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Health care professionals' intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting: Applying UTAUT model

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1	Health care professionals' intention to use mobile phone short message service
2	and its predictors for adherence support and care of patients with tuberculosis
3	infection in a resource-limited setting: Applying UTAUT model
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23 Abstract

Objective: This study aimed to assess healthcare providers' intentions and its associated factors
to use mobile phone short message services to support adherence and care of TB patients in the
Oromia region of southwest Ethiopia.

27 Study design: An institutional-based cross-sectional study was conducted from October to
28 November 2022.

Participants: A total of 625 (54.9% male and 45.1% female) health professionals participated in the study. The study participants were selected using a simple random sampling technique. All health professionals permanently working in Ilu Aba Bor and Buno Bedelle zones were included in this study. However, Health professionals with less than six months of experience and those who were not present during the data collection period were excluded from this study.

34 Setting: Public hospitals which includes Mettu Karl referral hospital, Dembi hospital, Bedelle
35 hospital, Darimu hospital, and Chora hospital.in Ilu Aba Bor and Buno Bedelle zones

36 Outcome measure: The main outcome measure was intention to use mobile based short message
 37 service to support TB patients

Result: Effort expectancy had a significant direct effect on attitude ($\beta = 0.162$, P<0.01) and intention towards using mobile phone SMS ($\beta = 0.329$, P<0.001). The behavioral intention to use mobile phone SMS was directly and significantly affected by facilitating conditions ($\beta = 0.104$, P< 0.01) and attitude ($\beta = 0.26$, P < 0.001). The relationship between effort expectation and intention to use a mobile phone SMS was mediated by attitude ($\beta = 0.043$, p-value < 0.01).

43 Conclusion: Effort expectancy, attitude, and facilitating conditions were significant factors that
44 determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort
45 expectancy had a more significant prediction power than intention to use mobile phone SMS. As
46 a result, system forms that are easily interactive and applicable should be implemented to improve
47 capacity building and support the adherence and care of TB patients.

48 Keywords: mobile health, short message service, tuberculosis, UTAUT

49 Strength and limitation of the study

- This is the first study in Ethiopia assessing the intentions of health care professionals to use a mobile phone-based SMS health service for TB patients.
- \succ The study implications for upcoming researchers, practice and health care policy
 - > The study may be tilted in favor of social desirability because it is a cross-sectional survey.
 - The study was not supported by qualitative findings
 - The study was not included private hospitals

57 Introduction

Globally, it is crucial to cure tuberculosis (TB) to reduce morbidity, mortality, and the risk of continued transmission, but it can be difficult to support and monitor patients during the entirety of treatment (1, 2). The consequences of patients' noncompliance with TB therapy include drug resistance, recurrence, and death (2-4). The World Health Organization (WHO) recommends inperson, directly observed therapy, either at home or in a medical facility, to increase TB adherence (5). However, directly observed therapy is frequently difficult and impractical to implement in most areas with a high TB burden; TB programs frequently struggle to provide the human resources to guarantee regular face-to-face interactions over a long period, and directly observed therapy is extremely time-consuming, can seriously interfere with work, family obligations, and other daily activities from the perspective of people with TB, and may be perceived as patronizing and intrusive(6).

According to studies carried out in northwest Ethiopia, 34% of patients' arguments for not adhering to TB treatment were forgetfulness (7, 8). Patients in the continuation phase, as opposed to those in the intensive phase, are in charge of returning their prescriptions once a week to the neighboring clinic and taking their medications at home while being observed by neighbors. However, community members may be too preoccupied with their daily tasks to remember and monitor patients for such a long time. Thus, the introduction of digital health technologies by the healthcare professional may improve patient adherence to TB therapy.

Digital technology adoption is viewed by health professionals as a key method for improving the efficacy, efficiency, and quality of healthcare delivery because it can improve patient care quality and service delivery efficiency while minimizing errors (9, 10). Particularly, there is an increase in the usage of mobile technology in healthcare, For instance, mobile technology's Short Message Service (SMS) feature can be used to track upcoming appointments, preventative immunizations, and long-term self-management treatments (9). To encourage the development of digital health innovations in worldwide efforts to improve TB care and prevention, the WHO has already formed its global task force on digital health, such as mobile health (11, 12).

84 With extensive adoption in low- and middle-income countries (LMIC), especially those with lower
85 socioeconomic standing, the number of mobile phone subscriptions now outnumbers the number

of people worldwide (13). With their ability to facilitate direct communication between health care providers and people with TB thanks to their short message service (SMS) and mobile voice call features, mobile phones have the potential to help overcome the difficulties associated with directing observed therapy-based TB care. Mobile calls that allow for audio communication are second most common to SMS, which includes basic text messaging and other app-based messaging options. Additionally, more individuals now own smartphones, making it possible in some locations with a strong internet connection to conduct video conversations.

The study may have effects on practice, policy, and upcoming researchers. The main beneficiaries of this study's useful information for normal practices are patients, health professionals, RHBs, and NGOs. According to our search of the literature, little research has been done on the subject of health care professionals' intentions to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting using the UTAUT model. As a result, this study investigates, introduces, and empirically tests a modified theoretical model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model to identify the main factors influencing healthcare professionals' intention to adopt and use a mobile phone SMS system.

Theoretical background and hypothesis development

Different types of models have been used to identify factors associated with the acceptance and use of health information system technologies (14, 15). A unified theory of acceptance and use of technology (UTAUT) model is currently regarded as the most accurate and up-to-date technology acceptance model used to evaluate intention to use and actual use of technology. After looking at eight models, including the theory of reasoned action, the technology acceptance model, the theory of planned behavior, the social cognitive theory, the motivational model, the combined technology acceptance model, and the innovation diffusion theory, the UTAUT model was developed to put forth a unified theory of technology acceptance (14, 16).

The acceptance and utilization of mobile-based SMS for TB treatment monitoring depend on the particular patients, healthcare providers, and facilities that serve TB patients. If adopted, our suggested approach will be implemented in resource-constrained settings, and healthcare professionals will play a crucial role in its adoption and continued use. The UTAUT model is Page 7 of 31

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suitable for this study due to its robustness and broad use in analyzing technology adoption at the individual level.

This model proposes four predictive elements, including performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) (16). After we used the fundamental elements of the UTAUT model we modified it in the context of a comprehensive review of the literature employing UTAUT in healthcare technology (14, 17-19). In addition to the four fundamental constructs (PE, EE, SI, and FC), attitude toward using technology (ATT) may have a substantial impact on the intention to use information technology (BI) in developing nations. Actual use is another factor in the UTAUT model that is important when the solution is frequently accessible. This variable was not included in our study because the solution is still not accessible for continuous use (Figure 1). The definitions of the constructs used and the associations that were hypothesized and tested in this study are provided below.

Behavioral Intention to Use (BI)

Behavioral intention is the degree to which a person has made deliberate plans to engage in or refrain from engaging in a particular future action (16). It essentially assesses the healthcare professional's intent to utilize the solution. In this study, healthcare professionals are questioned about their intentions to employ the proposed solution when it becomes accessible in the future.

Performance Expectancy (PE)

Performance expectancy is described as the extent to which a person believes that implementing the solution will enable him or her to boost their level of productivity at work (16). Respondents were questioned about the solution's value and how it influenced their task effectiveness, productivity, job effectiveness, quality of work, and the TB monitoring process. Health professionals' views toward the solution and their intention to adopt it may be positively influenced by the improved work output and improved health outcomes that this digital solution may enable. Thus, healthcare professionals are more likely to use mobile phone-based SMS, if they think that PE is high (9, 20-24). Based on the above-mentioned literature, the following hypotheses were investigated in this study:

H1-PE has a positive influence on the intention to use mobile phone SMS technology. 143 H2-PE has a positive influence on attitudes toward using mobile phone SMS technology.

144 Effort Expectancy (EE)

Effort Expectancy is the degree of ease with which a system is used (16). Items in this design have to do with how simple it is to use, learn and build new skills, and comprehend how the suggested solution interacts with the user. In the treatment value chain, healthcare professionals are expected to enter information, read it, and engage with communication technology like mobile phones. Because of this, the system must be simple to use when it comes to entering patient data throughout therapy and retrieving it to confirm and send the data to patients. According to studies, users' intention to utilize technology is influenced by their effort expectations (9, 21, 22, 24). Based on these, the following hypotheses were investigated in this study:

153 H3. EE has a positive influence on the intention to use mobile phone SMS technology

154 H4. EE has a positive influence on attitude to use mobile phone SMS technology

155 Social Influence (SI)

Social influence is the extent to which the user believes that significant others think he or she should use the system (16). SI is thought to be significant, particularly outside of the workplace.
SI may play a significant role in the adoption and continued use of the solution given the experience of inconsistent adherence to reporting guidelines and treatment regimens by patients, medical professionals, allied healthcare professionals, and their organizations (clinic/hospital management). Intention to use the mobile phone for SMS may therefore be strong if SI is positive (9, 20, 21, 24). In the context of this, the following hypotheses were investigated in this study:

163 H5: SI has a positive influence on the intention to use mobile phone SMS technology.

46
47 164 H6: SI has a positive influence on attitudes toward using mobile phone SMS technology.
48

⁴⁹50 165 Facilitating Condition (FC)

A facilitating Condition is an extent to which a person believes that an institutional and
technological framework exists to enable the use of the system (16). Conditions in the context of
TB treatment monitoring include having the knowledge and tools required to utilize the system as

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2		
3 4	169	well as the proposed solution's compatibility with existing systems (9, 20, 23, 24). On account of
5 6 7	170	these empirical findings, our study makes the following hypothesis:
8 9 10	171	H7.FC has a positive influence on the intention to use mobile phone SMS technology.
11 12 13	172	H8. FC has a positive influence on attitudes toward using mobile phone SMS technology.
14 15	173	Attitude (ATT)
16 17	174	The concept of attitude describes how social opinions regarding new technologies influence
18 19	175	people's feelings and conduct (25). In a context with low resources, health professionals have little
20	176	knowledge about access to technology, which makes changing their attitude about using a new
21 22	177	technology extremely difficult (14). We reasoned that including attitude as a category could seem
23 24	178	pertinent to studying behavioral intentions to use new technology in certain contexts (14, 20, 22,
25 26	179	26-29). On account of those findings, our study makes the following hypothesis:
27 28	180	H9: ATT has a positive influence on the intention to use mobile phone SMS technology.
29 30	181	H10: Attitude mediates the relationship between PE and intention to use mobile phone SMS
31	182	technology.
32 33	183	H11: Attitude mediates the relationship between EE and intention to use mobile phone SMS
34 35	184	technology.
36	185	H12: Attitude mediates the relationship between SI and intention to use mobile phone SMS
37 38	186	technology.
39 40	187	H13: Attitude mediates the relationship between FC and intention to use mobile phone SMS
41	188	technology.
42 43 44	189	Methods and materials
45 46 47	190	Study design and setting
48 49	191	The institutional-based cross-sectional study design was conducted from October to November
50 51	192	2022 at public hospitals in Ilu Aba Bor and Buno Bedelle zones, Oromia Regional State, southwest
52	193	Ethiopia. Illu Aba Bor Zone comprises one town administration and fourteen rural districts with a
53 54 55	194	total population of 1,606,502, according to the 2019 district finance and economic development

office annual data report. Among those zones, five hospitals exist, namely: Mettu Karl referral
hospital, Dembi hospital, Bedelle hospital, Darimu hospital, and Chora hospital.

197 Study Population

All healthcare professionals working in the southwest Oromia region of public hospitals in the two zones were used as study populations. All health professionals working at public health hospitals in the Ilu Aba Bor and Buno Bedelle zones who were available during data collection time were included in the study. Health professionals with less than six months of working experience in the two zones were excluded from the study

203 Sample size determination

The sample size was estimated based on structural equation modeling assumptions of determining model-free parameters using the modified model (Figure 1) by considering 25 variances of the independent variables, 6 covariances between independent variables, 16 load factors between latent and latent indicators, and 8 direct effects. 4 indirect effects of regression coefficients and between observed or latent variables were estimated, yielding a total of 59 free parameters. But the variances of dependent variables, the covariance between dependent variables, and the covariance between dependent and independent variables are never parameters (as would be explained by other parameters), and for each latent variable, its metric must be set: Set its variance to a constant (typically 1) and fix a load factor between latent and its indicator for independent latent (68). Accordingly, A 1: 10 ratio of responders to free parameters to be estimated was suggested to estimate the sample size based on the number of free parameters in the hypothetical model(30). As a result, the minimum sample size necessary was 590, taking into account the 59 parameters that needed to be estimated and taking participants by a free parameter ratio of 10. The final sample size was 649 since the computed sample size considers the 10% non-response rate.

218 Sampling Procedure

Participants for the study were chosen from five hospitals in southwest Ethiopia. Using population
proportion allocation, the study subjects were chosen from the following hospitals: Mettu Karl
referral hospital, Dembi hospital, Bedelle hospital, Darimu hospital, and Chora hospital. The

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number of healthcare professionals from the five hospitals in southwest Ethiopia was calculatedusing population proportional allocation and simple random sampling.

224 Data collection tools, data quality control, and procedures

To investigate the hypotheses provided by this study, a structured questionnaire was used from earlier investigations (14, 26-29). There are two sections to the questionnaire. In a multiple-choice format, Section A focuses on user demographic data, including gender, age, education, and years of experience. Various professions. 18 encouraging statements make up Section B, which represents the constructions that are part of the UTAUT as well as the one newly introduced construct, ATT. A five-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree, was used to measure the constructs.

To control the quality of the data, two days of training were given to data collectors and supervisors on the objective of the study, data collection procedures, data collection tools, respondents' approaches, data confidentiality, and respondents right before the data collection date. Before the actual data collection, pretesting of the questionnaire was conducted by about 10% of the study participants outside of the study in Jimma Hospital. After obtaining feedback from the respondents, language experts modified the wording of the questions

Verify the internal consistency of the items using the Cronbach alpha coefficient (C α), and composite reliability (CR). The results showed that all of the items' scores were above 0.7. The assumptions were examined for outliers, multi-collinearity, and independent error factors before running the structural equation model. The results showed that there was no existing multi-collinearity, with the overall variance inflation factor (VIF) value being less than 2 and the tolerance being greater than 0.5.

47 24 48 2

244 Patient and public involvement

The research question, outcome measures, design, recruitment, analysis and interpretation of the results and study execution were all developed without the involvement of any patients. Additionally, there are no plans to share the findings with the patients and the study's design did not directly engage the general public.

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249 Data processing and analysis

Data from respondents were entered into Epi-Data version 4.6 and exported to SPSS version 25 for descriptive data analysis. Additionally, model constructs were evaluated using structural equation modeling (SEM) analysis via Analysis of Moment Structure (AMOS) version 26 software. On the test measurement model, confirmatory factor analysis (CFA) using standardized data was used. As part of confirmatory factor analysis, a correlation between constructs less than 0.8 and factor loadings greater than 0.6 for each item was examined (31). The chi-square ratio (<5), the tucker-lewis index (TLI>0.9), the comparative fit index (CFI>0.9), the goodness of fit index (GFI > 0.9), the adjusted goodness of fit index (AGFI > 0.8), the root means square error approximation (RMSEA<0.08), and the root mean square of the standardized residual (RMSR<0.08) were all used to evaluate the goodness of fit (25, 32, 33).

Data normality was evaluated using multivariate kurtosis < 5 and the critical ratio between -1.96 and +1.96. Multicollinearity was also tested using VIF < 10 and tolerance > 0.1, as well as the correlation between exogenous constructs of <0.8, and there were no problems. In the measurement model, Cronbach's alpha test was used to assess construct reliability; each construct in the study met the required threshold of >0.70, and the composite reliability was above 0.70 (34). The Average Variance Extracted (AVE) approach, with values above 0.5, was used to assess the converging validity, while the square root of AVE in Furnell Larcker criterion, with values below 0.9, was used to assess the diverging validity (25, 35, 36).

To evaluate a structural model, the critical ratio (CR) and the path coefficient were used to analyze the relationship between exogenous and endogenous variables. A p-value of less than 0.05 and 95% confidence intervals was used to assess the predictors' statistical significance. The influence and level of significance of each of the four possible mediation paths in the model were explored, partial mediation occurs when a construct's direct, indirect, and total effects are all statistically significant, and full mediation occurs when the direct and indirect effects are both statistically significant but the total effect is not. To confirm mediation, we typically looked for a substantial indirect effect with a p-value < 0.05

54 276

1 2 3 4	278	Results			
5	270	Kesuits			
6 7 8	279	Socio-demographic cl	naracteristics of hea	lthcare professiona	ls
9 10	280	A total of 625 study parti	cipants have included	in the study with a res	ponse rate of 96.3% of them
11	281	who gave their consent	and responded to the	e questions. Of the to	tal of (n=625) respondents,
12 13	282	343(54.9%) of them were	e males, 293(46.9%) re	espondents were in the	age group of <30 years and
14 15	283	the mean age of the resp	ondents was 32 <u>+</u> 6.01 y	years About more than	half of the respondents 451
16	284	(72.2%) had less than or	equal to 3 years of wor	k experience. In additi	on, about 228(36.5%) of the
17 18 19	285	respondents were medica	l doctor professionals	(Table 1).	
20 21	286	Table 1: Socio demogra	aphic characteristics of	of health care profession	onals in a resource-limited
22 23	287	setting, 2022 (n=625)			
24 25		Sociodemographic	Category	Frequency(N)	Percentage (%)
26 27		Characteristics			
28		Gender	Male	343	54.9
29 30			Female	282	45.1
31 32		Age (year)	<30	293	46.9
33 34			30-39	254	40.6
35			>40	78	12.5
36 37		Profession	Medical doctor	228	36.5
38 39			Nurse	165	26.4
40 41			Midwifery	117	18.6
42			Health officer	46	7.4
43 44			Others	115	11
45 46		Work experience	1-3	451	72.2
47			3-5	62	9.9
48 49			>5	112	17.9
50 51 52	288	Others: Anestl	hesia, Radiology, Psyc	hiatry and Pharmacy	
52 53 54	289				
55 56 57 58	290				12
59 60		For peer re	eview only - http://bmjope	en.bmj.com/site/about/gu	

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291 Measurement model

292 Reliability and validity of the construct

All of the constructs had Cronbach's alpha scores between 0.77 and 0.91 and composite reliability scores between 0.78 and 0.92, factor loadings of the items ranged between 0.64 and 0.89, and the value of AVE varied between 0.61 and 0.71. Therefore, all of the constructs had strong convergent validity (Table 2).

Table 2: Convergent validity between constructs of health care professionals' intention to use
mobile phone short message service and its predictors for adherence support and care of patients
with tuberculosis infection in a resource-limited setting, 2022

Construct	Indicators /	Standard	Composite	Cronbach	AVE	Convergent
	Items	loading	Reliability	alpha		Validity
Performance	PE1	0.85	0.88	0.85	0.65	Established
Expectancy	PE2	0.84				
	PE3	0.67				
	PE4	0.74				
Effort	EE1	0.87	0.91	0.87	0.69	Established
Expectancy	EE2	0.89				
	EE3	0.69				
	EE4	0.73				
Social	SI1	0.78	0.90	0.90	0.68	Established
Influence	SI2	0.97				
	SI3	0.88				
Facilitating	FC1	0.81	0.92	0.91	0.72	Established
Condition	FC2	0.84				
	FC3	0.83				
	FC4	0.82				
Attitude	ATT1	0.67	0.78	0.77	0.61	Established
	ATT2	0.71				

		ATT3		.68					
		ATT4		.66					
	Behavioral	BI1	0	.80	0.79	0.7	79	0.64	Established
	Intention	BI2	0	.64					
		BI3	0	.82					
300	No	te; AVE: A	Average	Variance	e Extracted	l			
301	According to the	he finding	s, the bo	olded val	ues (diago	nal value	s) or the s	quare root	of the AVE of
302	the construct w	ere higher	than the	e other va	lues in that	column,	and the ra	w. As a res	ult, the model
303	constructs' disc	riminant v	alidity	has been	proven (Ta	uble 3).			
204	T-11- 2. Di	• • • • • • •	1: 1: 1	5		£ 1 141.			
304	Table 3: Discr								
305	mobile phone s		-		-			pport and o	care of patien
306	with tuberculos	sis infectio	n in a re	esource-li	imited setti	ng, 2022			
	Construct		PE	EE	SI	FC	ATT	BI	Divergent
									Validity
	Performance		0.806		Ĺ				Established
	Expectancy (I	P E)							
	Effort		0.143	0.831		-4			Established
	Expectancy (I	EE)							
	~ · 1		0 4 3 6	0.516	0.825		0		Established
	Social		0.150		01020				
	Social Influence (SI)	I	0.120						
				0.178	0.543	0.848	2		Established
	Influence (SI)					0.848	2	1	Established
	Influence (SI) Facilitating	Condition				0.848	0.781		
	Influence (SI) Facilitating ((FC)	Condition	0.533	0.178	0.543		0.781 0.603	0.800	Established
	Influence (SI) Facilitating ((FC) Attitude (ATT	Condition	0.533	0.178	0.543	0.511		0.800	Established
	Influence (SI) Facilitating ((FC) Attitude (ATT Behavioral	Condition	0.533	0.178	0.543	0.511		0.800	Established
307	Influence (SI) Facilitating ((FC) Attitude (ATT Behavioral	Condition	0.533	0.178	0.543	0.511		0.800	Established
	Influence (SI) Facilitating ((FC) Attitude (ATT Behavioral	Condition	0.533	0.178	0.543	0.511		0.800	Established
307 308	Influence (SI) Facilitating ((FC) Attitude (ATT Behavioral	Condition	0.533	0.178	0.543	0.511		0.800	Established Established Established
	Influence (SI) Facilitating ((FC) Attitude (ATT Behavioral	Condition	0.533	0.178	0.543	0.511		0.800	Establishe

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The results in confirmatory factor analysis showed that model fit indices with respective values were chi squire difference ($x^2/df=2.76$), Goodness-of-fit-index (GFI=0.93), Adjusted goodness-of-fit-index (AGFI=0.91), Comparative fit index (CFI=0.94), Tucker-Lewis's index (TLI=0.93), Root means the square error of approximation (RMSEA=0.05) and standardized root mean squared residual (SRMR=0.03). Accordingly, the goodness of fit model's values met the requirements.

Structural equation model

The result showed that effort expectancy had a significant direct effect on health care professionals' attitude to using mobile phone short message service ($\beta = 0.162, 95\%$ CI: [0.061, 0.270], P<0.01) and intention towards using mobile phone SMS (β =0.329, 95% CI: [0.233], (0.433], P<0.001). The facilitating condition had a direct significant effect on healthcare provider's intention towards using mobile phone SMS ($\beta = 0.104, 95\%$ CI: [0.025, 0.191], P<0.01), and also healthcare professionals' attitude towards the system had a direct significant effect on behavioral intention to use mobile phone SMS ($\beta = 0.268, 95\%$ CI: [0.163, 0.373], P<0.001). whereas the relationship between performance expectancy ($\beta = 0.268, 95\%$ CI: [-0.017,0.170], P=0.109), social influence ($\beta = 0.015, 95\%$ CI: [-0.044, 0.075], P=0.610) and facilitating conditions ($\beta = 0.055, 95\%$ CI: [-0.026, 0.140], P=0.184) were not significant effect on health care professionals' attitude towards using mobile phone SMS, and the path relationship of performance expectancy ($\beta = 0.002$, 95% CI: [-0.088, 0.094], P=0.980) and social influence(β =-0.030, 95% CI: [-0.086,0.028], P=0.318) to use mobile phone SMS were not statistically significant (Table 4).

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Path	Hypothesis	В	S . E	C.R	P-Value	95% CI		Decision
						Lower	Upper	_
PE → BI	H1	0.002	0.041	0.055	0.980	-0.088	0.094	Not
								Supporte
PE→ ATT	H2	0.076	0.044	1.70	0.109	-0.017	0.170	Not
								Supporte
EE → BI	H3	0.329	0.048	6.583	0.000***	0.233	0.433	Supporte
EE→ ATT	H4	0.162	0.050	3.229	0.001**	0.061	0.270	Supporte
SI → BI	H5	-0.030	0.030	-1.002	0.318	-0.086	0.028	Not
								supporte
SI → ATT	H6	0.015	0.032	0.475	0.610	-0.044	0.075	Not
								Supporte
FC → BI	H7	0.104	0.039	2.649	0.011**	0.025	0.191	Supporte
FC→ ATT	H8	0.055	0.041	1.317	0.184	-0.026	0.140	Not
								Supporte
ATT → BI	H9	0.268	0.054	4.956	0.001**	0.163	0.373	Supporte

39 336 Note: ** p value <0.01, ***p value is <0.001 C, R: critical ratio S.E: standard error, CI: confidence
 40 337 interval, β: estimate
 42

According to the finding, performance expectancy, effort expectancy, social influence, and facilitating conditions accounted for 68% and 74% of the variance (R²) in attitude and intention to use mobile phone short message services, respectively (Figure 2).

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Mediation effects

The results revealed that attitude played a mediating role in the relationship between health care professionals' effort expectations and their intention to use mobile phone short message service to support TB patients, as opposed to the relationship between performance expectancy, social influence, and facilitating conditions. Both the relationship between attitude and intention to use the system, as well as the regression coefficient between attitude and effort expectancy, were statistically significant. The indirect effect of the standardized estimation value was 0.043 and P< 0.01. In the context of this, the relationship between effort expectancy and an intention to use mobile-based SMS was statistically significant through attitude (Table 5).

Table 5: Mediating effects of Attitude and health care professionals' intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting

Path	Hypothesis	Effect	β	P-value	Result	Decision
PE→AT→ BI	H10	Total effect	0.025	0.643	No	Not
		Indirect effect	0.023	0.090	relationship	Support
		Direct effect	0.003	0.982	-	
EE→AT→ BI	H11	Total effect	0.365	0.000***	Partial	Support
		Indirect effect	0.043	0.001**	Mediation	
		Direct effect	0.323	0.000***		
SI→AT→ BI	H12	Total effect	-0.038	0.390 🗧	No	Not
		Indirect effect	0.006	0.587	relationship	Support
		Direct effect	-0.323	0.311	-	
FC→AT→ BI	H13	Total effect	0.136	0.005 **	Direct	Not
		Indirect effect	0.017	0.158	- relationship	Support
		Direct effect	0.119	0.012*	-	

Discussion

This research used the UTAUT model for determining the predictors that may influence the use of mobile phone short message service systems to support adherence and care of patients with tuberculosis. The findings show that effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectation and intention to use the system. Thus, H3, H4, H7, H9, and H11 were supported and thus can be used as effective measures of mobile phone SMS adoption in resource-limited settings.

According to the findings, healthcare professional effort expectancy had a positive direct effect on attitude and both direct and indirect effects on the intention to use mobile phone SMS. This suggested that when healthcare professionals perceived the system's simplicity or lack of effort in use, their perceptions of its usefulness, attitude, and intention to use mobile phone SMS were significantly improved. This finding is consistent with findings from other studies in different countries (9, 22, 37-40). This could be because an individual's attitude and acceptance of the use of mobile phone SMS systems are greatly affected by the work required to manipulate the system. If the system is expected to manipulate people's intentions to use mobile phone SMS systems with less effort, the system's performance will improve. As a result, when implementing the use of mobile phone SMS technologies, the system should be simple for healthcare providers to understand and use to ensure long-term system adoption.

Facilitating conditions also positively influenced the intention to use mobile phone short message services to support adherence and care of patients with tuberculosis. This showed the significance of creating the organizational and IT requirements for this example, including the resources, technical support, and training that are necessary for the adoption and ongoing use of mobile-based SMS-enabled solutions by healthcare providers in the public health system This finding is consistent with findings from other studies in different countries (9, 23, 24, 41). This could be because health professionals think that as mobile phone use has increased, more people have access to them and are familiar with using devices to communicate with their intended recipients. As a result, they are convinced and have no trouble supporting patient care and adherence.

Health professionals' attitudes positively influenced their intention to use mobile phone SMS systems. Medical experts supported the usage of mobile phone SMS as a tool for bettering their health and the standard of tuberculosis treatment as they observed it being done. This finding is in line with findings from other studies done in different settings (9, 20, 42-44). This might be because new technologies will deeply irritate medical professionals who have a fixed, favorable opinion of the usage of SMS systems on mobile phones. Therefore, it is important to give priority to initiatives that change attitudes, such as providing mobile devices at work, providing ongoing training and assistance, and fostering knowledge exchange about eHealth technologies such as mobile SMS for the remainder of the patient's care.

395 Conclusion

Overall, the UTAUT model was the most suitable model for determining the predictors that may influence the use of mobile phone short message service systems to support adherence and care of patients with tuberculosis in Ethiopia. The findings show that effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectations and the intention to use the system. Among the five influencing predictors, effort expectancy had a more significant prediction power for healthcare providers' intention to use mobile phone SMS systems. Therefore, easily interactive and applicable forms of the system should be implemented for health care professionals, as well as improving capacity and building on the simplicity of technology to support adherence and the care of TB patients.

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413 Abbreviations and acronyms

414 AMOS: Analysis of Moment and Structure; ATT: Attitude; BI: Behavioral Intention; CI:
415 Confidence Intervals; EE: Effort Expectancy; FC: Facilitating Condition; PE: Performance
416 Expectancy; SEM: Structural Equation Modeling: SI: Social Influence; SMS: Short Message
417 Service; SPSS: Statistical Package for Social Science; UTAUT: Unified Theory of Acceptance
418 and Use of Technology; WHO: World Health Organization

6 419 Ethics approval and consent to participate

420 The study participants gave their informed consent after the study protocol was evaluated and 421 approved by Mettu University's ethical review board with approval number MeU/RAC/1036/15. 422 Each hospital provided a letter of permission. Each participant in the study gave their written and 423 oral consent after being informed of the study's goal. Furthermore, all data collectors and 424 investigators strictly adhered to the law's requirements for data privacy and confidentiality. Only 425 the study was conducted using the data that was retrieved. As a result, the data-gathering tool did 426 not contain participant's names or any other personal information about them. Furthermore, study 427 was done according to the Declaration of Helsinki.

428 **Consent for publication**

429 Not applicable

- 430 Availability of data and materials
- 431 Upon reasonable request from the corresponding author, the datasets created and/or analyzed
- 432 during the current work will be made available.
- 3 433 Competing interests
- 2 434 The authors declare that we have no competing interests.
- 3 435 Funding

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⁰ 436 No Funding

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Authors' contributions

The authors contributed equally to the conceptualization, study design, data collection, analysis, and interpretation of the study and agreed to be held accountable for all aspects of the work. Furthermore, they contributed to the paper's formulation or critical revision of its core intellectual ideas

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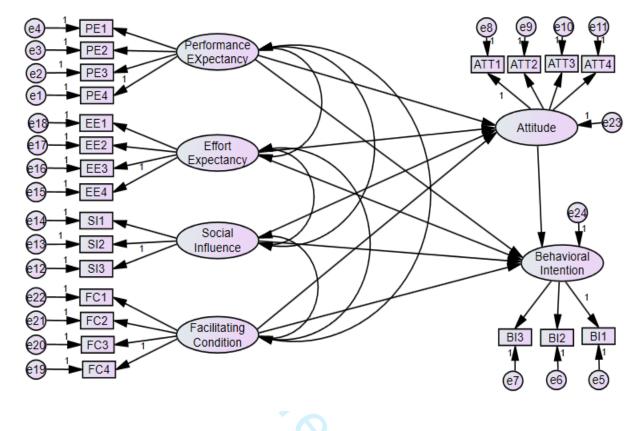
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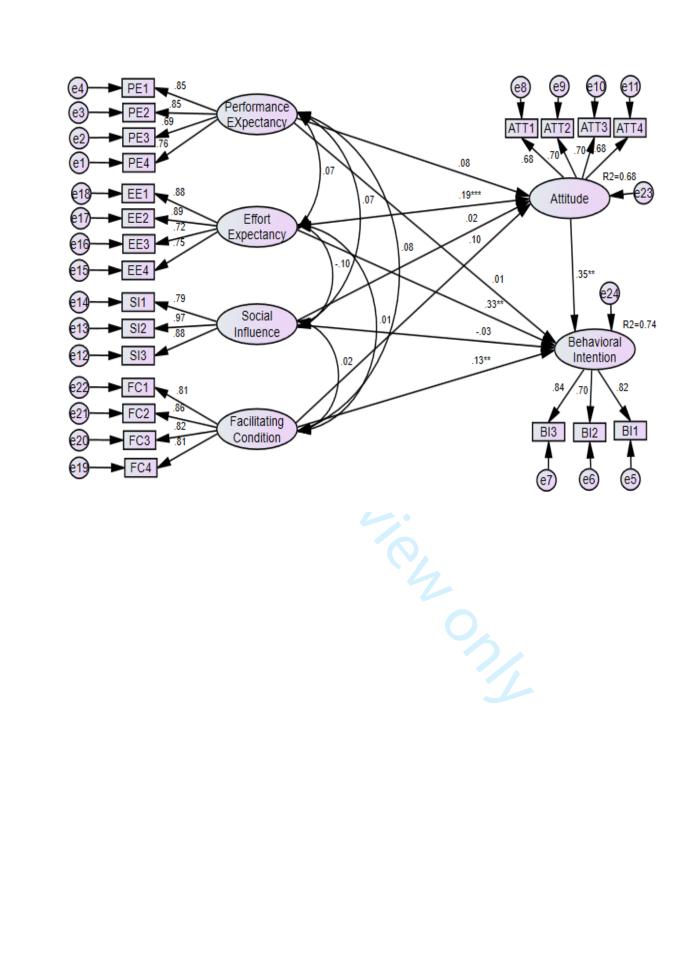
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23 24	605	Figure 1: Modified UTAUT models of health care professionals' intention to use mobile phone
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42 43	615	Figure 2: SEM analysis of health care professionals' intention to use mobile phone short message
44 45	616	service and its predictors for adherence support and care of patients with tuberculosis infection in
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	Item No	Recommendation	Pag No
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title or the abstract	2
		(<i>b</i>) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5-9
Methods			
Study design	4	Present key elements of study design early in the paper	10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	10
Participants	6	(<i>a</i>) Give the eligibility criteria, and the sources and methods of selection of participants	10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-9
Data sources/	8*	For each variable of interest, give sources of data and details of methods	11-
measurement		of assessment (measurement). Describe comparability of assessment methods if there is more than one group	12
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	12
Statistical methods	12	(<i>a</i>) Describe all statistical methods, including those used to control for confounding	11- 12
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(<i>d</i>) If applicable, describe analytical methods taking account of sampling strategy	
		(<u>e</u>) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	14
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical,	14-
1		social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	15,1
Main results	16	(<i>a</i>) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	

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		(b) Report category boundaries when continuous variables were	15-
		categorized	16
		(c) If relevant, consider translating estimates of relative risk into absolute	
		risk for a meaningful time period	
Other analyses	17	Report other analyses done-eg analyses of subgroups and interactions,	16
		and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential	18
		bias or imprecision. Discuss both direction and magnitude of any potential	
		bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	17-
		limitations, multiplicity of analyses, results from similar studies, and other	18
		relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present	20
		study and, if applicable, for the original study on which the present article	
		is based	

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Healthcare professionals' intention to use mobile phonebased SMS and its predictors for adherence support and care of TB patients in a resource-limited setting: A structural equation modeling analysis

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1	Healthcare professionals' intention to use mobile phone-based SMS and its
2	predictors for adherence support and care of TB patients in a resource-limited
3	setting: A structural equation modeling analysis
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23 Abstract

Objective: To assess healthcare providers' intentions and its associated factors to use mobile
phone-based SMS to support adherence and care of TB patients in the Oromia region of southwest
Ethiopia.

27 Study design: An institutional-based cross-sectional study was conducted from October to
28 November 2022.

Setting: Public hospitals which include Mettu Karl referral hospital, Dembi hospital, Bedelle
hospital, Darimu hospital, and Chora hospital.in Ilu Aba Bor and Buno Bedelle zones.

Participants: A total of 625 (54.9% male and 45.1% female) health professionals participated in the study. The study participants were selected using a simple random sampling technique. All health professionals permanently working in Ilu Aba Bor and Buno Bedelle zone hospitals were included in this study. However, health professionals with less than six months of experience and those who were not present during the data collection period were excluded from this study.

36 Outcome measure: The intention to use mobile phone-based short message service to support TB
37 patients.

Results: Healthcare professionals' intention to use mobile SMS was 54.4%. Effort expectancy had a significant direct effect on attitude ($\beta = 0.162$, P<0.01) and intention towards using mobile phone SMS ($\beta = 0.329$, P<0.001). The intention to use mobile phone SMS was directly influenced by facilitating conditions ($\beta = 0.104$, P< 0.01) and attitude ($\beta = 0.26$, P < 0.001). The relationship between effort expectancy and intention to use SMS was mediated by attitude ($\beta = 0.043$, p-value <0.01).

44 Conclusions: Overall, intention to use of mobile-based SMS was high. Effort expectancy,
45 attitude, and facilitating conditions were significant factors that determined healthcare
46 professionals' behavioral intention to use mobile phone SMS. Effort expectancy had a more
47 significant prediction power than others. As a result, system forms that are easily interactive and

2		
3 4	48	applicable should be implemented to improve capacity building and support the adherence and
5 6 7	49	care of TB patients.
8 9	50	Keywords: mobile health, short message service, tuberculosis, UTAUT
10 11 12	51	Strengths and limitations of the study
13 14	52	> This study used the unified theory of acceptance and use of technology, which is the most
15 16	53	accurate and recent model to identify important factors to influence mobile health
17	54	technologies.
18 19	55	
20 21	56	> The study covers public hospitals with a large sample size, which improved its
22 23	57	generalizability.
24 25	58	This study may be tilted in favor of social desirability because it is a cross-sectional survey.
26	59	The study was not supported by qualitative findings
27 28	60	The study was not included private hospitals
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62 Introduction

Globally, it is crucial to cure tuberculosis (TB) to reduce morbidity, mortality, and the risk of continued transmission, but it can be difficult to support and monitor patients during the entirety of treatment (1, 2). The consequences of patients who experience treatment interruptions with TB therapy include drug resistance, recurrence, and death (2-4). The World Health Organization (WHO) recommends in-person, directly observed therapy, either at home or in a medical facility, to increase TB adherence (5). However, directly observed therapy is frequently difficult and impractical to implement in most areas with a high TB burden; TB programs frequently struggle to provide the human resources to guarantee regular face-to-face interactions over a long period. and directly observed therapy is extremely time-consuming, can seriously interfere with work, family obligations, and other daily activities from the perspective of people with TB, and may be perceived as patronizing and intrusive(6).

According to studies carried out in northwest Ethiopia, 34% of patients' arguments for not adhering to TB treatment were forgetfulness (7, 8). Patients in the continuation phase, as opposed to those in the intensive phase, are in charge of returning their prescriptions once a week to the neighboring clinic and taking their medications at home while being observed by neighbors. However, community members may be too preoccupied with their daily tasks to remember and monitor patients for such a long time. Thus, the introduction of digital health technologies by healthcare professional may improve patient adherence to TB therapy.

Digital technology adoption is viewed by health professionals as a key method for improving the efficacy, efficiency, and quality of healthcare delivery because it can improve patient care quality and service delivery efficiency while minimizing medical errors (9, 10). Particularly, there is an increase in the usage of mobile technology in healthcare, For instance, mobile technology's Short Message Service (SMS) feature can be used to track upcoming appointments, preventative immunizations, and long-term self-management treatments (9). To encourage the development of digital health innovations in worldwide efforts to improve TB care and prevention, the WHO has already formed its global task force on digital health, such as mobile health (11, 12).

89 With extensive adoption in low- and middle-income countries (LMIC), especially those with lower
90 socioeconomic standing, the number of mobile phone subscriptions now outnumbers the number

of people worldwide (13). With their ability to facilitate direct communication between health care providers and people with TB thanks to their short message service (SMS) and mobile voice call features, mobile phones have the potential to help overcome the difficulties associated with directing observed therapy-based TB care. Mobile calls that allow for audio communication are second most common to SMS, which includes basic text messaging and other app-based messaging options. Additionally, more individuals now own smartphones, making it possible in some locations with a strong internet connection to conduct video conversations. However, in comparison to other developed regions, the use of mobile technology in the healthcare system in developing countries is too often limited to certain roles for health interventions. The evidence done in Ethiopia showed that mobile-phone messaging revealed a positive effect in improving healthcare services (2, 14, 15), but the intention level of healthcare providers to use mobile health with SMS to support patients in the resource-limited setting is uncertain.

In the original background and hypothesis development Theoretical background and hypothesis development

Different types of models have been used to identify factors associated with the acceptance and use of health information system technologies (16, 17). A unified theory of acceptance and use of technology (UTAUT) model is currently regarded as the most accurate and up-to-date technology acceptance model used to evaluate intention to use and actual use of technology. After looking at eight models, including the theory of reasoned action, the technology acceptance model, the theory of planned behavior, the social cognitive theory, the motivational model, the combined technology acceptance model, and the innovation diffusion theory, the UTAUT model was developed to put forth a unified theory of technology acceptance (16, 18).

The acceptance and utilization of mobile-based SMS for TB treatment monitoring depend on the particular patients, healthcare providers, and facilities that serve TB patients. The UTAUT model is suitable for this study due to its robustness and broad use in analyzing technology adoption at the individual level. Since the UTAUT model is an extension of other models and therefore has a strong capability to clarify the behavioral intentions of users as compared with other single models (19, 20). Accordingly, we used the model through adapt or modify the constructs in our study setting

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This model proposes four predictive elements, including performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) (18). After we used the fundamental elements of the UTAUT model we modified it in the context of a comprehensive review of the literature employing UTAUT in healthcare technology (16, 21-23). In addition to the four fundamental constructs (PE, EE, SI, and FC), attitude toward using technology (ATT) may have a substantial impact on the intention to use information technology (BI) in developing nations. Actual use is another factor in the UTAUT model that is important when the solution is frequently accessible. This variable was not included in our study because the solution is still not accessible for continuous use (Figure 1). The constructs used and the associations that were hypothesized and tested in this study are provided below. **Behavioral Intention to Use (BI)**

Behavioral intention is the degree to which a person has made deliberate plans to engage in or refrain from engaging in a particular future action (18). It essentially assesses the healthcare professional's intent to utilize the solution. In this study, healthcare professionals are questioned about their intentions to employ the proposed solution when it becomes accessible in the future.

Performance Expectancy (PE)

Respondents were questioned about the solution's value and how it influenced their task effectiveness, productivity, job effectiveness, quality of work, and the TB monitoring process. Health professionals' views toward the solution and their intention to adopt it may be positively influenced by the improved work output and improved health outcomes that this digital solution may enable. Thus, healthcare professionals are more likely to use mobile phone-based SMS, if they think that PE is high (9, 24-28). Based on the above-mentioned literature, the following hypotheses were investigated in this study:

- H1-PE has a positive influence on the intention to use mobile phone SMS technology.
 - H2-PE has a positive influence on attitudes toward using mobile phone SMS technology.
 - **Effort Expectancy (EE)**

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In system design has to do with how simple it is to use, learn and build new skills, and comprehend how the suggested solution interacts with the user. In the treatment value chain, healthcare professionals are expected to enter information, read it, and engage with communication technology like mobile phones. Because of this, the system must be simple to use when it comes to entering patient data throughout therapy and retrieving it to confirm and send the data to patients. According to studies, users' intention to utilize technology is influenced by their effort expectations (9, 25, 26, 28). Based on these, the following hypotheses were investigated in this study: H3. EE has a positive influence on the intention to use mobile phone SMS technology H4. EE has a positive influence on attitude to use mobile phone SMS technology **Social Influence (SI)** Social influence is thought to be significant, particularly outside of the workplace. SI may play a significant role in the adoption and continued use of the solution given the experience of inconsistent adherence to reporting guidelines and treatment regimens by patients, medical professionals, allied healthcare professionals, and their organizations (clinic/hospital management). Intention to use the mobile phone for SMS may therefore be strong if SI is positive (9, 24, 25, 28). In the context of this, the following hypotheses were investigated in this study: H5: SI has a positive influence on the intention to use mobile phone SMS technology. H6: SI has a positive influence on attitudes toward using mobile phone SMS technology. **Facilitating Condition (FC)** Conditions in the context of TB treatment monitoring include having the knowledge and tools required to utilize the system as well as the proposed solution's compatibility with existing systems (9, 24, 27, 28). On account of these empirical findings, our study makes the following hypothesis: H7.FC has a positive influence on the intention to use mobile phone SMS technology. H8. FC has a positive influence on attitudes toward using mobile phone SMS technology. Attitude (ATT)

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1 2			
- 3 4	170	In a context with low resources, health professionals have little knowledge about access the	0
5 6	171	technology, which makes changing their attitude about using a new technology extremely difficul	lt
7	172	(16). We reasoned that including attitude as a category could seem pertinent to studying behaviora	ıl
8 9	173	intentions to use new technology in certain contexts (16, 24, 26, 29-32). On account of thos	e
10 11	174	findings, our study makes the following hypothesis:	
12 13	175	H9: ATT has a positive influence on the intention to use mobile phone SMS technology.	
14 15	176	H10: Attitude mediates the relationship between PE and intention to use mobile phone SMS	
16 17	177	technology.	
18 19	178	H11: Attitude mediates the relationship between EE and intention to use mobile phone SMS	
20	179	technology.	
21 22	180	H12: Attitude mediates the relationship between SI and intention to use mobile phone SMS	
23 24	181	technology.	
25 26	182	H13: Attitude mediates the relationship between FC and intention to use mobile phone SMS	
27	183	technology.	
28 29	184	The main beneficiaries of this study will be patients, health professionals, Regional Health Bureau	.S
30 31	185	(RHBs), and health organizations for health system practices. According to our search of th	e
32	186	literature, little research has been done on the subject of healthcare professionals' intentions to us	e
33 34	187	mobile phone short message service and its predictors for adherence support and care of patient	S
35 36	188	with tuberculosis infection in a resource-limited setting using the Unified Theory of Acceptanc	e
37 38	189	and Use of Technology (UTAUT)model. As a result, this study investigates, introduces, and	d
39	190	empirically tests a modified theoretical model based on the Unified Theory of Acceptance and Us	e
40 41	191	of Technology (UTAUT) model to identify the main factors influencing healthcare professionals	s'
42 43	192	intention to adopt and use a mobile phone SMS system.	
44 45	193	Methods and materials	
46 47 48	194	Study design and setting	
49 50	195	The institutional-based cross-sectional study design was conducted from October to Novembe	r
51 52	196	2022 at public hospitals in Ilu Aba Bor and Buno Bedelle zones, Oromia Regional State, southwes	st
53	197	Ethiopia. Illu Aba Bor Zone comprises one town administration and fourteen rural districts with	
54 55	198	total population of 1,606,502, according to the 2019 district finance and economic development	
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office annual data report. Among those zones, five hospitals exist, namely: Mettu Karl referralhospital, Dembi hospital, Bedelle hospital, Darimu hospital, and Chora hospital.

201 Study Population

All healthcare professionals working in the southwest Oromia region of public hospitals in the two zones were used as study populations. All health professionals, working at public health hospitals, who were available during data collection time were included in the study. However, Health professionals with less than six months of working experience and who were on maternal or annual leave or those who were seriously ill during the study period were excluded from the study.

Operational definition

The outcome variable was the intention to use mobile-based SMS among healthcare professionals. Intention to use means the extent to which a person has made intentional plans to use new technology (33, 34). When a healthcare professional rates intention to use a technology measurement and scores median, and above the median was considered as intended to use mobile phone-based SMS, else not intended to use it, with a five-point Likert scale of three questions (33).

213 Sample size determination

The sample size was estimated based on structural equation modeling assumptions of determining model-free parameters using the modified model (33, 34) (Figure 1), by considering 25 variances of the independent variables, 6 covariance between independent variables, 16 load factors between latent and latent indicators, and 8 direct effects and4 indirect effects of regression coefficients between observed or latent variables were estimated Finally a total of 59 free parameters was estimated. But the variances of dependent variables, the covariance between dependent variables, and the covariance between dependent and independent variables are never parameters (as would be explained by other parameters), and for each latent variable, its metric must be set: Set its variance to a constant (typically 1) and fix a load factor between latent and its indicator for independent latent (68). Accordingly, A 1: 10 ratios of responders to free parameters to be estimated was suggested to estimate the sample size based on the number of free parameters in the hypothetical model (33-35). As a result, the minimum sample size necessary was 590, taking into

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account the 59 parameters that needed to be estimated and taking participants by a free parameter ratio of 10. Since the computed sample size considers the 10% non-response rate. Thus, the final sample size of 649 study participants was calculated.

Sampling Procedure

The participants of this study were health professionals across all five study hospitals in southwest Ethiopia. The number of healthcare professionals from the five hospitals was calculated using population proportional allocation and a simple random sampling technique. Finally, consecutive healthcare professionals who full fill the inclusion criterion were included in the study until the allocated size was obtained in each of the five hospitals.

Data collection tools, data quality control, and procedures

To investigate the hypotheses provided by this study, a structured questionnaire was used from earlier investigations (16, 29-32). There are two sections to the questionnaire. In a multiple-choice format, Section A focuses on user demographic data, including gender, age, education, and years of experience. Section B contains 18 positive statements that symbolize the constructs, which represents the constructions that are part of the UTAUT as well as the one newly introduced construct, ATT. A five-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree, was used to measure the constructs.

To control the quality of the data, two days of training were given to data collectors and supervisors on the objective of the study, data collection procedures, data collection tools, respondents' approaches, data confidentiality, and respondents right before the data collection date. Before the actual data collection, pretesting of the questionnaire was conducted by about 10% of the study participants outside of the study in Jimma Hospital. After obtaining feedback from the respondents, language experts modified the wording of the questions

We calculated the internal consistency of the items using the Cronbach alpha coefficient ($C\alpha$), and composite reliability (CR). The results showed that all of the items' scores were above 0.7. The assumptions were examined for outliers, multi-collinearity, and independent error factors before running the structural equation model. The results showed that there was no existing multi-

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collinearity, with the overall variance inflation factor (VIF) value being less than 2 and thetolerance being greater than 0.5.

255 Patient and public involvement

The research question, outcome measures, design, recruitment, analysis, and interpretation of the
results and study execution were all developed without the involvement of any patients.
Additionally, there are no plans to share the findings with the patients and the study's design did
not directly engage the general public.

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260 Data processing and analysis

Data from respondents were entered into Epi-Data version 4.6 and exported to SPSS version 25 for descriptive data analysis. Additionally, model constructs were evaluated using structural equation modeling (SEM) analysis via Analysis of Moment Structure (AMOS) version 26 software. On the test measurement model, confirmatory factor analysis (CFA) using standardized data was used. As part of confirmatory factor analysis, a correlation between constructs less than 0.8 and factor loadings greater than 0.6 for each item was examined (36). The chi-square ratio (<5), the tucker-lewis index (TLI>0.9), the comparative fit index (CFI>0.9), the goodness of fit index (GFI > 0.9), the adjusted goodness of fit index (AGFI > 0.8), the root means square error approximation (RMSEA<0.08), and the root mean square of the standardized residual (RMSR<0.08) were all used to evaluate the goodness of fit (37-39).

Data normality was evaluated using multivariate kurtosis < 5 and the critical ratio between -1.96 and +1.96. Multicollinearity was also tested using VIF < 10 and tolerance > 0.1, as well as the correlation between exogenous constructs of <0.8, and there were no problems. In the measurement model, Cronbach's alpha test was used to assess construct reliability; each construct in the study met the required threshold of >0.70, and the composite reliability was above 0.70 (40). The Average Variance Extracted (AVE) approach, with values above 0.5, was used to assess the converging validity, while the square root of AVE in Fornell Larcker criterion, with values below 0.9, and the correlations with other latent constructs should have a lower value than the square root of AVE in each constructs was used to assess the diverging validity (33, 38, 41, 42).

To evaluate a structural model, the critical ratio (CR) and the path coefficient were used to analyze the relationship between exogenous and endogenous variables. A p-value of less than 0.05 and 95% confidence intervals were used to assess the predictors' statistical significance. The influence and level of significance of each of the four possible mediation paths in the model were explored. partial mediation occurs when a construct's direct, indirect, and total effects are all statistically significant, and full mediation occurs when the direct and indirect effects are both statistically significant but the total effect is not. To confirm mediation, we typically looked for a substantial indirect effect with a p-value < 0.05

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Results

290 Socio-demographic characteristics of healthcare professionals

A total of 625 study participants have included in the study with a response rate of 96.3% of them who gave their consent and responded to the questions. Of the total of (n=625) respondents, 343(54.9%) of them were males, 293(46.9%) respondents were in the age group of <30 years and the mean age of the respondents was 32 ± 6.01 years About more than half of the respondents 451 (72.2%) had less than or equal to 3 years of work experience. In addition, 228(36.5%) of the respondents were medical doctor professionals (Table 1).

Table 1: Socio-demographic characteristics of health care professionals in a resource-limited
setting, 2022 (n=625)

Sociodemographic	Category	Frequency(N)	Percentage (%)
Characteristics			
Gender	Male	343	54.9
	Female	282	45.1
Age (year)	<30	293	46.9
	30-39	254	40.6
	>40	78	12.5
Profession	Medical doctor	228	36.5
	Nurse	165	26.4
	Midwifery	117	18.6
	Health officer	46	7.4
	Others	115	11
Work experience	1-3	451	72.2
	3-5	62	9.9
	>5	112	17.9

Others: Anesthesia, Radiology, Psychiatry, and Pharmacy

302 Intention to use mobile-based SMS

Overall, 340 (54.4 %; 95% CI: [49.9–58.1]) healthcare professionals were intended to use mobile
phone-based SMS in southwest Ethiopia. The median score of intention to use mobile phone-based
SMS was 10.1, with a standard deviation of 3.3. The minimum and maximum scores were 3 and
15, respectively.

307 Measurement model

308 Reliability and validity of the construct

All of the constructs had Cronbach's alpha scores between 0.77 and 0.91 and composite reliability scores between 0.78 and 0.92, factor loadings of the items ranged between 0.64 and 0.89, and the value of AVE varied between 0.61 and 0.71. Therefore, all of the constructs had strong convergent validity (Table 2).

Table 2: Convergent validity between constructs of health care professionals' intention to use
mobile phone short message service and its predictors for adherence support and care of patients
with tuberculosis infection in a resource-limited setting, 2022

Construct	Indicators	Standard	Composite	AVE	Convergent
	/Items	loading	Reliability	2	Validity
Performance	PE1	0.85	0.88	0.65	Established
Expectancy	PE2	0.84			
	PE3	0.67			
	PE4	0.74			
Effort	EE1	0.87	0.91	0.69	Established
Expectancy	EE2	0.89			
	EE3	0.69			
	EE4	0.73			
Social	SI1	0.78	0.90	0.68	Established
Influence	SI2	0.97			
	SI3	0.88			

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Facilitating	FC1	0.81	0.92	0.72	Established
Condition	FC2	0.84			
	FC3	0.83			
	FC4	0.82			
Attitude	ATT1	0.67	0.78	0.61	Established
	ATT2	0.71			
	ATT3	0.68			
	ATT4	0.66			
Behavioral	BI1	0.80	0.79	0.64	Established
Intention	BI2	0.64			
	BI3	0.82			

Note; AVE: Average Variance Extracted

According to the findings, the bolded values (diagonal values) or the square root of the AVE of the construct were higher than the other values in that column, and the raw. As a result, the model's constructs' discriminant validity has been proven (Table 3).

Table 3: Discriminant validity between constructs of health care professionals' intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting, 2022

Construct	PE	EE	SI	FC	ATT	BI	Divergent
							Validity
Performance	0.806						Established
Expectancy (PE)							
Effort	0.143	0.831					Established
Expectancy (EE)							
Social	0.436	0.516	0.825				Established
Influence (SI)							
Facilitating Condition	0.533	0.178	0.543	0.848			Established
(FC)							

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Attitude (ATT)	0.366	0.601	0.383	0.511	0.781		Established
Behavioral	0.325	0.556	-0.112	0.362	0.603	0.800	Established
Intention to use (BI)							

324 Goodness of fit

The results in confirmatory factor analysis showed that model fit indices with respective values were chi squire difference($x^2/df=2.76$), Goodness-of-fit-index (GFI=0.93), Adjusted goodness-offit-index (AGFI=0.91), Comparative fit index (CFI=0.94), Tucker-Lewis's index (TLI=0.93), Root means the square error of approximation (RMSEA=0.05) and standardized root mean squared residual (SRMR=0.03). Accordingly, the goodness of fit model's values met the requirements.

330 Structural equation model

331 The result showed that effort expectancy had a significant direct effect on health care 332 professionals' attitude to using mobile phone short message service (β =0.162, 95% CI: 333 [0.061, 0.270], P<0.01) and intention towards using mobile phone SMS ($\beta = 0.329, 95\%$ CI: [0.233, 0.05]334 0.433], P<0.001). The facilitating condition had a direct significant effect on healthcare provider's 335 intention towards using mobile phone SMS ($\beta = 0.104$, 95% CI: [0.025, 0.191], P<0.01), and also 336 healthcare professionals' attitude towards the system had a direct significant effect on behavioral 337 intention to use mobile phone SMS ($\beta = 0.268, 95\%$ CI: [0.163, 0.373], P<0.001). whereas the 338 relationship between performance expectancy ($\beta = 0.268, 95\%$ CI: [-0.017,0.170], P=0.109), social 339 influence ($\beta = 0.015, 95\%$ CI: [-0.044, 0.075], P=0.610) and facilitating conditions ($\beta = 0.055, 95\%$ 340 CI: [-0.026, 0.140], P=0.184) were not significant effect on health care professionals' attitude 341 towards using mobile phone SMS, and the path relationship of performance expectancy ($\beta = 0.002$, 342 95% CI: [-0.088, 0.094], P=0.980) and social influence (β =-0.030, 95% CI: [-0.086,0.028], 343 P=0.318) to use mobile phone SMS were not statistically significant (Table 4).

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Table 4: SEM analysis of health care professionals' intention to use mobile phone short message
service and its predictors for adherence support and care of patients with tuberculosis infection in
a resource-limited setting

Path	Hypothesis	В	S.E	C.R	P-Value	95% CI		Decision
						Lower	Upper	-
PE → BI	H1	0.002	0.041	0.055	0.980	-0.088	0.094	Not
								Supported
PE→ ATT	H2	0.076	0.044	1.70	0.109	-0.017	0.170	Not
	C							Supported
EE → BI	H3	0.329	0.048	6.583	0.000***	0.233	0.433	Supported
EE→ ATT	H4	0.162	0.050	3.229	0.001**	0.061	0.270	Supported
SI → BI	H5	-0.030	0.030	-1.002	0.318	-0.086	0.028	Not
								supported
SI→ ATT	H6	0.015	0.032	0.475	0.610	-0.044	0.075	Not
								Supported
FC → BI	H7	0.104	0.039	2.649	0.011**	0.025	0.191	Supported
FC→ ATT	H8	0.055	0.041	1.317	0.184	-0.026	0.140	Not
					4			Supported
ATT → BI	H9	0.268	0.054	4.956	0.001**	0.163	0.373	Supported

348 Note: ** p value <0.01, ***p value is <0.001 C, R: critical ratio S.E: standard error, CI: confidence
349 interval, β: estimate

According to the finding, performance expectancy, effort expectancy, social influence, and facilitating conditions accounted for 68% and 74% of the variance (\mathbb{R}^2) in attitude and intention to use mobile phone short message services, respectively (Figure 2).

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355 Mediation effects

The results revealed that attitude played a mediating role in the relationship between health care professionals' effort expectations and their intention to use mobile phone short message service to support TB patients, as opposed to the relationship between performance expectancy, social influence, and facilitating conditions. Both the relationship between attitude and intention to use the system, as well as the regression coefficient between attitude and effort expectancy, were statistically significant. The indirect effect of the standardized estimation value was 0.043 and P< 0.01. In the context of this, the relationship between effort expectancy and an intention to use mobile-based SMS was statistically significant through attitude (Table 5).

Table 5: Mediating effects of Attitude and health care professionals' intention to use mobile phone
short message service and its predictors for adherence support and care of patients with
tuberculosis infection in a resource-limited setting

Path	Hypothesis	Effect	β	P-value	Result	Decision
PE→AT→ BI	H10	Total effect	0.025	0.643	No	Not
		Indirect effect	0.023	0.090	relationship	Support
		Direct effect	0.003	0.982	-	
EE→AT→ BI	H11	Total effect	0.365	0.000***	Partial	Support
		Indirect effect	0.043	0.001**	Mediation	
		Direct effect	0.323	0.000***		
SI→AT→ BI	H12	Total effect	-0.038	0.390	No	Not
		Indirect effect	0.006	0.587	relationship	Support
		Direct effect	-0.323	0.311	-	
FC→AT→ BI	H13	Total effect	0.136	0.005 **	Direct	Not
		Indirect effect	0.017	0.158	relationship	Support
		Direct effect	0.119	0.012*	-	

367 *Significance at P< 0.05, **significance at P< 0.01, ***significance at P< 0.001, β : estimate

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Discussion

This research used the UTAUT model for determining the level of intention and its predictors that may influence the use of mobile phone short message service systems to support adherence and care of patients with tuberculosis. Overall, 340 (54.4 %; 95% CI: [49.9-58.1]) of healthcare professionals was intended to use mobile phone-based SMS to support TB patients in southwest Ethiopia. This finding was higher than study done on intention of health providers electronic medical record in Amhara regional state of Ethiopia (39.8%) (43). This discrepancy could be due to study period and use small sample size. Similarly, willingness of healthcare professionals to use mobile based health services in Ethiopia was 44% (44). This possible difference could be due to study participants only obstetric health providers and they used smaller sample size.

The findings show that effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectation and intention to use the system. Thus, H3, H4, H7, H9, and H11 were supported and thus can be used as effective measures of mobile phone SMS adoption in resource-limited settings.

According to the findings, healthcare professional effort expectancy had a positive direct effect on attitude and both direct and indirect effects on the intention to use mobile phone SMS. This suggested that when healthcare professionals perceived the system's simplicity or lack of effort in use, their perceptions of its usefulness, attitude, and intention to use mobile phone SMS were significantly improved. This finding is consistent with findings from other studies in different countries (9, 26, 45-48). This could be because an individual's attitude and acceptance of the use of mobile phone SMS systems are greatly affected by the work required to manipulate the system. If the system is expected to manipulate people's intentions to use mobile phone SMS systems with less effort, the system's performance will improve. As a result, when implementing the use of mobile phone SMS technologies, the system should be simple for healthcare providers to understand and use to ensure long-term system adoption.

Facilitating conditions also positively influenced the intention to use mobile phone short message
 services to support adherence and care of patients with tuberculosis. This showed the significance

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of creating the organizational and IT requirements for this example, including the resources, technical support, and training that are necessary for the adoption and ongoing use of mobile-based SMS-enabled solutions by healthcare providers in the public health system This finding is consistent with findings from other studies in different countries (9, 27, 28, 49). This could be because health professionals think that as mobile phone use has increased, more people have access to them and are familiar with using devices to communicate with their intended recipients. As a result, they are convinced and have no trouble supporting patient care and adherence.

Health professionals' attitudes positively influenced their intention to use mobile phone SMS systems. Medical experts supported the usage of mobile phone SMS as a tool for bettering their health and the standard of tuberculosis treatment as they observed it being done. This finding is in line with findings from other studies done in different settings (9, 24, 50-52). Therefore, it is important to give priority to initiatives that change attitudes, such as providing mobile devices at work, providing ongoing training and assistance, and fostering knowledge exchange about eHealth technologies such as mobile SMS for the remainder of the patient's care. This study provides theoretical and practical implications based on the findings. The findings might alleviate any concerns regarding mobile-based SMS and its acceptability in resource-constrained environments. MHealth and other digital communication technologies have a positive impact on healthcare. The need to support further innovative mHealth initiatives from all stakeholders. Policymakers, healthcare providers, and planners should be concerned about improving the ability of users regarding mobile health technologies in addition to resources, technical support, and training of all health professionals, as well as improving the attitude to adopt mobile-based SMS in Ethiopia.

418 Conclusions

Overall, healthcare professionals' intention to use mobile-based SMS was high. The findings show that effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectations and the intention to use the system. Among the five influencing predictors, effort expectancy had a more significant prediction power for healthcare providers' intention to use mobile phone SMS systems. Therefore, easily interactive

426 and applicable forms of the system should be implemented for health care professionals, as well
427 as improving capacity and building on the simplicity of technology to support adherence and the
428 care of TB patients. Finally, we recommend that upcoming investigators include external variables,
429 and all health institutions, similarly, support it with a qualitative study.

¹¹ 430

0 Abbreviations and acronyms

AMOS: Analysis of Moment and Structure; ATT: Attitude; BI: Behavioral Intention; CI: Confidence Intervals; **EE**: Effort Expectancy; **FC**: Facilitating Condition; **PE**: Performance Expectancy; SEM: Structural Equation Modeling: SI: Social Influence; SMS: Short Message Service; SPSS: Statistical Package for Social Science; UTAUT: Unified Theory of Acceptance and Use of Technology; WHO: World Health Organization

436 Ethics approval and consent to participate

The study participants gave their informed consent after the study protocol was evaluated and approved by Mettu University's ethical review board with approval number MeU/RAC/1036/15. Each hospital provided a letter of permission. Each participant in the study gave their written and oral consent after being informed of the study's goal. Furthermore, all data collectors and investigators strictly adhered to the law's requirements for data privacy and confidentiality. Only the study was conducted using the data that was retrieved. As a result, the data-gathering tool did not contain participants' names or any other personal information about them. Furthermore, the study was done according to the Declaration of Helsinki.

40445Consent for publication41

42 446 Not applicable

43 447 Availability of data and materials

46 448 Upon reasonable request from the corresponding author, the datasets created and/or analyzed
48 449 during the current work will be made available.
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⁵⁰₅₁ 450 **Competing interests**

52
53 451 The authors declare that we have no competing interests.
54

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12	457	visualization, writing -original draft, AWD also done the conception and design, acquisition of
13 14	458	data or analysis and interpretation of data, and MKH contributed the funding acquisition,
15 16	459	investigation, methodology and resources. ADW and AWD wrote the final draft of the manuscript,
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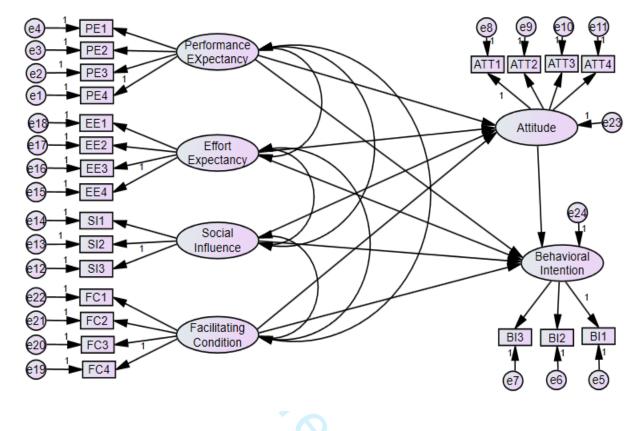
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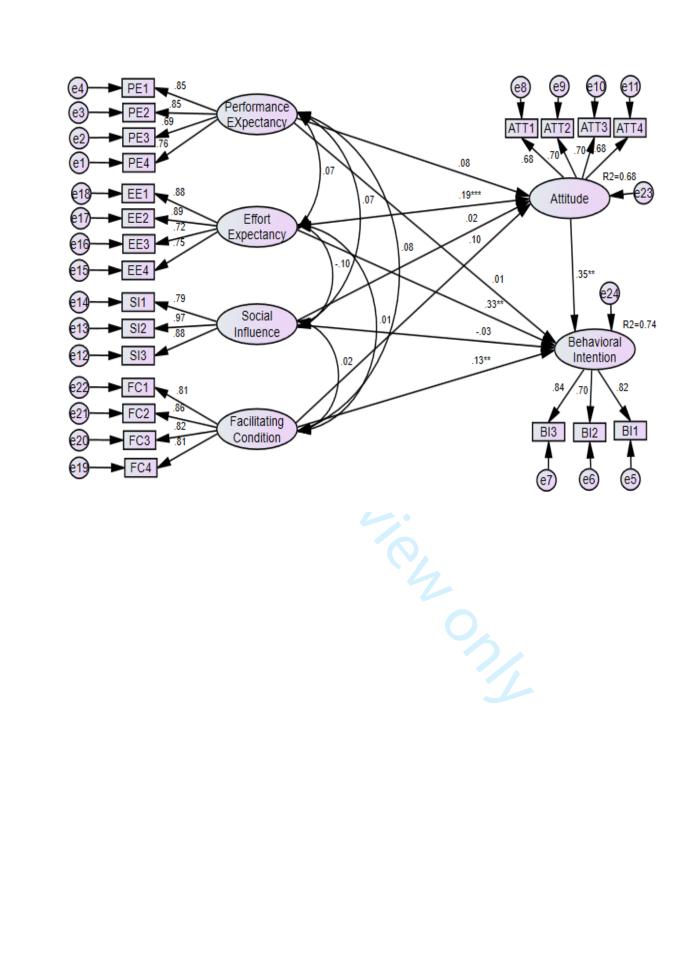
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15 16	641	Figure 1: Modified UTAUT models of health care professionals' intention to use mobile phone
17 18 19 20 21 22 23	642	short message service and its predictors for adherence support and care of patients with
	643	tuberculosis infection in a resource-limited setting, 2022
	644	Figure 2: SEM analysis of health care professionals' intention to use mobile phone short message
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	Item No	Recommendation	Pag No
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title or the abstract	2
		(<i>b</i>) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5-9
Methods			
Study design	4	Present key elements of study design early in the paper	10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	10
Participants	6	(<i>a</i>) Give the eligibility criteria, and the sources and methods of selection of participants	10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-9
Data sources/	8*	For each variable of interest, give sources of data and details of methods	11-
measurement		of assessment (measurement). Describe comparability of assessment methods if there is more than one group	12
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	12
Statistical methods	12	(<i>a</i>) Describe all statistical methods, including those used to control for confounding	11- 12
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(<i>d</i>) If applicable, describe analytical methods taking account of sampling strategy	
		(<i>e</i>) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	14
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical,	14-
1		social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	15,1
Main results	16	(<i>a</i>) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	

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		(b) Report category boundaries when continuous variables were	15-
		categorized	16
		(c) If relevant, consider translating estimates of relative risk into absolute	
		risk for a meaningful time period	
Other analyses	17	Report other analyses done-eg analyses of subgroups and interactions,	16
		and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential	18
		bias or imprecision. Discuss both direction and magnitude of any potential	
		bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	17-
		limitations, multiplicity of analyses, results from similar studies, and other	18
		relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present	20
		study and, if applicable, for the original study on which the present article	
		is based	

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Healthcare professionals' intention to use mobile phonebased SMS and its predictors for adherence support and care of TB patients in a resource-limited setting: A structural equation modeling analysis

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23 Abstract

Objective: To assess healthcare providers' intentions and its associated factors to use mobile
phone-based SMS to support adherence and care of TB patients in the Oromia region of southwest
Ethiopia.

27 Study design: An institutional-based cross-sectional study was conducted from October to
28 November 2022.

Setting: Public hospitals which include Mettu Karl referral hospital, Dembi hospital, Bedelle
hospital, Darimu hospital, and Chora hospital.in Ilu Aba Bor and Buno Bedelle zones.

Participants: A total of 625 (54.9% male and 45.1% female) health professionals participated in the study. The study participants were selected using a simple random sampling technique. All health professionals permanently working in Ilu Aba Bor and Buno Bedelle zone hospitals were included in this study. However, health professionals with less than six months of experience and those who were not present during the data collection period were excluded from this study.

36 Outcome measure: The intention to use mobile phone-based short message service to support TB
37 patients.

Results: Healthcare professionals' intention to use mobile SMS was 54.4%. Effort expectancy had a significant direct effect on attitude ($\beta = 0.162$, P<0.01) and intention towards using mobile phone SMS ($\beta = 0.329$, P<0.001). The intention to use mobile phone SMS was directly influenced by facilitating conditions ($\beta = 0.104$, P< 0.01) and attitude ($\beta = 0.26$, P < 0.001). The relationship between effort expectancy and intention to use SMS was mediated by attitude ($\beta = 0.043$, p-value <0.01).

44 Conclusions: Overall, intention to use of mobile-based SMS was high. Effort expectancy,
45 attitude, and facilitating conditions were significant factors that determined healthcare
46 professionals' behavioral intention to use mobile phone SMS. Effort expectancy had a more
47 significant prediction power than others. As a result, system forms that are easily interactive and

48	applicable should be implemented to improve capacity building and support the adherence and
49	care of TB patients.
50	Keywords: mobile health, short message service, tuberculosis, UTAUT
51	Strengths and limitations of the study
52	> This study used the unified theory of acceptance and use of technology, which is the most
53	accurate and recent model to identify important factors to influence mobile health
54	technologies.
55	> The study covers public hospitals with a large sample size, which improved its
56	generalizability.
57	> This study may be tilted in favor of social desirability because it was a cross-sectional
58	survey.
59	The study was not supported by qualitative findings
60	The study was not included private hospitals
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	 49 50 51 52 53 54 55 56 57 58 59 60

62 Introduction

Globally, it is crucial to cure tuberculosis (TB) to reduce morbidity, mortality, and the risk of continued transmission, but it can be difficult to support and monitor patients during the entirety of treatment (1, 2). The consequences of patients who experience treatment interruptions with TB therapy include drug resistance, recurrence, and death (2-4). The World Health Organization (WHO) recommends in-person, directly observed therapy, either at home or in a medical facility, to increase TB adherence (5). However, directly observed therapy is frequently difficult and impractical to implement in most areas with a high TB burden; TB programs frequently struggle to provide the human resources to guarantee regular face-to-face interactions over a long period. and directly observed therapy is extremely time-consuming, can seriously interfere with work, family obligations, and other daily activities from the perspective of people with TB, and may be perceived as patronizing and intrusive (6).

According to studies carried out in northwest Ethiopia, 34% of patients' arguments for not adhering to TB treatment were forgetfulness (7, 8). Patients in the continuation phase, as opposed to those in the intensive phase, are in charge of returning their prescriptions once a week to the neighboring clinic and taking their medications at home while being observed by neighbors. Thus, the introduction of digital health technologies by healthcare professional may improve patient adherence to TB therapy.

Digital technology adoption is viewed by health professionals as a key method for improving the efficacy, efficiency, and quality of healthcare delivery because it can improve patient care quality and service delivery efficiency while minimizing medical errors (9, 10). Particularly, there is an increase in the usage of mobile technology in healthcare. For instance, mobile technology's Short Message Service (SMS) feature can be used to track upcoming appointments, preventative immunizations, and long-term self-management treatments (9). To encourage the development of digital health innovations in worldwide efforts to improve TB care and prevention, the WHO has already formed its global task force on digital health, such as mobile health (11, 12).

With extensive adoption in low- and middle-income countries (LMIC), especially those with lower
socioeconomic standing, the number of mobile phone subscriptions now outnumbers the number
of people worldwide (13). The evidence done in Ethiopia showed that mobile-phone messaging

91 revealed a positive effect in improving healthcare services (2, 14, 15), but the intention level of 92 healthcare providers to use mobile health with SMS to support patients in the resource-limited 93 setting is uncertain.

94 Theoretical background and hypothesis development

95 Different types of models have been used to identify factors associated with the acceptance and 96 use of health information system technologies (16, 17). A unified theory of acceptance and use of 97 technology (UTAUT) model is currently regarded as the most accurate and up-to-date technology 98 acceptance model used to evaluate intention to use and actual use of technology.

The UTAUT model is suitable for this study due to its robustness and broad use in analyzing technology adoption at the individual level. Since the UTAUT model is an extension of other models and therefore has a strong capability to clarify the behavioral intentions of users as compared with other single models (18, 19). Accordingly, we used the model through adapt or modify the constructs in our study setting

This model proposes four predictive elements, including performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC) (20). After we used the fundamental elements of the UTAUT model we modified it in the context of a comprehensive review of the literature employing UTAUT in healthcare technology (16, 21-23). In addition to the four fundamental constructs (PE, EE, SI, and FC), attitude toward using technology (ATT) may have a substantial impact on the intention to use information technology (BI) in developing nations. Actual use is another factor in the UTAUT model that is important when the solution is frequently accessible. This variable was not included in our study because the solution is still not accessible for continuous use (Figure 1).

46 113 Behavioral Intention to Use (BI)

114 Behavioral intention is the degree to which a person has made deliberate plans to engage in or
 115 refrain from engaging in a particular future action (20).

52 116 Performance Expectancy (PE) 53

117 Health professionals' views toward the solution and their intention to adopt it may be positively 118 influenced by the improved work output and improved health outcomes. Thus, healthcare Page 7 of 31

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professionals are more likely to use mobile phone-based SMS, if they think that PE is high (9, 24- 28). Based on the above-mentioned literature, the following hypotheses were investigated in this study:
H1-PE has a positive influence on the intention to use mobile phone SMS technology.
H2-PE has a positive influence on attitudes toward using mobile phone SMS technology.
Effort Expectancy (EE)
In the treatment value chain, healthcare professionals are expected to enter information, read it, and engage with communication technology like mobile phones. Because of this, the system must be simple to use when it comes to entering patient data throughout therapy and retrieving it to confirm and send the data to patients. According to studies, users' intention to utilize technology is influenced by their effort expectations (9, 25, 26, 28). Based on these, the following hypotheses were investigated in this study:
H3. EE has a positive influence on the intention to use mobile phone SMS technology
H4. EE has a positive influence on attitude to use mobile phone SMS technology Social Influence (SI)
Social influence may play a significant role in the adoption and continued use of the digital solution given the experience of inconsistent adherence to reporting guidelines and treatment regimens by patients, medical professionals, allied healthcare professionals, and their organizations (clinic/hospital management). Intention to use the mobile phone for SMS may therefore be strong if SI is positive (9, 24, 25, 28). In the context of this, the following hypotheses were investigated in this study:
H5: SI has a positive influence on the intention to use mobile phone SMS technology.
H6: SI has a positive influence on attitudes toward using mobile phone SMS technology.
Facilitating Condition (FC)
6 For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Conditions in the context of TB treatment monitoring include having the knowledge and tools required to utilize the system as well as the proposed solution's compatibility with existing systems (9, 24, 27, 28). On account of these empirical findings, our study makes the following hypothesis: H7.FC has a positive influence on the intention to use mobile phone SMS technology. H8. FC has a positive influence on attitudes toward using mobile phone SMS technology. Attitude (ATT) In a context with low resources, health professionals have little knowledge about access to technology, which makes changing their attitude about using a new technology extremely difficult (16). We reasoned that including attitude as a category could seem pertinent to studying behavioral intentions to use new technology in certain contexts (16, 24, 26, 29-32). On account of those findings, our study makes the following hypothesis: H9: ATT has a positive influence on the intention to use mobile phone SMS technology. H10: Attitude mediates the relationship between PE and intention to use mobile phone SMS technology. H11: Attitude mediates the relationship between EE and intention to use mobile phone SMS technology. H12: Attitude mediates the relationship between SI and intention to use mobile phone SMS technology. H13: Attitude mediates the relationship between FC and intention to use mobile phone SMS technology. According to our search of the literature, little research has been done about this study. As a result, this study investigates, introduces, and empirically tests a modified theoretical model based on theUTAUT model to identify the main factors influencing healthcare professionals' intention to adopt and use a mobile phone SMS system. **Methods and materials** For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

168 Study design and setting

The institutional-based cross-sectional study design was conducted from October to November 2022 at public hospitals in Ilu Aba Bor and Buno Bedelle zones, Oromia Regional State, southwest Ethiopia. Illu Aba Bor Zone comprises one town administration and fourteen rural districts with a total population of 1,606,502, according to the 2019 district finance and economic development office annual data report. Among those zones, five hospitals exist, namely: Mettu Karl referral hospital, Dembi hospital, Bedelle hospital, Darimu hospital, and Chora hospital.

175 Study Population

All healthcare professionals working in the southwest Oromia region of public hospitals in the two zones were used as study populations. All health professionals, working at public health hospitals, who were available during data collection time were included in the study. However, Health professionals with less than six months of working experience and who were on annual leave or those who were seriously ill during the study period were excluded from the study.

Operational definition

The outcome variable was the intention to use mobile-based SMS among healthcare professionals. Intention to use means the extent to which a person has made intentional plans to use new technology (33, 34). When a healthcare professional rates intention to use a technology measurement and scores median, and above the median was considered as intended to use mobile phone-based SMS, else not intended to use it, with a five-point Likert scale of three questions (33).

187 Sample size determination

The sample size was estimated based on structural equation modeling assumptions of determining model-free parameters using the modified model (33, 34) (Figure 1), by considering 25 variances of the independent variables, 6 covariance between independent variables, 16 load factors between latent and latent indicators, and 8 direct effects and 4 indirect effects of regression coefficients between observed or latent variables were estimated Finally a total of 59 free parameters was estimated. But the variances of dependent variables, the covariance between dependent variables,

and the covariance between dependent and independent variables are never parameters (as would be explained by other parameters), and for each latent variable, its metric must be set: Set its variance to a constant (typically 1) and fix a load factor between latent and its indicator for independent latent (68). Accordingly, A 1: 10 ratios of responders to free parameters to be estimated was suggested to estimate the sample size based on the number of free parameters in the hypothetical model (33-35). As a result, the minimum sample size necessary was 590, taking into account the 59 parameters that needed to be estimated and taking participants by a free parameter ratio of 10. Since the computed sample size considers the 10% non-response rate. Thus, the final sample size of 649 study participants was estimated.

Sampling Procedure

The participants of this study were health professionals across all five study hospitals in southwest Ethiopia. The number of healthcare professionals from the five hospitals was calculated using population proportional allocation and a simple random sampling technique. Finally, consecutive healthcare professionals who full fill the inclusion criterion were included in the study until the allocated size was obtained.

Data collection tools, data quality control, and procedures

To investigate the hypotheses provided by this study, a structured questionnaire was used from earlier investigations (16, 29-32). There are two sections to the questionnaire. Section A focuses on user demographic data, including gender, age, education, and years of experience. Section B contains 18 positive statements that symbolize the constructs, which represents the constructions that are part of the UTAUT and newly introduced construct, ATT. A five-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree, was used to measure the constructs.

To control the quality of the data, two days of training were given to data collectors and supervisors on the objective of the study, data collection procedures, data collection tools, respondents' approaches, data confidentiality, and respondents right before the data collection date. Before the actual data collection, pretesting of the questionnaire was conducted by about 10% of the study participants outside of the study in Jimma Hospital. After obtaining feedback from the respondents, language experts modified the wording of the questions.

1		
2 3	222	We estimated the internal consistency of the items using the Cronbach alpha coefficient (C α), and
4 5	223	composite reliability (CR). The results showed that all of the items' scores were above 0.7. The
6 7	224	assumptions were examined for outliers, multi-collinearity, and independent error factors before
8 9	225	running the structural equation model. The results showed that there was no existing multi-
10 11	226	collinearity, with the overall variance inflation factor (VIF) value being less than 2 and the
12	227	tolerance being greater than 0.5.
13 14		
15 16	228	Patient and public involvement
17 18	229	No patient and public were involved
19 20		
21 22		
23 24		
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26 27		No patient and public were involved
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230 Data processing and analysis

Data from respondents were entered into Epi-Data version 4.6 and exported to SPSS version 25 for descriptive data analysis. Additionally, model constructs were evaluated using structural equation modeling (SEM) analysis via Analysis of Moment Structure (AMOS) version 26 software. This analysis technique is multivariate types of analysis, which is important to examine the relationship between multiple independent variables, making clear comparison, discard unwanted information, predict future outcome, correct errors, get new insights address the confounders' issue and more accurate, realistic and closer to the real life situation than bivariate and univariate types of statistical technique (36). To test measurement model, confirmatory factor analysis (CFA) using standardized data was used. As part of confirmatory factor analysis, a correlation between constructs less than 0.8 and factor loadings greater than 0.6 for each item was examined (37). The chi-square ratio (<5), the tucker-lewis index (TLI>0.9), the comparative fit index (CFI>0.9), the goodness of fit index (GFI > 0.9), the adjusted goodness of fit index (AGFI > 0.8), the root means square error approximation (RMSEA<0.08), and the root mean square of the standardized residual (RMSR< 0.08) were all used to evaluate the goodness of fit (38-40).

Data normality was evaluated using multivariate kurtosis < 5 and the critical ratio between -1.96 and +1.96. Multicollinearity was also tested using VIF < 10 and tolerance > 0.1, as well as the correlation between exogenous constructs of <0.8, and there were no problems. Cronbach's alpha test was used to assess construct reliability; each construct in the study met the required threshold of >0.70, and the composite reliability was above 0.70 (41). The Average Variance Extracted (AVE) approach, with values above 0.5, was used to assess the converging validity, while the square root of AVE in Fornell Larcker criterion, with values below 0.9, and the correlations with other latent constructs should have a lower value than the square root of AVE in each constructs was used to assess the divergent validity (33, 39, 42, 43).

To evaluate a structural model, the critical ratio (CR) and the path coefficient were used to analyze the relationship between exogenous and endogenous variables. A p-value of less than 0.05 and 95% confidence intervals were used to assess the predictors' statistical significance. In mediation analysis, partial mediation occurs when a construct's direct, indirect, and total effects are all statistically significant, and full mediation occurs when the direct and indirect effects are both

statistically significant but the total effect is not. To confirm mediation, we typically looked for a substantial indirect effect with a p-value < 0.05Results Socio-demographic characteristics of healthcare professionals A total of 625 study participants have included in the study with a response rate of 96.3% of them who gave their consent and responded to the questions. Of the total of (n=625) respondents, 343(54.9%) of them were males, 293(46.9%) respondents were in the age group of <30 years and the mean age of the respondents was 32+6.01 years About more than half of the respondents 451 (72.2%) had less than or equal to 3 years of work experience. In addition, 228(36.5%) of the respondents were medical doctor professionals (Table 1). Table 1: Socio-demographic characteristics of health care professionals in a resource-limited setting, 2022 (n=625) Sociodemographic Category Frequency(N) Percentage (%) Characteristics 54.9 Gender Male Female 45.1 <30 46.9 Age (year) 30-39 40.6 >40 12.5 Profession Medical doctor 36.5 Nurse 26.4

Midwifery

Others

1-3

3-5

>5

Work experience

Health officer

18.6

7.4

72.2

9.9

17.9

2		
3 4 5	271	Others: Anesthesia, Radiology, Psychiatry, and Pharmacy
6 7	272	
8 9 10	273	Intention to use mobile-based SMS
11	274	Overall, 340 (54.4 %; 95% CI: [49.9–58.1]) healthcare professionals were intended to use mobile
12 13	275	phone-based SMS in southwest Ethiopia. The median score of intention to use mobile phone-based
14 15	276	SMS was 10.1, with a standard deviation of 3.3. The minimum and maximum scores were 3 and
16	277	15, respectively.
17 18	_,,	
19 20	278	Measurement model
21 22	279	Reliability and validity of the construct
23		
24 25	280	All of the constructs had Cronbach's alpha scores between 0.77 and 0.91 and composite reliability
26 27	281	scores between 0.78 and 0.92, factor loadings of the items ranged between 0.64 and 0.89, and the
28	282	value of AVE varied between 0.61 and 0.71. Therefore, all of the constructs had strong convergent
29 30 31	283	validity (Supplemental Table 1).
32 33	284	According to the findings, the bolded values (diagonal values) or the square root of the AVE of
34	285	the construct were higher than the other values in that column, and the raw. As a result, the model's
35 36	286	constructs' discriminant validity has been proven (Supplemental Table 2).
37 38		
39 40	287	Goodness of fit
41 42	288	The model fit results in confirmatory factor analysis showed that chi squire difference($x^2/df=2.76$),
43 44	289	Goodness-of-fit-index (GFI=0.93), Adjusted goodness-of-fit-index (AGFI=0.91), Comparative fit
45 46	290	index (CFI=0.94), Tucker-Lewis's index (TLI=0.93), Root means the square error of
47	291	approximation (RMSEA=0.05) and standardized root mean squared residual (SRMR=0.03).
48 49	292	Accordingly, the goodness of fit model's values met the requirements.
50 51 52	293	Structural equation model
53 54	294	The result showed that effort expectancy had a significant direct effect on health care
55	295	professionals' attitude (β =0.162, 95% CI: [0.061, 0.270], P<0.01) and intention towards using
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mobile phone SMS (β =0.329, 95% CI: [0.233, 0.433], P<0.001). The facilitating condition had a direct significant effect on healthcare provider's intention ($\beta = 0.104, 95\%$ CI: [0.025, 0.191], P<0.01), and also healthcare professionals' attitude towards the system had a direct significant effect on behavioral intention to use mobile phone SMS ($\beta = 0.268, 95\%$ CI: [0.163, 0.373], P<0.001). whereas the relationship between performance expectancy ($\beta = 0.268$, 95% CI: [-0.017,0.170], P=0.109), social influence (β =0.015, 95% CI: [-0.044, 0.075], P=0.610) and facilitating conditions ($\beta = 0.055, 95\%$ CI: [-0.026, 0.140], P=0.184) were not significant effect on health care professionals' attitude, and the path relationship of performance expectancy ($\beta = 0.002$, 95% CI: [-0.088, 0.094], P=0.980) and social influence(β =-0.030, 95% CI: [-0.086,0.028], P=0.318) to use mobile phone SMS were not statistically significant (Table 2).

Table 2: SEM analysis of health care professionals' intention to use mobile phone short message
 service and its predictors for adherence support and care of patients with tuberculosis infection in
 a resource-limited setting

Path	Hypothesis	В	S. E	C.R	P-Value	95% CI		Decision
						Lower	Upper	-
PE → BI	H1	0.002	0.041	0.055	0.980	-0.088	0.094	Not
					2			Supported
PE→ ATT	H2	0.076	0.044	1.70	0.109	-0.017	0.170	Not
						5.		Supported
EE → BI	H3	0.329	0.048	6.583	0.000***	0.233	0.433	Supported
EE→ ATT	H4	0.162	0.050	3.229	0.001**	0.061	0.270	Supported
SI → BI	H5	-0.030	0.030	-1.002	0.318	-0.086	0.028	Not
								supported
SI→ ATT	H6	0.015	0.032	0.475	0.610	-0.044	0.075	Not
								Supported
FC → BI	H7	0.104	0.039	2.649	0.011**	0.025	0.191	Supported
FC→ ATT	H8	0.055	0.041	1.317	0.184	-0.026	0.140	Not
								Supported

	ATT → BI	Н9	0.268	0.054	4.956	0.001**	0.163	0.373	Supported
310	Note: ** p val	ue <0.01, ***	p value is	<0.001 0	C, R: critic	cal ratio S.E:	standard	error, CI:	confidence
311	interval, β: estimate								
312	According to	the finding,	performa	ance exp	ectancy,	effort expe	ctancy, s	ocial infl	uence, and
313	facilitating con	nditions accou	inted for (58% and	74% of th	ne variance (R ²) in att	itude and	intention to
314	use mobile ph	one short mes	sage serv	ices, resp	pectively	(Figure 2).			
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317 Mediation effects

The results revealed that attitude played a mediating role in the relationship between health care professionals' effort expectations and their intention to use mobile phone short message service to support TB patients, as opposed to the relationship between performance expectancy, social influence, and facilitating conditions. Both the relationship between attitude and intention to use the system, as well as the regression coefficient between attitude and effort expectancy, were statistically significant. The indirect effect of the standardized estimation value was 0.043 and P< 0.01. In the context of this, the relationship between effort expectancy and an intention to use mobile-based SMS was statistically significant through attitude (Table 3).

Table 3: Mediating effects of Attitude and health care professionals' intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting

Path	Hypothesis	Effect	β	P-value	Result	Decision
PE→AT→ BI	H10	Total effect	0.025	0.643	No	Not
		Indirect effect	0.023	0.090	relationship	Support
		Direct effect	0.003	0.982	-	
EE→AT→ BI	H11	Total effect	0.365	0.000***	Partial	Support
		Indirect effect	0.043	0.001**	Mediation	
		Direct effect	0.323	0.000***		
SI→AT→ BI	H12	Total effect	-0.038	0.390	No	Not
		Indirect effect	0.006	0.587	relationship	Support
		Direct effect	-0.323	0.311	-	
FC→AT→ BI	H13	Total effect	0.136	0.005 **	Direct	Not
		Indirect effect	0.017	0.158	relationship	Support
		Direct effect	0.119	0.012*		

*Significance at P< 0.05, **significance at P< 0.01, ***significance at P< 0.001, β : estimate

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data mining, AI training, and similar technologies

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Discussion

This study was used the UTAUT model for determining the level of intention and its predictors that may influence the use of mobile phone short message service systems to support adherence and care of patients with tuberculosis. Overall, 340 (54.4 %; 95% CI: [49.9–58.1]) of healthcare professionals was intended to use mobile phone-based SMS to support TB patients in southwest Ethiopia. This finding was higher than study done on intention of health providers electronic medical record in Amhara regional state of Ethiopia (39.8%) (44). This discrepancy could be due to study period and use small sample size. Similarly, willingness of healthcare professionals to use mobile based health services in Ethiopia was 44% (45). This possible difference could be due to study participants only obstetric health providers and they used smaller sample size. Similarly, the study done in Ethiopia proved that 85.9% of the healthcare professionals were willing to use the EMR system in their assigned clinic and committed to advance patient data management system (46). This consistency in the high percentages of persons who were eager to use the EMR system could be explained by global contextual technology advancement (automation of medical systems for advancement in healthcare practice) (47).

The findings show that effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectation and intention to use the system. Thus, H3, H4, H7, H9, and H11 were supported and thus can be used as effective measures of mobile phone SMS adoption in resource-limited settings.

According to the findings, healthcare professional effort expectancy had a positive direct effect on attitude and both direct and indirect effects on the intention to use mobile phone SMS. This suggested that when healthcare professionals perceived the system's simplicity or lack of effort in use, their perceptions of its usefulness, attitude, and intention to use mobile phone SMS were significantly improved. This finding is consistent with findings from other studies in different countries (9, 26, 48-51). This could be because an individual's attitude and acceptance of the use of mobile phone SMS systems are greatly affected by the work required to manipulate the system. If the system is expected to manipulate people's intentions to use mobile phone SMS systems with less effort, the system's performance will improve (46). As a result, when implementing the use of

360 mobile phone SMS technologies, the system should be simple for healthcare providers to 361 understand and use to ensure long-term system adoption.

Facilitating conditions also positively influenced the intention to use mobile phone short message services to support adherence and care of patients with tuberculosis. This showed the significance of creating the organizational and IT requirements for this example, including the resources, technical support, and training that are necessary for the adoption and ongoing use of mobile-based SMS-enabled solutions by healthcare providers in the public health system This finding is consistent with findings from other studies in different countries (9, 27, 28, 52). This could be because health professionals think that as mobile phone use has increased, more people have access to them and are familiar with using devices to communicate with their intended recipients. As a result, they are convinced and have no trouble supporting patient care and adherence.

Health professionals' attitudes positively influenced their intention to use mobile phone SMS systems. Medical experts supported the usage of mobile phone SMS as a tool for bettering their health and the standard of tuberculosis treatment as they observed it being done. This finding is in line with findings from other studies done in different settings (9, 24, 53-55). Therefore, it is important to give priority to initiatives that change attitudes, such as providing mobile devices at work, providing ongoing training and assistance, and fostering knowledge exchange about eHealth technologies such as mobile SMS for the remainder of the patient's care.

This study provides theoretical and practical implications based on the findings. The findings might alleviate any concerns regarding mobile-based SMS and its acceptability in resource-constrained environments. MHealth and other digital communication technologies have a positive impact on healthcare. The need to support further innovative mHealth initiatives from all stakeholders. Policymakers, healthcare providers, and planners should be concerned about improving the ability of users regarding mobile health technologies in addition to resources, technical support, and training of all health professionals, as well as improving the attitude to adopt mobile-based SMS in Ethiopia.

Conclusions

387 Overall, healthcare professionals' intention to use mobile-based SMS was high. The findings show
 388 that effort expectancy, attitude, and facilitating conditions were significant factors that determined

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healthcare professionals' behavioral intention to use mobile phone SMS. Among the five influencing predictors, effort expectancy had a more significant prediction power for healthcare providers' intention to use mobile phone SMS systems. Therefore, easily interactive and applicable forms of the system should be implemented for health care professionals, as well as improving capacity and building on the simplicity of technology to support adherence and the care of TB patients. Finally, we recommend that upcoming investigators include external variables, and wide range of study area, similarly, support it with a qualitative study.

Declarations

Abbreviations and acronyms

AMOS: Analysis of Moment and Structure; ATT: Attitude; BI: Behavioral Intention; CI: Confidence Intervals; EE: Effort Expectancy; FC: Facilitating Condition; PE: Performance Expectancy; SEM: Structural Equation Modeling: SI: Social Influence; SMS: Short Message Service; SPSS: Statistical Package for Social Science; UTAUT: Unified Theory of Acceptance and Use of Technology; WHO: World Health Organization

Ethics approval and consent to participate

The study participants gave their informed consent after the study protocol was evaluated and approved by Mettu University's ethical review board with approval number MeU/RAC/1036/15. Each hospital provided a letter of permission. Each participant in the study gave their written and oral consent after being informed of the study's goal. Furthermore, all data collectors and investigators strictly adhered to the law's requirements for data privacy and confidentiality. Only the study was conducted using the data that was retrieved. As a result, the data-gathering tool did not contain participants' names or any other personal information about them. Furthermore, the study was done according to the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

Upon reasonable request from the corresponding author, the datasets created and/or analyzed during the current work will be made available.

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3 4 5 6 7 8 9 10	417	Competing interests
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17 18	423	investigation, methodology, project administration, resources, software, supervision, validation,
19 20	424	visualization, writing -original draft, AWD also done the conception and design, acquisition of
21	425	data or analysis and interpretation of data, and MKH contributed the funding acquisition,
22 23 24 25 26 27 28 29 30	426	investigation, methodology and resources. ADW and AWD wrote the final draft of the manuscript,
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33	431	participants.
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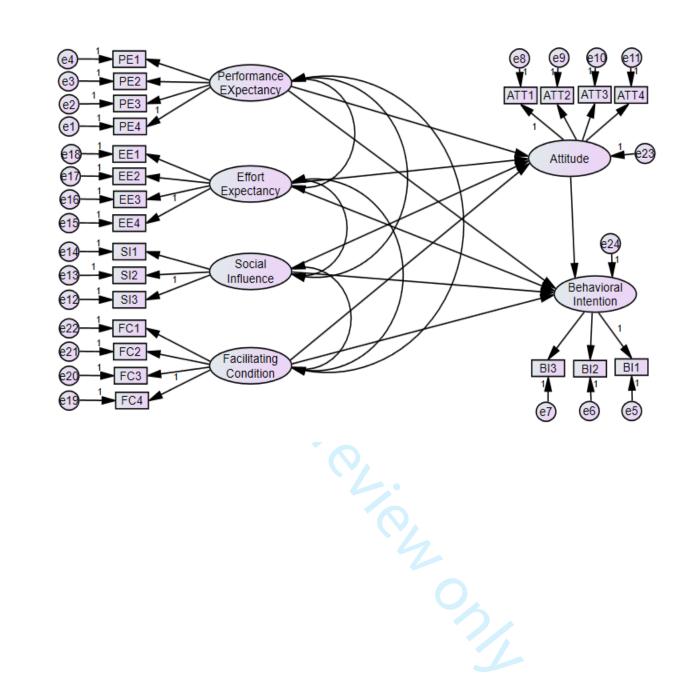
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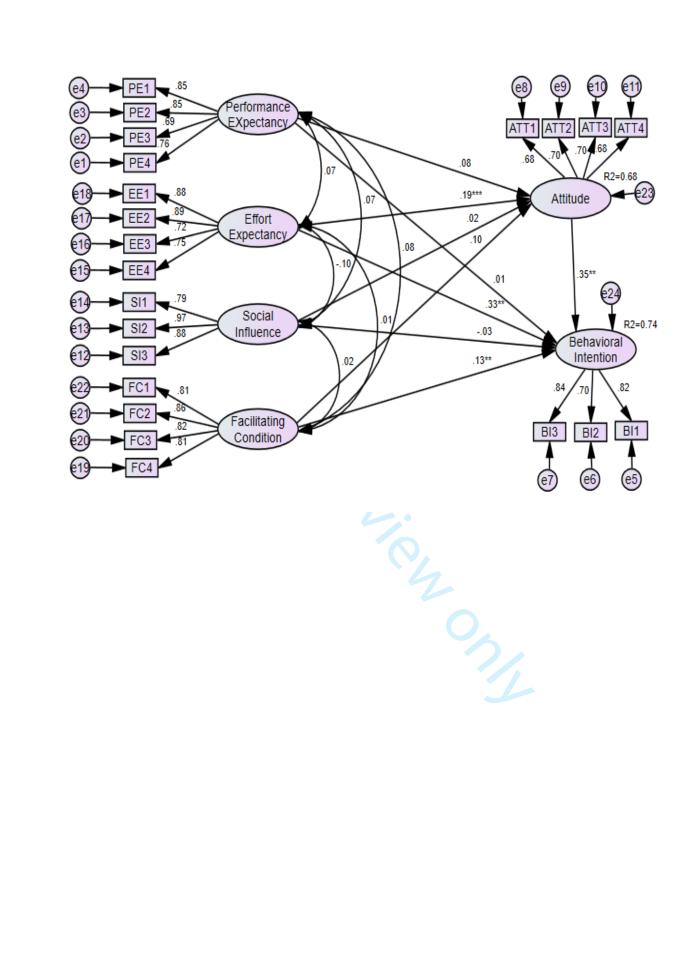
1 2		
3 4 5	603	Figures
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8 9	605	Figure 1: Modified UTAUT models of health care professionals' intention to use mobile phone
10 11	606	short message service and its predictors for adherence support and care of patients with
12 13	607	tuberculosis infection in a resource-limited setting, 2022
14 15	608	
16 17	609	
18 19	610	Figure 2: SEM analysis of health care professionals' intention to use mobile phone short message
20	611	service and its predictors for adherence support and care of patients with tuberculosis infection in
21 22	612	a resource-limited setting, 2022
23 24 25	613	
26	614	Supplemental tables
27 28	615	
29 30 31	616	Supplemental Table 1: Convergent validity between constructs of health care professionals'
31 32	617	intention to use mobile phone short message service and its predictors for adherence support and
33 34	618	care of patients with tuberculosis infection in a resource-limited setting, 2022
35 36	619	
37 38	620	
39 40	621	Supplemental Table 2: Discriminant validity between constructs of health care professionals'
41 42	622	intention to use mobile phone short message service and its predictors for adherence support and
43 44	623	care of patients with tuberculosis infection in a resource-limited setting, 2022
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Construct	Indicators	Standard	Composite	AVE	Convergent
	/Items	loading	Reliability		Validity
Performance	PE1	0.85	0.88	0.65	Established
Expectancy	PE2	0.84			
	PE3	0.67			
	PE4	0.74			
Effort	EE1	0.87	0.91	0.69	Established
Expectancy	EE2	0.89			
	EE3	0.69			
	EE4	0.73			
Social	SI1	0.78	0.90	0.68	Established
Influence	SI2	0.97			
	SI3	0.88			
Facilitating	FC1	0.81	0.92	0.72	Established
Condition	FC2	0.84			
	FC3	0.83			
	FC4	0.82	1		
Attitude	ATT1	0.67	0.78	0.61	Established
	ATT2	0.71	L	2	
	ATT3	0.68			
	ATT4	0.66			
Behavioral	BI1	0.80	0.79	0.64	Established
Intention	BI2	0.64			
	BI3	0.82			

Note; AVE: Average Variance Extracted

Construct	PE	EE	SI	FC	ATT	BI	Divergent
							Validity
Performance	0.806						Established
Expectancy (PE)							
Effort	0.143	0.831					Established
Expectancy (EE)							
Social	0.436	0.516	0.825				Established
Influence (SI)							
Facilitating Condition	0.533	0.178	0.543	0.848			Established
(FC)							
Attitude (ATT)	0.366	0.601	0.383	0.511	0.781		Established
		0					
Behavioral	0.325	0.556	-0.112	0.362	0.603	0.800	Established
Intention to use (BI)							
			(ez				

	Item No	Recommendation	Pag No
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title or the abstract	2
		(<i>b</i>) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5-9
Methods			
Study design	4	Present key elements of study design early in the paper	10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	10
Participants	6	(<i>a</i>) Give the eligibility criteria, and the sources and methods of selection of participants	10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-9
Data sources/	8*	For each variable of interest, give sources of data and details of methods	11-
measurement		of assessment (measurement). Describe comparability of assessment methods if there is more than one group	12
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	12
Statistical methods	12	(<i>a</i>) Describe all statistical methods, including those used to control for confounding	11- 12
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(<i>d</i>) If applicable, describe analytical methods taking account of sampling strategy	
		(<i>e</i>) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	14
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical,	14-
1		social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	15,1
Main results	16	(<i>a</i>) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	

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		(b) Report category boundaries when continuous variables were	15-
		categorized	16
		(c) If relevant, consider translating estimates of relative risk into absolute	
		risk for a meaningful time period	
Other analyses	17	Report other analyses done-eg analyses of subgroups and interactions,	16
		and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential	18
		bias or imprecision. Discuss both direction and magnitude of any potential	
		bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	17-
		limitations, multiplicity of analyses, results from similar studies, and other	18
		relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present	20
		study and, if applicable, for the original study on which the present article	
		is based	

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Healthcare professionals' intention to adopt mobile phonebased SMS and its predictors for adherence support and care of TB patients in a resource-limited setting: A structural equation modeling analysis

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1	Healthcare professionals'	intention to	adopt mobile	phone-based	SMS	and	its
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predictors for adherence support and care of TB patients in a resource-limited

setting: A structural equation modelling analysis

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23 Abstract

Objective: To assess healthcare providers' intentions and the associated factors to use mobile
phone-based SMS to support adherence and care of TB patients in the Oromia region of southwest
Ethiopia.

Study design: An institutional-based cross-sectional study was conducted from October to
November 2022.

Setting: Public hospitals which include Mettu Karl referral hospital, Dembi Hospital, Bedelle
Hospital, Darimu Hospital, and Chora Hospital.in Ilu Aba Bor and Buno Bedelle zones.

Participants: A total of 625 (54.9% male and 45.1% female) health professionals participated in the study. The study participants were selected using a simple random sampling technique. All health professionals permanently working in Ilu Aba Bor and Buno Bedelle zone hospitals were included in this study. However, health professionals with less than six months of experience and those who were not present during the data collection period were excluded from this study.

36 Outcome measure: The intention to use mobile phone-based short message service to support TB
 37 patients.

Results: Healthcare professionals' intention to use mobile SMS was 54.4%. Effort expectancy had a significant direct effect on attitude ($\beta = 0.162$, P<0.01) and intention towards using mobile phone SMS ($\beta = 0.329$, P<0.001). The intention to use mobile phone SMS was directly influenced by facilitating conditions ($\beta = 0.104$, P< 0.01) and attitude ($\beta = 0.26$, P < 0.001). The relationship between effort expectancy and intention to use SMS was mediated by attitude ($\beta = 0.043$, p-value
< 0.01).

44 Conclusions: Overall, intention to use of mobile-based SMS was high. Effort expectancy,
45 attitude, and facilitating conditions were significant factors that determined healthcare
46 professionals' behavioral intention to use mobile phone SMS. Effort expectancy had a more
47 significant prediction power than others. As a result, system forms that are easily interactive and

2		
3 ∠ 4	48	applicable should be implemented to improve capacity building and support the adherence and
5 4 6	49	care of TB patients.
7 8 5 9	50	Keywords: mobile health, short message service, tuberculosis, UTAUT
10	51	Strengths and limitations of the study
13 14	52	> This study used the unified theory of acceptance and use of technology, which is the most
15	53	accurate and recent model to identify important factors to influence mobile health
	54	technologies.
	55	> The study covers public hospitals with a large sample size, which improved its
20 21	56	generalizability.
22 23	57	> This study may be tilted in favor of social desirability because it is a cross-sectional survey.
24	58	The study was not supported by qualitative findings
	59	The study did not include private hospitals
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55	50	

61 Introduction

Globally, it is crucial to cure tuberculosis (TB) to reduce morbidity, mortality, and the risk of continued transmission, but it can be difficult to support and monitor patients during the entirety of treatment (1, 2). The consequences for patients who experience treatment interruptions with TB therapy include drug resistance, recurrence, and death (2-4). The World Health Organization (WHO) recommends in-person, directly observed therapy, either at home or in a medical facility, to increase TB adherence (5). However, directly observed therapy is frequently difficult and impractical to implement in most areas with a high TB burden(6).

According to studies carried out in northwest Ethiopia, 34% of patients' arguments for not adhering to TB treatment were forgetfulness (7, 8). Community members may be too preoccupied with their daily tasks to remember and monitor patients for such a long time. Thus, the introduction of digital health technologies by healthcare professionals may improve patient adherence to TB therapy.

Digital technology adoption is viewed by health professionals as a key method for improving the efficacy, efficiency, and quality of healthcare delivery because it can improve patient care quality and service delivery efficiency while minimizing medical errors (9-11). For instance, mobile technology's Short Message Service (SMS) feature can be used to track upcoming appointments, preventative immunizations, and long-term self-management treatments (9). To encourage the development of digital health innovations in worldwide efforts to improve TB care and prevention, the WHO has already formed its global task force on digital health, such as mobile health (12, 13).

With extensive adoption in low- and middle-income countries (LMIC), especially those with lower socioeconomic standing, the number of mobile phone subscriptions now outnumbers the number of people worldwide (14). Individuals now have own smartphones, making it possible in some locations with a strong internet connection to conduct video conversations. However, in comparison to other developed regions, the use of mobile technology in the healthcare system in developing countries is too often limited to certain roles for health interventions. The evidence done in Ethiopia showed that mobile phone messaging revealed a positive effect in improving healthcare services (2, 15, 16), but the intention level of healthcare providers to use mobile health with SMS to support patients in the resource-limited setting is uncertain.

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89 Theoretical background and hypothesis development

90 Different types of models have been used to identify factors associated with the acceptance and 91 use of health information system technologies (17, 18). After looking at eight models, including 92 the theory of reasoned action, the technology acceptance model, the theory of planned behavior, 93 the social cognitive theory, the motivational model, the combined technology acceptance model, 94 and the innovation diffusion theory; the UTAUT model was developed to put forth a unified theory 95 of technology acceptance and it is the most accurate and up-to-date technology acceptance model 96 used to evaluate intention to use and actual use of technology (17, 19).

97 The acceptance and utilization of mobile-based SMS for TB treatment monitoring depend on the 98 particular patients, healthcare providers, and facilities that serve TB patients. The UTAUT model 99 is suitable for this study due to its robustness and broad use in analyzing technology adoption at 100 the individual level. Accordingly, we used the model by adapting or modifying the constructs in 101 our study setting

Accordingly, after we used the fundamental constructs of the UTAUT model (PE, EE, SI, and FC), we modified it in the context of a comprehensive review of the literature (17, 20-22). So, attitude toward using technology (ATT) may have a substantial impact on the intention to use information technology (BI) in developing nations. Actual use is another factor in the UTAUT model that is important when the solution is frequently accessible. However, this variable was not included in our study because the solution is still not accessible for continuous use (Figure 1). The constructs used and the associations that were hypothesized and tested in this study are provided below.

Behavioral Intention to Use (BI): is the degree to which a person has made deliberate plans to engage in or refrain from engaging in a particular future action (19). In this study, healthcare professionals are questioned about their intentions to employ the proposed solution when it becomes accessible in the future.

Performance Expectancy (PE): Respondents were questioned about the solution's value and how
it influenced their task effectiveness, productivity, job effectiveness, quality of work, and the TB
monitoring process. Thus, healthcare professionals are more likely to use mobile phone-based
SMS, if they think that PE is high (9, 23-27). Based on the above-mentioned literature, the
following hypotheses were investigated in this study:

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2 3 4 5	118	H1-PE has a positive influence on the intention to use mobile phone SMS technology.
6 7	119	H2-PE has a positive influence on attitudes toward using mobile phone SMS technology.
8 9	120	Effort Expectancy (EE): System design has to do with how simple it is to use, learn, and build new
10 11	121	skills, and comprehend how the suggested solution interacts with the user. In the treatment value
12 13	122	chain, healthcare professionals are expected to enter information, read it, and engage with
14	123	communication technology like mobile phones. According to studies, users' intention to utilize
15 16	124	technology is influenced by their effort expectations (9, 24, 25, 27). Based on these, the following
17 18 19	125	hypotheses were investigated in this study:
19 20 21	126	H3. EE has a positive influence on the intention to use mobile phone SMS technology
22 23	127	H4. EE has a positive influence on attitude to use mobile phone SMS technology
24 25	128	Social Influence (SI): Play a significant role in the adoption and continued use of the solution given
26 27	129	the experience of inconsistent adherence to reporting guidelines and treatment regimens by
28	130	patients, medical professionals, allied healthcare professionals, and organizations. Intention to use
29 30	131	the mobile phone for SMS may therefore be strong, if SI is positive (9, 23, 24, 27). In the context
31 32 33	132	of this, the following hypotheses were investigated in this study:
34 35 36	133	H5: SI has a positive influence on the intention to use mobile phone SMS technology.
37 38 39	134	H6: SI has a positive influence on attitudes toward using mobile phone SMS technology.
40	135	Facilitating Condition (FC): Conditions in the context of TB treatment monitoring include having
41 42	136	the knowledge and tools required to utilize the system as well as the proposed solution's
43 44	137	compatibility with existing systems (9, 23, 26, 27). On account of these empirical findings, our
45 46	138	study makes the following hypothesis:
47 48 49 50	139	H7.FC has a positive influence on the intention to use mobile phone SMS technology.
50 51 52 53	140	H8. FC has a positive influence on attitudes toward using mobile phone SMS technology.
55 54 55	141	Attitude (ATT): In a context with low resources, health professionals have little knowledge about
56 57 58	142	access to technology, which makes changing their attitude about using a new technology (17). We
59 60		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

- reasoned that including attitude as a category could seem pertinent to studying behavioral intentions to use new technology in certain contexts (17, 23, 25, 28-31). On account of those findings, our study makes the following hypothesis: H9: ATT has a positive influence on the intention to use mobile phone SMS technology. H10: Attitude mediates the relationship between PE and intention to use mobile phone SMS technology. H11: Attitude mediates the relationship between EE and intention to use mobile phone SMS technology. H12: Attitude mediates the relationship between SI and intention to use mobile phone SMS technology. H13: Attitude mediates the relationship between FC and intention to use mobile phone SMS technology. The main beneficiaries of this study will be patients, health professionals, Regional Health Bureaus (RHBs), and health organizations for health system practices. According to our search of the literature, little research has been done on the subject of healthcare professionals' intentions to use mobile phone short message service using the UTAUT model in Ethiopia. As a result, this study investigates, introduces, and empirically tests a modified theoretical model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model to identify the main factors influencing healthcare professionals' intention to adopt a mobile phone SMS system. **Methods and materials** Study design and setting The institutional-based cross-sectional study design was conducted from October to November 2022 at public hospitals in the Ilu Aba Bor and Buno Bedelle zones, Oromia Regional State, southwest Ethiopia. Illu Aba Bor Zone comprises one town administration and fourteen rural districts with a total population of 1,606,502, according to the 2019 District Finance and Economic
 - 169 Development Office annual data report. Among those zones, five hospitals exist, namely: Mettu170 Karl Referral Hospital, Dembi Hospital, Bedelle Hospital, Darimu Hospital, and Chora Hospital.
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Study Population

All healthcare professionals working in the southwest Oromia region of public hospitals in the two zones were used as study populations. All health professionals, working at public health hospitals, who were available during data collection time were included in the study. However, Health professionals with less than six months of working experience and who were on maternal or annual leave, or those who were seriously ill during the study period were excluded from the study.

Operational definition

Intention to use mobile-based SMS: the extent to which a person has made intentional plans to use new technology (32, 33). When a healthcare professional rates intention to use a technology measurement and scores median, and above the median was considered as intended to use mobile phone-based SMS, else not intended to use it, with a five-point Likert scale of three questions (32).

Sample size determination and sampling procedure

The sample size was estimated based on assumptions of determining model-free parameters via the modified model (32, 33) (Figure 1). By considering 25 variances of the independent variables, 6 covariance between independent variables, 16 load factors between latent and latent indicators, and 8 direct effects and 4 indirect effects of regression coefficients were estimated. Finally a total of 59 free parameters was estimated. But the variances of dependent variables, the covariance between dependent variables, and the covariance between dependent and independent variables are never parameters (34, 35). Accordingly, A 1: 10 ratio of responders to free parameters to be estimated was suggested to estimate the sample size based on the number of free parameters in the hypothetical model (32, 33, 36). As a result, the minimum sample size was 590, through taking participants with a free parameter ratio of 10. Since the computed sample size considers the 10% non-response rate. Thus, the final sample size of 649 study participants was calculated.

The number of healthcare professionals from the five hospitals was calculated using population proportional allocation and a simple random sampling technique. Finally, consecutive healthcare professionals who fulfilled the inclusion criterion were included in the study until the allocated size was obtained in each of the five hospitals.

198 Data collection tools, data quality control, and procedures

To investigate the hypotheses provided by this study, a structured questionnaire was used from earlier investigations (17, 28-31). There are two sections to the questionnaire. Section A; focuses on user demographic data Section B; contains 18 positive statements that symbolize the UTAUT constructs. A five-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree, was used to measure the constructs.

To control the quality of the data, two days of training were given to data collectors and supervisors on the objective of the study, data collection procedures, data collection tools, respondents' approaches, data confidentiality, and respondents right before the data collection date. Before the actual data collection, pretesting of the questionnaire was conducted among 10% of the study participants outside of the study (Jimma Hospital). After obtaining feedback from the respondents, language experts modified the wording of the questions.

The internal consistency of the items was estimated using the Cronbach alpha coefficient (C α), and composite reliability (CR). The results showed that all of the items' scores were above 0.7. The assumptions were examined for outliers, multi-collinearity, and independent error factors before running the structural equation model. The results showed that there was no existing multicollinearity, with the overall variance inflation factor (VIF) value being less than 2 and the tolerance being greater than 0.5.

Patient and public involvement

Patients and public were not involved

218 Data processing and analysis

Data from respondents were entered into Epi-Data version 4.6 and exported to SPSS version 25 for descriptive data analysis. Additionally, model constructs were evaluated using structural equation modelling (SEM) analysis via Analysis of Moment Structure (AMOS) version 26 software. To test measurement model, confirmatory factor analysis (CFA) using standardized data was used. As part of confirmatory factor analysis, a correlation between constructs less than 0.8 and factor loadings greater than 0.6 for each item was examined (37). The chi-square ratio (\leq 5), the tucker-lewis index (TLI>0.9), the comparative fit index (CFI>0.9), the goodness of fit index (GFI > 0.9), the adjusted goodness of fit index (AGFI > 0.8), the root means square error approximation (RMSEA<0.08), and the root mean square of the standardized residual (RMSR<0.08) were all used to evaluate the goodness of fit (38-40).

Data normality was evaluated using multivariate kurtosis < 5 and the critical ratio between -1.96 and +1.96. Multi-collinearity was also tested using VIF < 10 and tolerance > 0.1, as well as the correlation between exogenous constructs of <0.8, and there were no problems. In the measurement model, Cronbach's alpha test was used to assess construct reliability; each construct in the study met the required threshold of >0.70, and the composite reliability was above 0.70 (41). The Average Variance Extracted (AVE) approach, with values above 0.5, was used to assess the converging validity, while the square root of AVE in Fornell Larcker criterion, with values below 0.9, and the correlations with other latent constructs should have a lower value than the square root of AVE in each construct was used to assess the diverging validity (32, 39, 42, 43).

To evaluate a structural model, the critical ratio (CR) and the path coefficient were used to analyze the relationship between exogenous and endogenous variables. A p-value of less than 0.05 and 95% confidence intervals were used to assess the predictors' statistical significance. The influence and level of significance of each of the four possible mediation paths in the model were explored. partial mediation occurs when a construct's direct, indirect, and total effects are all statistically significant, and full mediation occurs when the direct and indirect effects are both statistically significant but the total effect is not. To confirm mediation, we typically looked for a substantial indirect effect with a p-value < 0.05.

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Results

248 Socio-demographic characteristics of healthcare professionals

A total of 625 study participants were included in the study with a response rate of 96.3% of them who gave their consent and responded to the questions. Of the total of (n=625) respondents, 343(54.9%) of them were males, 293(46.9\%) respondents were in the age group of <30 years and the mean age of the respondents was 32 ± 6.01 years About more than half of the respondents 451 (72.2%) had less than or equal to 3 years of work experience. In addition, 228(36.5%) of the respondents were medical doctor professionals (Table 1).

Table 1: Socio-demographic characteristics of health care professionals in a resource-limited setting, 2022 (n=625)

Sociodemographic	Category	Frequency(N)	Percentage (%)
Characteristics			
Gender	Male	343	54.9
	Female	282	45.1
Age (year)	<30	293	46.9
	30-39	254	40.6
	>40	78	12.5
Profession	Medical doctor	228	36.5
	Nurse	165	26.4
	Midwifery	117	18.6
	Health officer	46	7.4
	Others	115	11
Work experience	1-3	451	72.2
	3-5	62	9.9
	>5	112	17.9

Others: Anesthesia, Radiology, Psychiatry, and Pharmacy

260 Intention to use mobile-based SMS

Overall, 340 (54.4 %; 95% CI: [49.9–58.1]) healthcare professionals were intended to use mobile
phone-based SMS in southwest Ethiopia. The median score of intention to use mobile phone-based
SMS was 10.1, with a standard deviation of 3.3. The minimum and maximum scores were 3 and
15, respectively.

265 Measurement model

266 Reliability and validity of the construct

All of the constructs had Cronbach's alpha scores between 0.77 and 0.91 and composite reliability scores between 0.78 and 0.92, factor loadings of the items ranged between 0.64 and 0.89, and the value of AVE varied between 0.61 and 0.71. Therefore, all of the constructs had strong convergent validity (Supplemental Table 1).

According to the findings, the bolded values (diagonal values) or the square root of the AVE of the construct were higher than the other values in that column, and the raw. As a result, the model's constructs' discriminant validity has been proven (Supplemental Table 2).

Goodness of fit

The results in confirmatory factor analysis showed that model fit indices with respective values were chi squire difference($x^2/df=2.76$), Goodness-of-fit-index (GFI=0.93), Adjusted goodness-offit-index (AGFI=0.91), Comparative fit index (CFI=0.94), Tucker-Lewis's index (TLI=0.93), Root means the square error of approximation (RMSEA=0.05) and standardized root mean squared residual (SRMR=0.03). Accordingly, the goodness of fit model's values met the requirements.

Structural equation model

According to the result effort expectancy had a significant direct effect on health care professionals' attitude to using mobile phone short message service ($\beta = 0.162$, 95% CI: [0.061,0.270], P<0.01) and intention towards using mobile phone SMS ($\beta = 0.329$, 95% CI: [0.233, 0.433], P<0.001). The facilitating condition had a direct significant effect on healthcare provider's intention towards using mobile phone SMS ($\beta = 0.104$, 95% CI: [0.025, 0.191], P<0.01), and also

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healthcare professionals' attitude towards the system had a direct significant effect on behavioral intention to use mobile phone SMS ($\beta = 0.268, 95\%$ CI: [0.163, 0.373], P<0.001). whereas the relationship between performance expectancy ($\beta = 0.268, 95\%$ CI: [-0.017,0.170], P=0.109), social influence ($\beta = 0.015, 95\%$ CI: [-0.044, 0.075], P=0.610) and facilitating conditions ($\beta = 0.055, 95\%$ CI: [-0.026, 0.140], P=0.184) were not significant effect on health care professionals' attitude towards using mobile phone SMS, and the path relationship of performance expectancy ($\beta = 0.002$, 95% CI: [-0.088, 0.094], P=0.980) and social influence(β =-0.030, 95% CI: [-0.086,0.028], P=0.318) to use mobile phone SMS were not statistically significant (Table 2).

Table 2: SEM analysis of health care professionals' intention to use mobile phone short message
service and its predictors for adherence support and care of patients with tuberculosis infection in
a resource-limited setting

Path	Hypothesis	В	S. E	C.R	P-Value	95% CI		Decision
						Lower	Upper	-
PE → BI	H1	0.002	0.041	0.055	0.980	-0.088	0.094	Not
				\bigcirc				Supported
PE→ ATT	H2	0.076	0.044	1.70	0.109	-0.017	0.170	Not
					0,			Supported
EE → BI	H3	0.329	0.048	6.583	0.000***	0.233	0.433	Supported
EE→ ATT	H4	0.162	0.050	3.229	0.001**	0.061	0.270	Supported
SI → BI	H5	-0.030	0.030	-1.002	0.318	-0.086	0.028	Not
								supported
SI→ ATT	H6	0.015	0.032	0.475	0.610	-0.044	0.075	Not
								Supported
$FC \rightarrow BI$	H7	0.104	0.039	2.649	0.011**	0.025	0.191	Supported
FC→ ATT	H8	0.055	0.041	1.317	0.184	-0.026	0.140	Not
								Supported
ATT → BI	H9	0.268	0.054	4.956	0.001**	0.163	0.373	Supported

Note: ** p value <0.01, ***p value is <0.001 C, R: critical ratio S.E: standard error, CI: confidence
interval, β: estimate

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nding, performance expec s accounted for 68% and 74	
ort message services, respec	

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The results revealed that attitude played a mediating role in the relationship between health care professionals' effort expectations and their intention to use mobile phone short message service to support TB patients, as opposed to the relationship between performance expectancy, social influence, and facilitating conditions. Both the relationship between attitude and intention to use the system, as well as the regression coefficient between attitude and effort expectancy, were statistically significant. The indirect effect of the standardized estimation value was 0.043 and P< 0.01. In the context of this, the relationship between effort expectancy and an intention to use mobile-based SMS was statistically significant through attitude (Table 3).

Table 3: Mediating effects of Attitude and health care professionals' intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting

Path	Hypothesis	Effect	β	P-value	Result	Decision
PE → AT → BI	H10	Total effect	0.025	0.643	No	Not
		Indirect effect	0.023	0.090	relationship	Support
		Direct effect	0.003	0.982		
EE → AT → BI	H11	Total effect	0.365	0.000***	Partial	Support
		Indirect effect	0.043	0.001**	Mediation	
		Direct effect	0.323	0.000***		
SI→AT→ BI	H12	Total effect	-0.038	0.390	No	Not
		Indirect effect	0.006	0.587	relationship	Support
		Direct effect	-0.323	0.311	-	
FC→AT→ BI	H13	Total effect	0.136	0.005 **	Direct	Not
		Indirect effect	0.017	0.158	relationship	Support
		Direct effect	0.119	0.012*	-	

*Significance at P< 0.05, **significance at P< 0.01, ***significance at P< 0.001, β : estimate

Discussion

This study was to determine the level of intention and its predictors that may influence the use of mobile phone short message service systems to support adherence and care of TB patients. Overall, 340 (54.4 %; 95% CI: [49.9–58.1]) of healthcare professionals intended to use mobile phone-based SMS to support TB patients in southwest Ethiopia. This finding was higher than the study done on the intention of health providers' electronic medical records in the Amhara regional state of Ethiopia (39.8%) (44). This discrepancy could be due to the study period and the use small sample size. Similarly, the willingness of healthcare professionals to use mobile-based health services in Ethiopia was 44% (45). This possible difference could be due to the study participants only obstetric health providers and they used a smaller sample size.

The findings show that effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' behavioral intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectation and intention to use the system. Thus, H3, H4, H7, H9, and H11 were supported and thus can be used as effective measures of mobile phone SMS adoption in resource-limited settings.

According to the findings, healthcare professional effort expectancy had a positive direct effect on attitude and both direct and indirect effects on the intention to use mobile phone SMS. This suggested that when healthcare professionals perceived the system's simplicity or lack of effort in use, their perceptions of its usefulness, attitude, and intention to use mobile phone SMS were significantly improved. This finding is consistent with findings from other studies in different countries (9, 25, 46-48). This could be because an individual's attitude and acceptance of the use of mobile phone SMS systems are greatly affected by the work required to manipulate the system and if the system is expected to manipulate people's intentions to use mobile phone SMS systems with less effort, the system's performance will improve (49). As a result, when implementing the use of mobile phone SMS technologies, the system should be simple for healthcare providers to understand and use to ensure long-term system adoption.

Facilitating conditions also positively influenced the intention to use mobile phone short message services to support adherence and care of TB patients. This showed the significance of creating

the organizational and IT requirements for this example, including the resources, technical support, and training that are necessary for the adoption and ongoing use of mobile-based SMS-enabled solutions by healthcare providers in the public health system This finding is consistent with findings from other studies in different countries (9, 26, 27, 50). This could be because health professionals think that as mobile phone use has increased, more people have access to them and are familiar with using devices to communicate with their intended recipients. As a result, they are convinced and have no trouble supporting patient care and adherence.

Health professionals' attitudes positively influenced their intention to use mobile phone SMS. Medical experts supported the usage of mobile phone SMS as a tool for bettering their health and the standard of tuberculosis treatment as they observed it being done. This finding is in line with findings from other studies done in different settings (9, 23, 51-53). Therefore, it is important to give priority to initiatives that change attitudes, such as providing mobile devices at work, providing ongoing training and assistance, and fostering knowledge exchange about eHealth technologies such as mobile SMS for the remainder of the patient's care.

Accordingly, this study provides theoretical and practical implications; the findings might alleviate any concerns regarding mobile-based SMS and its acceptability in resource-constrained environments. MHealth and other digital communication technologies have a positive impact on healthcare. The study also offers a framework for future interventional research aimed at developi ng and evaluating mobile text messaging interventions as a means of enhancing tuberculosis prev ention programme.in Ethiopia. Policymakers, healthcare providers, and planners should be concerned about improving the ability of users by providing technological resources, technical support, and training to adopt mobile-based SMS in Ethiopia.

Conclusions

Overall, healthcare professionals' intention to use mobile-based SMS was high. Effort expectancy, attitude, and facilitating conditions were significant factors that determined healthcare professionals' intention to use mobile phone SMS. Effort expectancy also influences healthcare providers' attitudes toward using these systems. Furthermore, the attitude acted as a partial mediator between effort expectations and the intention to use the system. Among the five influencing predictors, effort expectancy had a more significant prediction power for healthcare

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providers' intention to use mobile phone SMS systems. Therefore, easily interactive and applicable forms of the system should be implemented for health care professionals, as well as improving capacity and building on the simplicity of technology to support adherence and the care of TB patients. Finally, we recommend that upcoming investigators include external variables, and all health institutions, similarly, support it with a qualitative study. **Abbreviations and acronyms**

AMOS: Analysis of Moment and Structure; ATT: Attitude; BI: Behavioral Intention; CI: Confidence Intervals; EE: Effort Expectancy; FC: Facilitating Condition; PE: Performance Expectancy; SEM: Structural Equation Modelling: SI: Social Influence; SMS: Short Message Service; SPSS: Statistical Package for Social Science; UTAUT: Unified Theory of Acceptance and Use of Technology; WHO: World Health Organization

Ethics approval and consent to participate

Ethical clearance was obtained from Mettu University's ethical review committees with approval number MeU/RAC/1036/15. Each hospital provided a letter of permission. Each participant in the study gave their written and oral consent after being informed of the study's goal. Furthermore, all data collectors and investigators strictly adhered to the law's requirements for data privacy and confidentiality. Furthermore, the study was done according to the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

Upon reasonable request from the corresponding author, the datasets created and/or analyzed during the current work will be made available.

- **Competing interests**
- The authors declare that we have no competing interests.

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Authors' contributions

ADW contributed to conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, and writing -original draft, AWD did the conception and design, acquisition of data or analysis and interpretation of data, and **MKH** contributed the funding acquisition, investigation, methodology, and resources. ADW and AWD wrote the final draft of the manuscript, and the final draft of the manuscript was read, edited, and approved by all authors.

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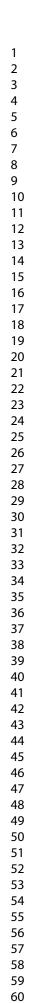
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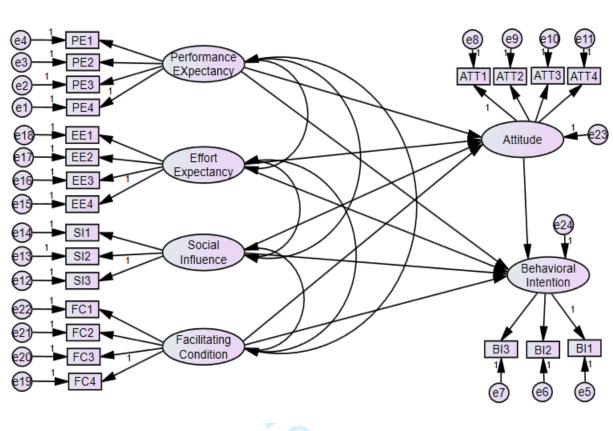
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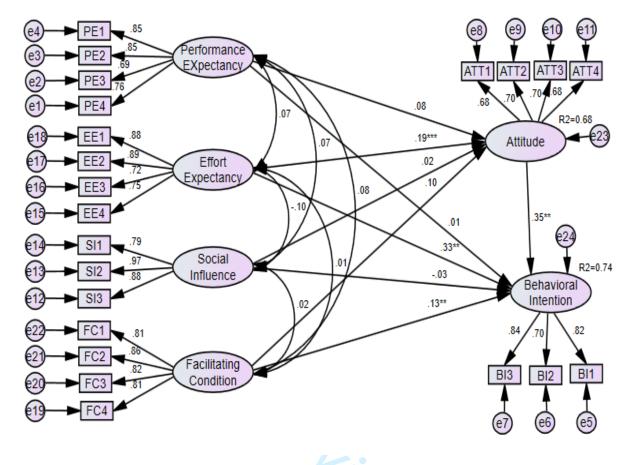
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29 30	572	Figures
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34	574	Figure 1: Modified UTAUT models of health care professionals' intention to use mobile phone
35 36	575	short message service and its predictors for adherence support and care of patients with
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38	576	tuberculosis infection in a resource-limited setting, 2022
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42 43	578	Figure 2: SEM analysis of health care professionals' intention to use mobile phone short message
44	579	service and its predictors for adherence support and care of patients with tuberculosis infection in
45 46	580	a resource-limited setting, 2022
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51 52	592	Supplemental tables
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3 4	585	Supplemental Table 1: Convergent validity between constructs of health care professionals'
5 6	586 587	intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting, 2022
7 8	588	
9 10	589	Supplemental Table 2: Discriminant validity between constructs of health care professionals'
11	590	
12 13	591	intention to use mobile phone short message service and its predictors for adherence support and care of patients with tuberculosis infection in a resource-limited setting, 2022
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Construct	Indicators	Standard	Composite	AVE	Convergent
	/Items	loading	Reliability		Validity
Performance	PE1	0.85	0.88	0.65	Established
Expectancy	PE2	0.84			
	PE3	0.67			
	PE4	0.74			
Effort	EE1	0.87	0.91	0.69	Established
Expectancy	EE2	0.89			
	EE3	0.69			
	EE4	0.73			
Social	SI1	0.78	0.90	0.68	Established
Influence	SI2	0.97			
	SI3	0.88			
Facilitating	FC1	0.81	0.92	0.72	Established
Condition	FC2	0.84			
	FC3	0.83			
	FC4	0.82			
Attitude	ATT1	0.67	0.78	0.61	Established
	ATT2	0.71		2	
	ATT3	0.68		0	
	ATT4	0.66			
Behavioral	BI1	0.80	0.79	0.64	Established
Intention	BI2	0.64		1	
	BI3	0.82			

Note; AVE: Average Variance Extracted

Construct	PE	EE	SI	FC	ATT	BI	Divergent
							Validity
Performance	0.806						Established
Expectancy (PE)							
Effort	0.143	0.831					Established
Expectancy (EE)							
Social	0.436	0.516	0.825				Established
Influence (SI)							
Facilitating Condition	0.533	0.178	0.543	0.848			Established
(FC)	1						
Attitude (ATT)	0.366	0.601	0.383	0.511	0.781		Established
		6					
Behavioral	0.325	0.556	-0.112	0.362	0.603	0.800	Established
Intention to use (BI)							
			(CZ				

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STROBE Statement—Checklist of items that should be included in reports of <i>cross-sectional studies</i>	

	Item No	Recommendation	Page No
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title or	2
		the abstract	
		(b) Provide in the abstract an informative and balanced summary of what	3
		was done and what was found	
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being	3-5
-		reported	
Objectives	3	State specific objectives, including any prespecified hypotheses	5-9
Methods			
Study design	4	Present key elements of study design early in the paper	10
Setting	5	Describe the setting, locations, and relevant dates, including periods of	10
e		recruitment, exposure, follow-up, and data collection	
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection	10
1 · · · ·		of participants	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders,	5-9
		and effect modifiers. Give diagnostic criteria, if applicable	
Data sources/	8*	For each variable of interest, give sources of data and details of methods	11-
measurement		of assessment (measurement). Describe comparability of assessment	12
		methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	10
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If	12
		applicable, describe which groupings were chosen and why	
Statistical methods	12	(<i>a</i>) Describe all statistical methods, including those used to control for	11-
		confounding	12
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling	
		strategy	
		(e) Describe any sensitivity analyses	
Results			1
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers	14
	15	potentially eligible, examined for eligibility, confirmed eligible, included	
		in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical,	14-
	11	social) and information on exposures and potential confounders	15
		(b) Indicate number of participants with missing data for each variable of	
		interest	
Outcome data	15*	Report numbers of outcome events or summary measures	15,1
Main results	16	(<i>a</i>) Give unadjusted estimates and, if applicable, confounder-adjusted	10,1
	10	estimates and their precision (eg, 95% confidence interval). Make clear	
		commutes and then precision (e.g., 2570 confidence interval). Wake clear	1

		(b) Report category boundaries when continuous variables were	15
		categorized	16
		(c) If relevant, consider translating estimates of relative risk into absolute	
		risk for a meaningful time period	
Other analyses	17	Report other analyses done-eg analyses of subgroups and interactions,	16
		and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential	18
		bias or imprecision. Discuss both direction and magnitude of any potential	
		bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	17
		limitations, multiplicity of analyses, results from similar studies, and other	18
		relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present	20
		study and, if applicable, for the original study on which the present article	
		is based	

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.