Internet use and e-health literacy among tuberculosis patients in the Directly Observed Therapy Centre, Lagos State, Nigeria

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Introduction. This study investigated Internet use and e-health literacy among tuberculosis patients attending Directly Observed Therapy Centre in Lagos State, Nigeria.

Method. The study population comprised registered adult tuberculosis patients on active treatment and assessing healthcare in the designated Directly Observed Therapy Centre. Data were collected using a questionnaire and e-health literacy was measured using the 8-item e-health literacy scale.

Analysis. Descriptive statistics and Pearson correlation coefficient was used for the analysis.

Results. The findings of the study revealed that a majority (73.3%) of the respondents had mobile phone devices for accessing e-health information and acknowledged that the Internet is very useful to their health. However, many of them did not have the skills to evaluate the health resources found on the Internet and cannot differentiate high quality from low quality health resources. Hence many of the patients did not feel confident in using information sourced from the Internet. The result of the hypotheses shows that educational level was significantly associated with usefulness and perceived importance of online health information ($r= 0.189$, $p=0.010$).

Conclusion. The results showed the need to inculcate e-health literacy into the educational program of tuberculosis patients in the country, and how to evaluate online information as a reliable source of medical information.

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Introduction

The proliferation of information technology in the developed and developing world has created opportunities for individuals, organizations, governments, healthcare providers and patients to have access to a variety of information resources. For the health sector, this has immensely facilitated health care service delivery, training, and research (Albabtain et al., 2014). The application of information communication technology has altered how health care is provided and accessed by patients and healthcare professionals.

This development has generated exciting new possibilities to improve patients' healthcare by providing instant access to a variety of information sources. The Internet, particularly the Web, has become a ubiquitous part of our information lives, so that most people have access to and are comfortable with using it to look for health-related information. The Internet has become an increasingly important source of health information for the public and patients (Marton and Choo, 2012). Many patients believe that using electronic and web-based resources can help improve their quality of life. This situation has motivated patients to seek online for health-related information pertaining to their health challenges. As such, e-health literacy is now a global issue and public health concern because of the accessibility to health information through information technology, which has proven to influence health outcomes and improves health conditions.

Literature review

Concepts of e-health and e-health literacy

The introduction of information technology as a tool and source of information about health has necessitated the concept of e-health and e-health literacy. Both concepts lack a collective accepted precise definition because they vary with the context in which the terms are used. Oh, et al. (2005) stated that there is no universally acceptable, universally applicable formal definition of e-health. E-health as a term is used to describe the use of Internet and other electronic technologies to enhance health (Alkhatlana et al., 2018).

Therefore, from the above definitions, there is a general consensus and recognition on the use of technologies and the Internet for health care either by healthcare-providers or patients. To simply put, e-health is designed to make it easier to access and share valuable information for health purposes. However, e-health or availability of technologies and the Internet does not automatically translate to improvement of health condition. Electronic health tools provide little value if the intended users lack the skills to effectively engage them (Norman and Skinner, 2006a). As such, in order to utilise health information on the Internet appropriately, e-health literacy has been identified as a prerequisite for obtaining and using such information to promote self-care and shared decision making.

Norman and Skinner (2006b) defined e-health literacy as the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem. Bautista (2015) criticized the definition of Norman and Skinner because it focused on the ability of the individual in making decision, instead of the collective goal of improving the healthcare system. Based on this premise, Bautista defines e-health literacy as the interplay of individual and social factors in the use of digital technologies to search, acquire, comprehend, appraise, communicate and apply health information in all contexts of healthcare with the goal of maintaining or improving the quality of life throughout the lifespan. With e-health tools that are commonly available, it has tremendously helped many patients by bridging the gap between what is known and unknown about their health condition. In the past, providing instructions about prevention and management of ailment was exclusively the role of health care provider, but the emergence of the Internet has made this information largely available to the public and removed professionals' monopoly on it (Valizadeh-Haghi and Rahmatizadeh, 2018).

Accordingly, e-health literacy is more than just the ability to read and understand Internet health related information; it also includes the motivation, ability and individual confidence to use the information to help improve health condition. Hence, e-health literacy is a function of a different set of skills; it is highly affected by different factors including individual characteristics, behavioural, cultural and economic factors (Akomolafe, 2014). Thus, Valizadeh-Haghi and Rahmatizadeh (2018) suggested that health professionals should have a proper understanding of the patients' ability to use electronic resources before recommending the use of online health information, and it is consequently necessary to assess people's e-health literacy level.

Evidence has shown that patients with adequate e-health literacy are usually well informed and can cope better with their health condition (Khan et al., 2018). Several studies have been conducted on the e-health literacy of patients in different cultural

settings. Findings of Alkhatlana et al., (2018); and Alwehaibi and Almeman (2014) discovered that many patients are using the Internet for obtaining health related information, especially disease-specific information. Abdullah and Pauzi (2016) found out that the prevalence of Internet use among the primary care patients is high but the e-health literacy skill is still poor. Low e-health literacy can prevent patients from making effective utilisation of online health information, and so lead to uncertainty or wrong choices.

Similarly a study by Stellefson et al. (2018) revealed moderate levels of e-health literacy with the majority of the respondents feeling confident in their ability to find helpful health resources on the Internet. However, respondents were much less confident in their ability to distinguish between high- and low-quality sources of Web-based health information. Although there is abundant access to health information on the Web, this also comes with dangers, especially if the quality of the content is poor and unregulated (Waterston and Pakenham Walsh, 2018). On the means of accessing the Internet by patients, Wentink et al. (2018) reported that a considerable number of their respondents (78%) used one or more devices every day, with the most frequently used devices being personal computer or laptop and smartphone.

Although several studies have been conducted on the use of the Internet and technology as means of providing health information to patients in many diseases-related situations (Abdullah and Pauzi, 2016; Kalichman et al., 2005; Stellefson,et al., 2018; Obiyo et al., 2016), the e-health literacy of tuberculosis patients have not been adequately considered when employing technology for fighting the diseases (Falzon and Raviglione, 2016). DiStefano and Schmidt (2016) posited that the use of technologies in the management of tuberculosis holds considerable promise to improve quality and efficiency in healthcare.

One of the factors that can influence the treatment outcome of tuberculosis patients is access and use of electronic health information. It remains one of the major determinants of tuberculosis patients' response to decision; this is because having adequate information and understanding health situation would enable patients to play an active role in making decisions about their health. Every patient needs access to information about choice of treatment, medication information, nutrition, disease management and chances of survival amongst other. Coupled with the fear and stigmatisation associated with the disease, many patients are having difficulty accessing health related information from members of the community. Nevertheless, the Internet has provided opportunities to information access regarding health through a wide range of e-health information in a timely manner.

Tuberculosis: an overview

Tuberculosis, or TB, is an infectious bacterial disease caused by the Mycobacterium tuberculosis, which most commonly affects the lungs, although it can spread to the organs around the body (Idigbe, 2014). Tuberculosis is an airborne disease, it is usually transmitted when individuals with infectious tuberculosis cough, sneezes, talk, or spit droplets and, by so doing, expel tuberculosis bacilli into the air (Webber, 2012); thus, transmission is rampant in crowded and poorly ventilated environs (Hassan et al., 2017). Tuberculosis has been identified as one of the top ten causes of death globally. In 2019, ten million people were sick with tuberculosis and 1.4 million died from the disease. Tuberculosis affects all age groups across the world. However, the disease commonly affects young adults and people living in low-income countries (World Health Organization, 2020).

Many innovative electronic health and mobile health schemes have been introduced by tuberculosis programmes globally as a support of efforts to improve treatment and prevention (Raviglione, 2015). Recognizing the importance of Internet health related information for clinicians and patients, Yu et al. (2001) provided a starting point and central location, known as a portal, for a number of common uses of the Internet related to tuberculosis. They classified the selected Web pages according to user needs. The mortality and morbidity cases of tuberculosis are increasingly becoming a source of concern to the society. There is an urgent need to find effective strategies at every level to prevent and manage the disease. Thus, it is imperative to develop means of controlling the infection through health information literacy as a complement to clinical treatment.

Research objectives and methods

Aim of the study

The main aim of the study is to investigate Internet use and e-health literacy among tuberculosis patients in the Directly Observed Therapy Centre (hereafter, the Centre) in Lagos State, Nigeria.

Research questions

a. What is the most preferred device used for accessing e-health information?
b. What is the usefulness of the Internet to health decision making of tuberculosis patients under study?
c. What is the perceived importance of having access to Internet health resources among tuberculosis patients under study?
d. What is the e-health literacy of tuberculosis patients under study?

Hypotheses

1. There is a significant relationship between socio-demographic variables and perceived usefulness of the Internet.
2. There is a significant relationship between socio-demographic variables and perceived access to health resources on the Internet.

Methods

A cross-sectional study design was adopted for the study carried out at the Centre, Nigerian Institute of Medical Research, Lagos State. The Institute is a tertiary health institution that serves as research institute and a referral site for the diagnosis and treatment monitoring of patients with tuberculosis. The study population comprises all the male and female registered adult tuberculosis patients of 18 years or older who were on active treatment and assessing healthcare at the time of the study. The E-health literacy scale (eHEALS) developed by Norman and Skinner (2006a) was adopted as the instrument used for the data collection. Cronbach's alpha was used to test the internal consistency of the instrument, and returned a correlation coefficient of 0.92 which agrees with those reported in other studies (Norman and Skinner, 2006b; Valizadeh-Haghi and Rahmatizadeh, 2018). The participants consisted of all the patients presenting to the Centre's clinic between June 2019 - February 2020. A total of one hundred and ninety-eight (198) patients participated in the study.

Ethical approval for the conduct of the study was obtained from the Institutional Review Board of the Nigerian Institute of Medical Research, Lagos State, Nigeria (IRB No.1/19/012). Written informed consent was obtained from the study participants. The data collection was anonymous to ensure confidentiality. Instruction on how to fill the questionnaire was provided after carefully explaining the focus of the study to the respondents by both researcher and the research assistants. All the respondents of the study signed a participation form of informed consent obliging to

participate in the study. The data obtained were coded using the Statistical Package for Social Sciences (SPSS) version 21. The Pearson correlation coefficient was used to test the hypotheses at $\alpha = 0.05$ level of significance. Out of the 198 questionnaire retrieved from the respondent of the study, 185 were found useful for study.

Results

The socio-demographic characteristics of the respondents are shown in Table 1. Among the 185 tuberculosis patients studied, the majority 116 (62.7%) of respondents were males and 68 (36.8%) were females, and 1 (.5%) did not respond. The results revealed that among the 185 respondents, 30.3 % were 45 years and above, 23.2% were between 25-34 years of age, 18.4% were aged 35-39 years, 17.3% between 40-44 years, while 10.8% of the respondents were between 18-24 years. 94 (50.8%) were married, single 67 (36.2%), widowed 10 (5.4%), divorced 9 (4.9%), separated 5 (2.7%). The result shows that the majority of the respondents have secondary school education with 42.7% of them admitting that they are secondary school certificate holders, 24.9% have attended tertiary education, 18.4% have primary school education, 8.1% did not go to school, while only 5.9% have other forms of qualification. The study shows that 23.2% of the respondents were working in a private organization and trading respectively, 15.1% were self-employed, 12.4% employed as civil servants, and 9.2 % were students.

Variable	Frequency	Percentage
Sex		
Male	116	62.7
Female	68	36.8
No response	1	0.5
Total	**185**	**100**
Age		
18-24	20	10.8
25-34	43	23.2
35-39	34	18.4
40-44	32	17.3
45 and Over	56	30.3
Total	**185**	**100**
Marital Status		
Single	67	36.2
Married	94	50.8
Divorced	9	4.9
Separated	5	2.7
Widowed	10	5.4
Total	**185**	**100**
Education		
None	15	8.1
Primary	34	18.4
Secondary	79	42.7
Tertiary	46	24.9
Other	11	5.9
Total	**185**	**100**
Occupation		
Civil Servant	23	12.4
Private Orgzn.	43	23.2
Trading	43	23.2
Self-employed	28	15.1
Unemployed	12	6.5
Student	17	9.2
Artisan	7	3.8
Others	12	6.5
Total	**185**	**100**

Table 1: Socio-demographic characteristics of respondents (n=185)

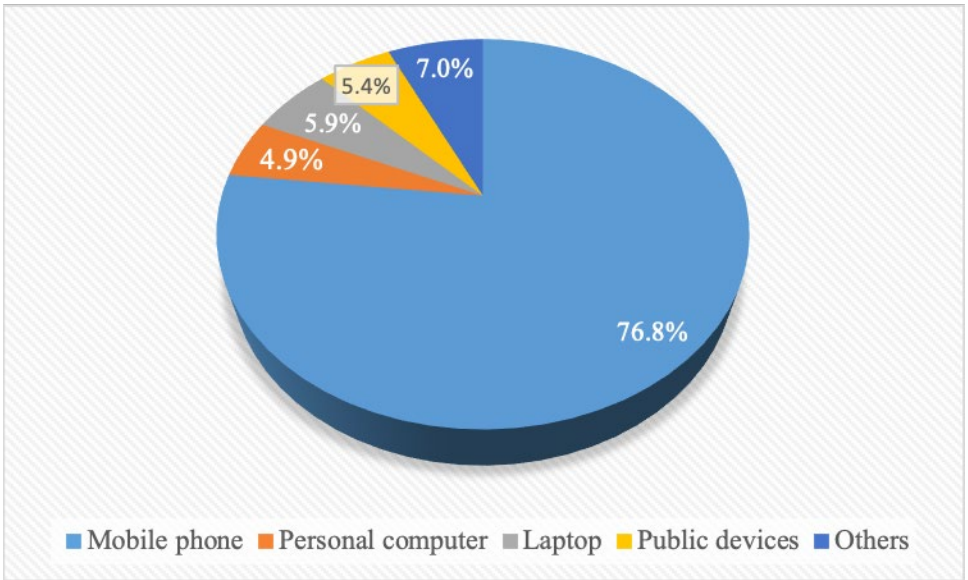

Figure 1: Preferred devices for e-health information

In figure 1, the preferred devices for accessing e-health information included mobile phones (76.8%), laptops (5.4%), public devices and the least used (4.9%) were personal computers.

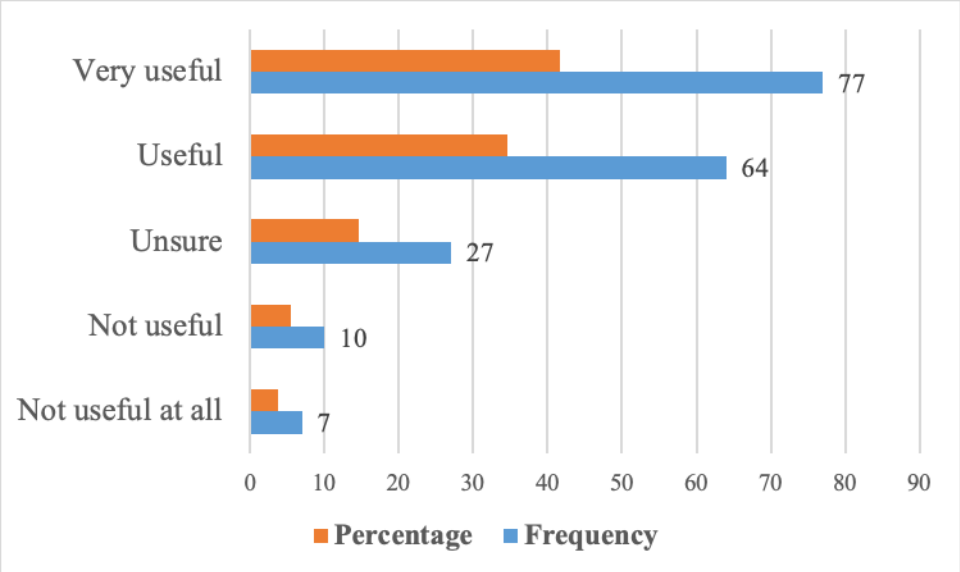

Figure 2: Perceived usefulness of the Internet in making decisions about health

Respondents' perceived usefulness of the Internet in helping them make decisions about their health is illustrated in Figure 2. Results showed that 141(75.2%) considered it to be useful or very useful. In contrast, 17 (9.2%) considered it not useful or not at all useful, while 27 (14.6%) were undecided.

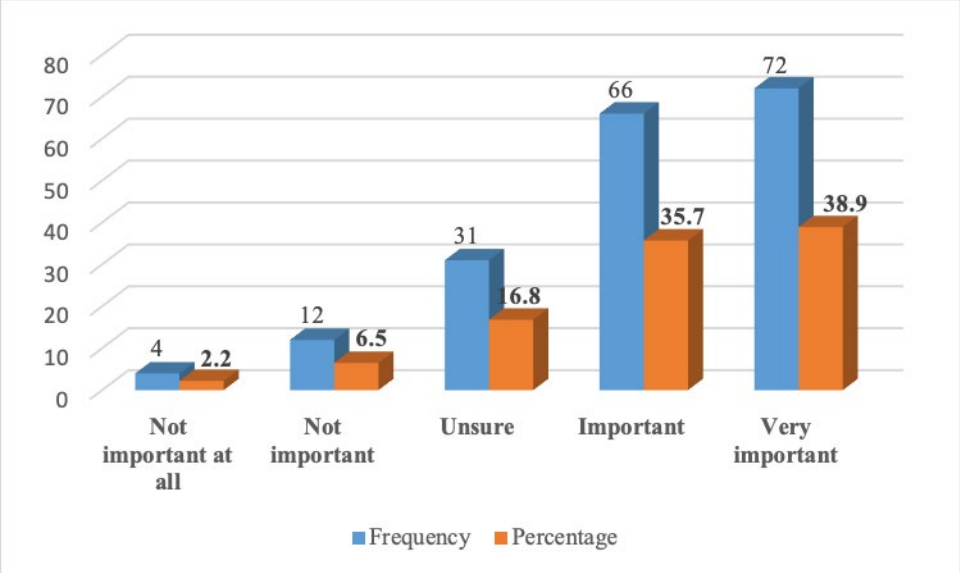

Figure 3: Perceived importance of access to health resources on the Internet

On the important of access to health resources on the Internet, Figure 3 indicated that 38.9% of respondents considered it very important, 66 (35.7%) important, 31 (16.8%) unsure, 12 (6.5%) not important and the least 4 (2.2%) considered it not important at all.

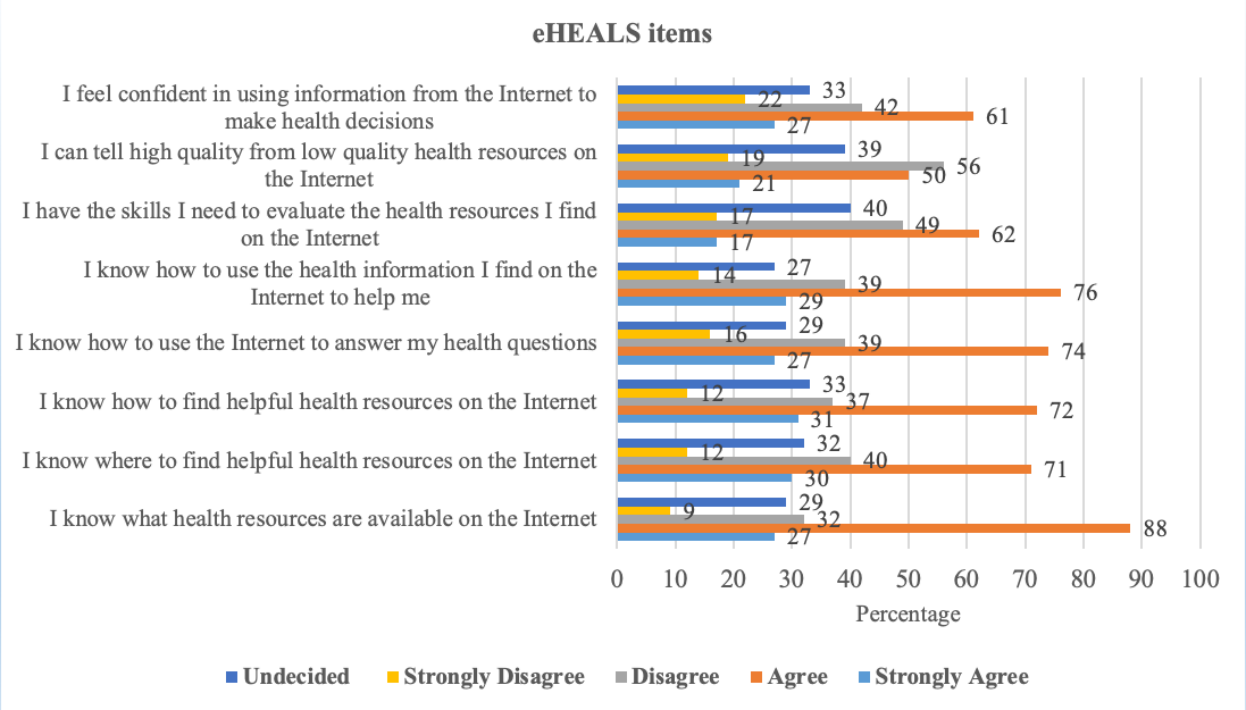

Figure 4: Responses frequencies to eHEALS items

Regarding the eHEALS items, figure 4 shows the frequency of responses to each item. On knowing what health resources are available on the Internet, the result reveals that an overwhelming majority of the respondents 88 (47.6%) agreed to knowing what health resources are available on the Internet. As regards the ability to find helpful health resources on the Internet, 71 (38.4%) of the respondents agreed to know where to find helpful health information on the Internet, meanwhile 40 (21.6%) disagreed. On how to find helpful health resources on the Internet, 72 (38.9%) of the respondents agreed to know how to find helpful health resources on the Internet.

E-health literacy scale	Mean	St. Dev.
I know what health resources are available on the Internet	3.41	1.25
I know where to find helpful health resources on the Internet	3.30	1.30
I know how to find helpful health resources on the Internet	3.30	1.32
I know how to use the Internet to answer my health questions	3.29	1.27
I know how to use the health information I find on the Internet to help me	3.36	1.25
I have the skills I need to evaluate the health resources I find on the Internet	2.99	1.29
I can tell high quality from low quality health resources on the Internet	2.97	1.29
I feel confident in using information from the Internet to make health decisions	3.15	1.31
Mean = 3.22		

Table 2: Mean and standard deviation of eHEALS items

Table 2 depicted shows the mean and standard deviation responses to the eHEALS items. The overall mean score indicates that the respondents had moderate e-health literacy skills on a 5-point likert scale. 'I know what health resources are available on the internet' had the highest mean score (3.41±1.25) followed by 'I know how to use the health information I find on the internet to help me' (3.36 ±1.25) on a 5-point likert scale. 'I have the skills I need to evaluate the health resources I find on the internet' (2.99 ±1.29), and 'I can tell high quality from low quality health resources on the internet' (2.97 ±1.29) had the lowest mean score.

Hypothesis testing

Hypothesis one: There is a significant relationship between socio-demographic variables and perceived usefulness of the Internet.

Variable		Sex	Educational levle	Occupation	Marital status
Usefulness of Internet	Pearson correlation	0.078	0.189	0.104	-0.057
	Significance (2-tailed)	0.289	0.010	0.160	0.441
	N	185	185	185	185

Table 3: Pearson product moment correlation showing the relationship between perceived usefulness of Internet to tuberculosis patients and socio-demographic variables.

Table 3 indicate that the usefulness of the Internet has no significant relationship with sex (r= 0.078, p=0.289), occupation (r = 0.104, p=0.160), or marital status (r = -0.057, p=0.441). However, the usefulness of the Internet has a significant relationship with the educational level of respondents (r = 0.189, p=0.010).

Variable		Age	Sex	Educational level	Occupation	Marital status
Access to health resources on the Internet	Pearson correlation	0.055	-0.118	0.188	0.066	-0.062
	Significance (2-tailed)	0.454	0.109	0.010	0.371	0.401
	N	185	185	185	185	185

Table 4: Pearson product moment correlation showing the relationship between access to health resources on the Internet tuberculosis patients and socio-demographic variables.

Table 4 indicates that perceived access to the Internet has no significant relationship with sex (r = 0.055, p=0.454), occupation (r= 0.066, p=0.371), or marital status (r= -0.062, p=0.401). However, the usefulness of the Internet has a significant relationship with the educational level of the respondents (r= 0.188, p=0.010).

Discussion

This study investigated Internet use and e-health literacy among tuberculosis patients attending Directly Observed Therapy Centre in Lagos State, Nigeria. One of the important considerations about the use of the Internet for health information purposes is the issue of access. It is imperative to identify if the patients have access to electronic device and how to use them. The outcome of the study shows that the most common devices for accessing e-health information among the respondents was mobile phones 142 (76.8%) with others using laptops, and other devices. This finding is consistent with the study of (Ramirez et al., 2016), which found an increased use of mobile phones with Internet capability among patients.

The outcome is also consistent with the study of Wentink et al. (2018) who found that patients used one or more devices every day, which included personal computer/laptop, smartphone, and tablet. This may be attributed to the availability of lower points phones and many network service providers in Nigeria, which have paved way for more Nigerians to own a device. Mobile phone penetration in Nigeria continues to be on the rise, with the number of subscribers rising in 2017, reaching 84 percent from 53 per cent in 2016 for both features and smart phones (Adepetun,

2018). By implication, the increased penetration of smartphones and expanding wireless network coverage provides digital health information sources with new possibilities to address barriers associated with inaccessibility to health information. Access to electronic devices and the Internet may encourage patients to go online for health information regarding their illness.

On the usefulness of the Internet, the study established that the largest proportion of the respondents (77, 41.6%) considered the use of Internet to be "very useful" in helping them in making decisions about their health. This finding is in consonance with the findings of (Akerkar et al., 2005). This outcome also corroborates the findings of Alwehaibi and Almeman, (2014); Alkhatlana et al., (2018) who reported that patients in Saudi Arabia and Kuwait respectively; are now using Internet to find specific-health related information having realized its importance to their health improvement. However, this is contrary to the finding of Muhamad et al. (2011) that cancer patients' reported that information on the Internet were not useful to improve their knowledge about health care issues.

On how important it is for the respondents to be able to access health resources on the Internet, again,the biggest group of the respondents (72, 38.9%) also considered the Internet to be "very important" to their health outcomes by making health information easily accessible. This may be attributed to the fact that the Internet provides an easy method of acquiring medical information that was previously available only through medical professionals. Access to health information is important to health especially for patients fighting deadly disease such as tuberculosis. Nigeria as a developing nation, there has been some concern that people at lower socio-economic ranks do not have equal access to Internet health resources. It is clearly understandable that access to computers/mobile devices are limited, literacy abilities are insufficient, and always inadequate basic technological skills. This outcome is in agreement with the outcome of Chiu (2011) who found out that patients acknowledge the importance of access to health-related information from the Internet, as it helps to understand and clarified unclear health information received from doctors.

While information technology is revolutionising the health sector for both patient and health professionals, it is imperative to know how tuberculosis patients could utilize electronic information in order to improve their health condition. E-health literacy through 'e-heals' seek to measure how knowledgeable and comfortable people are at finding, evaluating and applying electronic health information to health problems, and how they perceive their skills. On the e-health literacy of the respondents, the largest group of respondents (88, 47.6%) "agreed" that they know about the availability of health resources on the Internet and "agreed" that they know where to find helpful health resources on the Internet. This finding is supported by

Yusuf and Alhaji (2015) who found that a high proportion of the patients are Internet users and are knowledgeable on the use of Internet, how to search for information.

However, the largest group of respondents (56, 30.3%) admitted to the inability to differentiate between high quality from low quality health resources found on the Internet. Hence, many of the respondents did not feel confident in using information sourced from the Internet to make health decisions. This corroborates the results of Abdullah and Pauzi, (nd) in Malaysia, where most of the patients were unable to determine the quality of information they read on the Internet, and this influenced their confidence in using information obtained from the Internet to make health decisions. This outcome is also in line with the findings of Stellefson (2018) who found out that their respondents were much less confident in their ability to distinguish between high - and low-quality sources of Web-based health information. Hence, Blair (2004) asserted that, even though information obtained from the Internet can empower patients and care-givers, there are worries about the quality of the information because they could be misleading or false since many of the websites are not subjected to editorial peer-review. Thus, it was suggested that users, especially patients, need to be critical of information obtained through the Internet. Therefore, healthcare practitioners need to know whether patients access Internet resources, discuss the implications and suggest websites that have reliable health information as well as provide guidance on how to evaluate Internet resources.

From the outcome of this study, hypothesis result shows that certain socio-demographic variables like gender, occupation and marital status were not significantly related or associated with usefulness of Internet and perceived access to health-related resources. However, there was a significant relationship between perceived usefulness / perceived access to health resources on the Internet and education. This shows that those that consider the usefulness and perceived access to Internet for health information were more educated. This outcome supported the view of Korp (2006) that, “well-educated and well-off have access to and use the Internet to a much greater extent than those who are less well educated and who are less well off”. This suggests that well-educated patients were more likely to search for health information online and as such they are likely to have good health outcome. For those who do not have high educational experience and exposure to computers or the Internet, online health information may present a formidable challenge. Thus it could be infer that the higher the educational attainment the more familiarity and skills an individual may have with Internet resources.

Conclusion and recommendations

The importance of the Internet and e-health has been identified by many health researchers. This study has shown that the most common devices for accessing e-health information among the respondents was mobile phone. The study also revealed that the respondents that use the Internet consider it "very useful and very important" in helping them in making decisions about their health condition. The study also established that the biggest group (88, 47.6%) of the respondents agreed that they know about the availability and where to find helpful health resources on the Internet. Nevertheless, a majority of respondents said they cannot differentiate between high quality and low quality health resources found on the Internet. Hence, many of the respondents did not feel confident in using information sourced from the Internet.

Based on the findings of the study, the following recommendations were made: the study suggests the need for healthcare providers and information professionals to collaborate to come up with ways to develop tuberculosis patients' e-health knowledge and skills, especially on ways to interpret health information for effective use. The federal government of Nigeria through the Ministry of Health should plan and implement a nationwide program to educate patients about computers and the Internet as an alternative access route to medical information. The programme should include a strategy to overcome barriers to Internet access and increase awareness of the websites that have the highest quality information. To avoid the complications arising out of the low-quality information available on several websites, there is a need to develop strategies to direct patients to reliable websites and make them aware about the criteria for judging quality standards for such sites.

This study provides worthwhile information to help understand the e-health literacy of tuberculosis patients; however, there are some limitations associated with this study. A point of limitation for this study was that only one Directly Observed Therapy Centre was selected for study. Hence, this raises concerns about generalizing the outcome of the study. More so, using questionnaires in a quantitative study to elicit information from patients does not give the same level of in-depth understanding as a qualitative study.

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References

Note: A link from the title, or from "Internet Archive", is to an open access document. A link from the DOI is to the publisher's page for the document.

Abdullah, A., & Pauzi, M. (2016). *Internet use and ehealth literacy levels among patients attending a hospital based primary care clinic in Malaysia.* Paper presented at The 4th International Health Literacy Conference; November 7-9, 2016; Haiphong City Vietnam. http://eprints.um.edu.my/16765/1/0001.pdf

Adepetun, A. (2018). Nigeria's mobile phone penetration hits 84 per cent. *The Guardian*. https://guardian.ng/business-services/nigerias-mobile-phone-penetration-hits-84-per-cent/

Akerkar, S.M., Kanitkar M., & Bichile, L.C. (2005). Use of the internet as a resource of health information by patients: a clinic-based study in the Indian population. *Journal of Postgraduate Medicine*, 51(2), 116-118. (Internet Archive)

Akomolafe, M. O. (2014). An evaluation of breast cancer website: Assessing the readability of breast cancer websites for the public. *Information and Knowledge Management*, 3(4), 1-14. https://www.iiste.org/Journals/index.php/IKM/article/view/10930/11233

Albabtain, A.F., AlMulhim, D.A., Yunus, F., & Househ, M.S. (2014). The role of mobile health in the developing world: a review of current knowledge and future trends. *Journal of Selected Areas in Health Informatics*, 42), 10-15. http://www.cyberjournals.com/Papers/Feb2014/08.pdf

Alkhatlana, H.M., Rahman, K.F., & Aljazzaf, B.H. (2018). Factors affecting seeking health-related information through the internet among patients in Kuwait. Alexandria *Journal of Medicine*, 54(4), 331-336. https://doi.org/10.1016/j.ajme.2017.05.008

Alwehaibi, I.A., & Almeman, A.A. (2014). Survey of internet use as a source of health-related information in Qassim Province, Saudi Arabia. *Tropical Journal of Pharmaceutical Research*, 13(8), 1371-1374. http://dx.doi.org/10.4314/tjpr.v13i8.25

Bautista, J. R. (2015). From solving a health problem to achieving quality of life: redefining eHealth literacy. *Journal of Literacy and Technology*, 16(2), 1-54. http://www.literacyandtechnology.org/uploads/1/3/6/8/136889/jlt_v16_2_bautista.pdf

Blair, J. (2004). Assessing the value of the internet in health improvement. *Nursing Times*, 100(35), 28-30. https://www.nursingtimes.net/archive/assessing-the-value-of-the-internet-in-health-improvement-31-08-2004/

Chiu, Y-C. (2011). Probing, impelling, but not offending doctors: the role of the internet as an information source for patients' interactions with doctors. *Qualitative Health Research*, 21(12), 1658–1666. https://doi.org/10.1177/1049732311417455

DiStefano, M.J., & Schmidt, H. (2016). Mhealth for tuberculosis treatment adherence: a framework to guide ethical planning, implementation, and valuation. *Global Health: Science and Practice*, 4(2), 211-221. http://dx.doi.org/10.9745/GHSP-D-16-00018

Falzon, D., & Raviglione, M. (2016). The internet of things to come: digital technologies and the end TB strategy. *BMJ Global Health*, 1(2), 1-3. http://dx.doi.org/10.1136/bmjgh-2016-000038

Hassan, A.O., Olukolade, R., Ogbuji, Q.C., Afolabi, S., Okwuonye, L.C., Kusimo, O.C., Osho, J.A., Osinowo, K.A., & Ladipo, O.A. (2017). Knowledge about tuberculosis: a precursor to effective TB control—findings from a follow-Up National KAP study on tuberculosis among Nigerians. Tuberculosis *Research and Treatment*, 2017, Article ID 6309092. https://doi.org/10.1155/2017/6309092

Idigbe, O.E. (2014). *Global overview of current strategies for tuberculosis case detection, treatment and cure.* Paper presented on 24th March 2014 to Mark the World TB day at Nigeria Institute of Medical Research Yaba, Lagos.

Kalichman, S.C., Cain, Cherry, C., Pope, H., Eaton, L., & Kalichman, M. O. (2005). Internet use among people living with HIV/AIDS: coping and health-related correlates. *AIDS Patient Care and STDs*, 9(7), 439-48. https://doi.org/10.1089/apc.2005.19.439

Khan, D., Fjerbæk, A., Andreasen, J.J., Thorup, C.B., & Dinesen, B. (2018). Cardiac surgery patients' e-health literacy and their use of a digital portal. *Health Education Journal*, 77(4), 482–494. https://doi.org/10.1177/0017896918756435

Korp, P. (2006). Health on the internet: implications for health promotion. *Health Education Research*, 21(1), 78–86. https://doi.org/10.1093/her/cyh043

Marton, C., & Choo, C.W. (2012). A review of theoretical models of health information seeking on the web. *Journal of Documentation*, 68(3), 330-352. https://doi.org/10.1108/00220411211225575

Muhamad, M., Afshari, M. & Mohamed, A.N. (2011). Internet use and breast cancer survivors. *The Turkish Online Journal of Educational Technology*, 10(4), 241-247. https://files.eric.ed.gov/fulltext/EJ946632.pdf

Norman, C.D., & Skinner, H.A. (2006a). eHEALS: The ehealth literacy scale. Journal of *Medical Internet research*, 8(4), e27. https://doi.org/10.2196/jmir.8.4.e27

Norman, C.D., & Skinner, H.A. (2006b). eHealth literacy: essential skills for consumer health in a networked world. Journal of Medical Internet Research, 8(2), e9. https://doi.org/10.2196/jmir.8.2.e9

Obiyo, L.T., Ellimoottil, C., Adams, W., Hannick, J.H., & Gupta, G.N. (2016). The influence of literacy and education on online health information seeking behavior in cancer patients. *ARC Journal of Urology*, 1(2), 20-26. https://www.arcjournals.org/pdfs/aju/v1-i2/5.pdf

Oh, H., Rizo, C., Enkin, M., & Jadad, A. (2005). What is eHealth (3): a systematic review of published definitions. *Journal of Medical Internet Research*, 7(1), e1. https://doi.org/10.2196/jmir.7.1.e1

Ramirez, V., Johnson, E., Gonzalez, C., Ramirez, V., Rubino, B., & Rossetti, G. (2016). Assessing the use of mobile health technology by patients: an observational

study in primary care clinics. JMIR mHealth *and uHealth*, 4(2), e41. https://doi.org/10.2196/mhealth.4928

Raviglione, M. (2015). *Digital health for the end TB strategy: an agenda for action*. World Health Organization. (Internet Archive)

Stellefson, M.L., Shuster, J.J., Chaney, B.H., Paige, S.R., Alber, J.M., Chaney, J.D., & Sriram, P.S. (2018). Web-based health information seeking and ehealth literacy among patients living with chronic obstructive pulmonary disease (COPD). *Health Communication*, 33(12), 1410–1424. https://doi.org/10.1080/10410236.2017.1353868

Valizadeh-Haghi, S., & Rahmatizadeh, S. (2018). eHealth literacy and general interest in using online health information: a survey among patients with dental diseases. Online Journal of Public Health Informatics, 10(3), e219. https://doi.org/10.5210/ojphi.v10i3.9487

Waterston, T., & Pakenham Walsh, N. (2018). Why health information needs to be accessible to all. BMJ Paediatrics Open, 2(1), e000352. https://doi.org/10.1136/bmjpo-2018-000352

Webber, R. (2012). *Communicable diseases: a global perspective*. (4th ed.). CAB International.

Wentink, M. M., Prieto, E., de Kloet, A. J., Vliet Vlieland T. P. M. & Meesters J.J.L. (2018). The patient perspective on the use of information and communication technologies and e-health in rehabilitation. Disability and Rehabilitation: Assistive Technology, 13(7), 620-625. http://dx.doi.org/10.1080/17483107.2017.1358302

World Health Organization (2020). *Tuberculosis: key facts*. WHO. (Internet Archive)

Yu, V.L., Kato-Maeda, M., & Small, P.M. (2001). User's guide to tuberculosis resources on the internet. *Clinical Infectious Diseases*, 32(11), 1580-1588. https://doi.org/10.1086/320533

Yusuf, A.A., & Alhaji, A.A. (2015). Knowledge, attitude, and use of internet for medical information by patients attending specialist clinics in ABUTH Zaria-Nigeria. Sub-Saharan African Journal *of Medicine*, 2(4), 160-164. http://dx.doi.org/10.4103/2384-5147.172435