experience at the COVID-19 treatment center		
One month and below	327	72.0
Two month	88	19.4
Three months and above	39	8.6
COVID-19 history		
No	411	90.5
Yes	43	9.5
Types of mobile phone		
Smart	392	86.3
Basic	62	13.7
Social media account		
No	56	12.3
Yes	398	87.7

Table 2
Individual characteristics of healthcare providers who worked at COVID-19 treatment centers in Amhara region, North Ethiopia, 2022.

Variables (n = 454)	Frequency (n)	Percentage (%)
Computer skill		
Good	254	55.7
Poor	202	44.3
Attitude		
Favorable	267	58.6
Unfavorable	189	41.4
Perceived ease of use		
Easy	191	41.9
Not easy	265	58.1
Perceived usefulness		
Useful	212	46.5
Not useful	220	53.5
Motivation		
Good	220	48.2
Poor	236	51.8

respondents were gate training access from both workplace and home and 7(4.3%) respondents were gates at others places. Of the total, 325 (71.3%) of respondents had computer access.

Among those, 126(38.8%) of respondents were gate computer access at the workplace, 96(29.5%) of respondents were gate computer access at home, 85 (26.2%) of respondents were gate computer access from both workplace and home and 18(5.5%) respondents were gates at others places. Of the total, 349(76.5%) of respondents had internet access. Among those, 121(34.8%) of respondents were gate internet access at the workplace, 62(17.8%) of respondents were gate internet access at home, 140 (40.2%) of respondents were gate internet from both workplace and home and 26(7.2%) respondents were at others places (Table 3).

3.4. Digital health literacy to share COVID-19 related information

The result of this study showed that out of 456 study participants 230 (50.4%) (95% CI; 46–55) of healthcare providers who worked in COVID-19 treatment centers were at a high level in digital health literacy to sharing of COVID-19 related information.

3.5. Factor associated with digital health literacy to share COVID-19 related information

All variables were entered into the binary logistic regression model. From those variables: age, sex, educational status, professional categories, salary, mobile phone types, computer training, computer access, internet access, attitude, perceived usefulness, motivation, and perceived ease of use were factors associated with literacy to share COVID-19 related information in the bi-variable analysis at *P*-value less than 0.2. Due to this, those variables were subjected to the multivariable logistic regression analysis to control potential confounders.

In the multivariate logistic regression analysis, respondents who were master holders and above [AOR = 4.37, 95% CI(2.08–9.17)], respondents who had computer training [AOR = 3.00, 95% CI (1.80–5.00)], respondents who had favorite attitude [AOR = 1.99, 95% CI(1.18–3.36)], respondents who said digital literacy to share COVID-19 related information were useful [AOR = 2.01, 95% CI(1.22–3.32)], respondents who said digital literacy to share COVID-19 related information were easy [AOR = 2.00, 95% CI(1.25–3.21)] and respondents had smartphone access [AOR = 5.21, 95% CI(2.34–9.62)] were significantly associated with digital health literacy to sharing of COVID-19 related information at *P*-value less than 0.05(Table 4).

4. Discussion

The present study examined Digital health literacy to share COVID-19 related information and its associated factors in COVID-19 treatment centers of resource-limited settings. The result of the study showed that out of 456 study participants 230(50.4%) (95% CI; 46–55) of healthcare providers who worked in COVID-19 treatment centers were at a high level in digital literacy to sharing of COVID-19 related information.

This finding was consistent with the study conducted in Ethiopia 46.5% [29], Pakistan 47.8% [27], 54.3% [26], and Iran 54.4% [28]. However, this finding was less than the study conducted on Dutch (76%) [30]. This variation could be due to infrastructure, internet penetration, educational system difference among developing countries Ethiopia, and developed countries. But this finding is also lower than the study

Table 3
Organizational factors among healthcare providers who worked at treatment centers in the Amhara region, North Ethiopia, 2022.

Variables (n = 454)	Frequency (n)	Percentage (%)
Internet access		
Yes	349	76.5
No	107	23.5
Computer access		
Yes	325	71.3
No	131	28.7
Computer training		
Yes	163	35.7
No	293	64.3

Table 4
Factors associated with digital health literacy to share COVID-19 related information among healthcare providers working at COVID-19 treatment centers in Amhara region, north Ethiopia, 2021.

Variables	Digital health literacy to share COVID-19 related information		OR	
	High	Low	COR(95%CI)	AOR(95%CI)
Sex				
Male	184 (40.3%)	154 (33.8%)	1.87 (1.22–2.87)	1.58 (0.86–2.49)
Female	46 (10.1%)	72 (15.8%)	1	1
Age				
21-30	101 (22.1%)	124 (27.2%)	0.36 (0.18–0.70)	0.34 (0.14–1.01)
31-40	97 (21.3%)	88 (19.3%)	0.48 (0.24–0.96)	0.43 (0.17–1.06)
41-50	32(8.1%)	14(2.0%)	1	1
Academic level				
BSc degree and below	150 (31.3%)	207 (47.0%)	1	1
Masters and above	80 (17.5%)	19(4.2%)	5.81 (3.38–9.99)	4.37 (2.08–9.17)*
Professions				
Medical doctor	58 (12.7%)	27(5.9%)	1	1
Nurse	83 (18.2%)	98 (21.5%)	0.39 (0.23–0.68)	1.06 (0.50–2.22)
Laboratory	48 (10.4%)	43(9.5%)	0.52 (0.28–0.96)	0.78 (0.35–1.82)
Pharmacy	25(6.0%)	32(6.5%)	0.36 (0.18–0.73)	1.08 (0.45–2.64)
Others	16(3.5%)	26(5.7%)	0.29 (0.13–0.62)	0.32 (0.12–1.01)
Salary (in ETB)				
Below 5000	9(2.0%)	24(5.2%)	0.17 (0.06–0.47)	0.65 (0.16–2.69)
5000-10000	196 (43.0%)	191 (41.9%)	0.45 (0.22–0.94)	2.54 (0.89–7.29)
Above 10000	25(5.5%)	11(2.4%)	1	1
Types of mobile phone				
Smartphone	218 (47.8%)	177 (38.8%)	5.03 (2.60–9.75)	5.21 (2.3411.62)*
Basic phone	12(2.6%)	49 (10.8%)	1	1
Computer access				
Yes	188 (41.2%)	137 (30.1%)	2.91 (2.00–4.46)	1.75 (0.93–3.29)
No			1	1
Internet access				
Yes	196 (43.0%)	153 (33.5%)	2.75 (1.74–4.35)	0.93 (0.46–1.88)
No	34(7.5%)	73 (16.0%)	1	1
Attitude				
Favorable attitude	161 (35.3%)	106 (23.3%)	2.64 (1.80–3.88)	1.99 (1.18–3.36)*
Unfavorable Attitude	69 (15.1%)	120 (26.3%)	1	1
Motivation of respondent				
Good motivation	121 (26.6%)	99 (21.3%)	1.42 (0.99–2.06)	0.81 (0.49–1.35)
Poor motivation	109 (23.9%)	127 (27.8%)	1	1
Perceived usefulness				
Useful	129 (28.3%)	83 (18.2%)	2.20 (1.51–3.20)	2.01 (1.22–3.32)*
Not useful	101 (21.9%)	143 (31.6%)	1	1
Perceived ease of use				
Easy	115 (25.2%)	76 (16.7%)	1.97 (1.35–2.88)	2.00 (1.25–3.21)*
Not easy	115 (25.2%)	150 (31.9%)	1	1
Computer training				
Yes	115 (25.2%)	48 (10.6%)	3.71 (2.46–5.59)	3.00 (1.80–5.00)
No	115 (25.2%)	178 (39.0%)	1	1

Note: *Variable significant at *P*-value less than 0.05, 1 = reference.

conducted in northwest Ethiopia, which was (60%) [32] and (69.3%) [49]. The possible reason for this variation could be the study unit, the study area, and the sample size between the previous study and this study. In this regard, the studies conducted in Northwest Ethiopia were focused on general digital health literacy but our study was specifically on COVID-19. Therefore, the operational definition used in this study has little difference from that of the previous one which could be the other justification for this variation.

Whereas, this study finding was higher than the study conducted in Korea 38.8% [50]. This different result may be related to the difference between study units of those studies. In our study, the participants were healthcare providers who worked in COVID-19 treatment centers, whereas the previous study was conducted among nursing students. This difference may be the main reason to gate different findings.

According to the result from multi-variable regression analysis, the odds of respondents who were masters and above holders were 4.37 times higher digital health literacy for sharing of COVID-19 related information than that of respondents who were BSc and below holders. This showed that the level of education increased, digital health literacy also increase to share COVID-19 related information. When the levels of educational status increase, awareness, and knowledge about digital health literacy to share COVID-19 related information also increase. This finding was supported by the study conducted in Ethiopia [29], the state of Florida [33], and Pakistan [51].

The odds of respondents who had smartphone access were 5.21 times higher digital health literacy to share COVID-19 related information than that of the respondents who had basic phone holders. This indicated that when the smartphone holder increases the respondent's knowledge and awareness about digital literacy for sharing of COVID-19 related information also increases. The reason could be due to if respondents have smartphones they could simply use important applications that help to know digital technology playing on sharing of COVID-19 related information by exercising more [5].

The odds of respondents who had a favorable attitude were 1.99 times higher digital health literacy to share COVID-19 related information than that of the respondents who had unfavorable attitudes. This indicated that when the respondent's attitude was favorable, the digital health literacy to share COVID-19 related knowledge was high and vice versa. This is because the respondents have a favorable attitude to know digital health; they simply take actions on how to understand the digital technology for applying to share COVID-19 related information. This finding was supported by the study conducted in Ethiopia [29,49], Taylor and Francis [52] Korea [38].

The odds of respondents who perceive digital tools as useful were 2.01 times higher in digital health literacy level than that of respondents who perceive digital tools were not useful. This might be due to the perceived benefit from using digital health tools enhanced healthcare providers who worked in COVID-19 treatment centers' attitude which ultimately leads sustainably practicing to use it. This is consistent with a previous study conducted in Northwest Ethiopia [32].

Respondents who perceived using digital health tools as easy were 2.00 times more likely to have a higher digital health literacy level than that of respondents who perceived digital health tools as not easy. The

main justification could be since healthcare providers who worked in COVID-19 treatment centers who consider using digital tools easy were more confident in practicing and building their literacy and it is known that perceived ease of use could be influencing respondents' acceptance of digital health information technologies [53]. This is in line with the studies conducted in Ref. [53].

The odds of respondents who gate computer training were 3.00 times more likely digital health literate than that of respondents who were not gated computer training access. This indicated that if respondents have computer training access at the workplace, home, both workplace and home and also others place were good awareness about digital health literacy.

5. Conclusion

This finding indicated that approximately half of the respondents had digital health literacy to share COVID-19 related information which was inadequate. Educational status, computer training, introducing smartphone technology, perceived usefulness, perceived ease of use, and creating awareness about the importance of digital health literacy for COVID-19 related information sharing were factors to be significantly associated with digital health literacy to share COVID-19 related information among healthcare providers worked in COVID-19 treatment centers.

6. Strengths and limitations of the study

This study was the first study in Ethiopia assessing digital health literacy specifically on COVID-19 related information sharing. However, it was conducted only at two teaching referral hospitals in the Amhara region which might be lower its generalizability to the other treatment centers. This study shares the limitation of cross-sectional studies. Therefore, it might not provide a strong cause-effect relationship. Additionally, this study wasn't supported by qualitative findings. The comparison of the study was made with limitation since the study specifically assess COVID-19 was lacking.

7. Recommendations

Considering digital health solutions are vital for tackling the COVID-19 pandemic, the MOH shall provide computer training in collaboration with NGOs. This will help healthcare providers to easily share and communicate COVID-19 related information for evidence-based decision making. In collaboration with other concerned bodies, the MOH shall stress creating awareness about the importance of adopting digital health technologies.

Furthermore, the government shall increase healthcare professionals' level of confidence to use digital technologies. Additionally, the government shall encourage healthcare professionals to use technologies for health information sharing and create health promotion activities through these technologies to save the life of individuals. Healthcare providers are recommended to introduce smartphone technology. It is also important for future researchers to consider exploring digital health literacy with qualitative findings. Additionally, this study needs further investigation to increase the consistency of the finding.

Authors' contributions

AAC and HSN made significant contributions in conception, design, data collection, supervision, data curation, investigation, data analysis, interpretation, and write-up of the manuscript. AWM and SYK have contributed to developing the proposal, validation, revising the manuscript, preparing figures, analysis, visualization, and interpretation of data as well. Finally, all authors (AAC, AWM, HSN, and SYK) reviewed and approved the final manuscript.

Research ethics approval: Human participants

Ethical clearance was obtained from the ethical review board of the University of Gondar College of Medicine and Health Science institute of public health (IPH) with ethical reference number: IPH/1476/013. Informed consent was obtained from each study participant before distribution questionnaires and after they were informed of the objective and purpose of the study. To keep the confidentiality of information provided by the study subjects, the data collection procedure was anonymous. Finally, data were collected based on the study participants' voluntariness and consents.

Consent for publication

Not applicable.

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Data availability

The data will be available upon request from the corresponding author.

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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Abbreviations

AOR	Adjusted Odds Ratio
CFI	Comparative Fit Index
CI	Confidence Intervals
COR	Crude Odds Ratio
DF	Degrees of Freedom
FMOH	Federal Ministry of Health
NGO	Non- Governmental Organization
RMSEA	Root Mean Square Error of Approximation
SPSS	Statistical Package for Social Science
TLI	Tucker-Lewis Index
VIF	Variance Inflation Factor
WHO	World Health Organization

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.imu.2022.100934.

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