

E-health Preparedness and Readiness for Change to Electronic Medical Records System at a Tertiary Health Facility in Osun State, South-West, Nigeria

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ABSTRACT

Introduction: An electronic medical records (EMR) system, as part of a broader e-health system, is needed to provide higher-quality health services, but its uptake is limited in low- and middle-income countries. E-health preparedness and readiness for change assessments are critical precursors of an EMR implementation success. However, little is known about the association between e-health preparedness and readiness for change to EMR system. Medical records staff were studied, being key stakeholders in its implementation success.

Method: This was a cross-sectional study of 60 medical records staff at a tertiary health facility in South-west, Nigeria, using an interviewer-administered questionnaire. Organizational and individual readiness for change assessed were the outcome variables. E-health preparedness was the predictor measured by assessing the institutions' core, technological, learning and societal readiness for EMR. The respondents' digital literacy was also assessed. Descriptive statistics, correlational tests and logistic regression analysis were done, with statistical significance set at $p < 0.05$.

Results: Respondents' mean age was 35.4 ± 6.9 years. Low e-health preparedness mean scores were found across the four categories assessed ranging from 3.2 to 2.9. The overall e-health preparedness mean score was 3.2 ± 0.8 . There were high organizational and individual readiness for change scores, (3.8 ± 0.8) and (3.9 ± 0.6) respectively, and both were significantly correlated, ($\rho = 0.5$, $p = 0.0001$). E-health preparedness also significantly correlated with organizational readiness for change only, ($\rho = 0.3$, $p = 0.032$). None of the factors assessed predicted organizational and individual readiness for change.

Conclusion: A strengthened e-health preparedness could significantly influence organizational readiness for change, which afterwards influences the medical records' staff readiness for change to EMR system. This could ensure ownership of the change and its successful implementation.

Keywords: Electronic medical records, digital literacy, e-Health, organizational readiness for change, individual readiness for change, preparedness, readiness, medical records' staff, low and middle-income countries.

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INTRODUCTION

The role of information technology in re-designing and transforming health service delivery for the 21st century has long been predicted as a means to bridge the quality gap in health systems globally. [1] Electronic Medical Record (EMR) which is the digital version of the paper-based medical record (PBMR) systems has emerged as an important tool to

improve the efficiency and effectiveness of healthcare delivery systems. [2,3] Some benefits of an EMR system include the reduction in patients' waiting time, easy access to patients' data and a more efficient database for research. —^[2,4] However, despite its numerous benefits, studies have shown variations in the level of adoption of EMR systems across countries.

There has been a rise in the adoption rate of EMR in

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developed countries compared to developing countries. Approximately 85.9% of office-based physicians in the United States of America (USA) possessed an EMR system in 2021.[5] Also, significant increments in the adoption of EMR systems have been reported in Japan.—[6] As of 2020, 63.1% of 600 Turkish hospitals assessed between 2014 and 2017 had adopted at least a basic EMR system.[7] However, there have been low EMR adoption rates in low and middle-income countries (LMICs) though with better adoption in Kenya, Rwanda, Uganda and Mozambique, while it is non-existent in some.—[8,9] The identified barriers to the adoption of EMR in LMICs include cost, necessary maintenance and infrastructural issues such as erratic power supply, lack of computers, poor internet connectivity, and lack of skilled personnel among others.—^[9,11] These have led to the persistent predominance of PBMR systems in LMICs, Nigeria inclusive.[12,13] However, there have been several attempts to shift to an EMR system at our study facility.

A shift from a PBMR system which is the predominant record system at our study facility, to an EMR system is considered a large-scale organizational change that may require behavioral change in the individual stakeholders.[9,14] Readiness for change is a multi-level construct. It measures readiness for the change from PBMR to EMR at organizational and individual levels. Organizational readiness for change (ORC) is a multifaceted psychological and behavioral concept that measures the perceived organizational members' collective resolve (change commitment) and shared perceived ability (change efficacy) to implement the change.[15] While individual readiness for change (IRC) assesses each member's commitment to manage the change and take on new roles, based on their perceived impact of the change.[16] Indeed, empirical evidence suggests that failure to establish sufficient readiness for change accounts for 50% of all unsuccessful, large-scale organizational change efforts.[15,17]

The electronic medical record is part of a broader e-health system believed to be complex with particular implementation challenges in developing countries.[18,19] Hence, there is a need to also assess the e-health preparedness at our study facility. Preparedness is different from readiness for change. Preparedness addresses what activities are in place to implement the change, while “readiness for change” addresses beyond being prepared, the willingness and perceived ability to implement the change. In this study, we assessed not just the ORC and IRC, but also the level of e-health preparedness for the change from a PBMR to an EMR system. The level of e-health preparedness was measured using validated e-health readiness assessment tools.[19,20] According to the literature, e-health readiness assessment tools measure the degree to which the users of the technology are prepared and make necessary provisions for its implementation.[19,20] These tools measuring e-health preparedness (sometimes referred to as readiness) consist of core readiness, technological readiness, learning readiness,

societal readiness and policy readiness. In this study, the policy readiness was not measured because the questions were not relevant to our study population.

Medical records staff were studied because they are critical to the implementation success of an EMR system. Medical records staff are the custodians of patients' records in the health facility. They engage in filing, archiving, retrieving, and scheduling patients' appointments to mention a few. They may be threatened by the introduction of an EMR system or they may perceive it as a relief. Medical records staff will be more directly involved in managing the EMR system. Hence, we believe they will be the first in line for the preparedness activities to implement an EMR system in the organization. Their competencies are critical to the success of the EMR system.

Most studies in the literature have assessed readiness or preparedness before implementing an EMR system without assessing their readiness for change to such a system. There is sparse evidence in the literature that relates ORC and/or IRC to e-health preparedness for EMR systems in the same study. The objectives of this study include determining the ORC, IRC and e-health preparedness for the change to EMR system at the study facility, the relationship between the ORC and IRC, and the influence of their e-health preparedness and other associated factors on their ORC and IRC to an EMR system. In addition, we assessed the level of digital literacy of the medical records staff, which measures their competencies in the use of electronic devices as this is beneficial for an EMR system and may influence their IRC.

METHODS

This was a cross-sectional study of medical records staff at a public tertiary health facility in Osun state, South-west, Nigeria. This facility was yet to implement an EMR system at the time of conducting the study in July 2021. At the time, there were 80 medical records staff in the employment at the study facility, and all were recruited into the study except those on recognized leave.

Data collection was quantitative using a structured interviewer-administered questionnaire. Organizational readiness for change and IRC were the dependent variables. Organizational readiness for change was assessed using a standardized 12-item Organizational readiness for implementing change (ORIC) tool which consisted of 5 items and 7 items assessing the respondents' change commitment and change efficacy respectively.[21] Individual readiness for change was also measured using a 12-item standardised tool with 6 items assessing their willingness to manage the change and 6 items assessing their perceived impact of the change.[16] Both ORC and IRC were measured on a 5-point Likert scale on agreement.

The independent variables included the e-health preparedness

sub-categories. The instrument used was adapted from the e-health readiness assessment tool for healthcare institutions.[20] These consisted of 23-item core readiness (planned need for EMR), 10-item technological readiness (available infrastructure), 6-item learning readiness (training activities in place) and 10-item societal readiness (existing collaborations made) to facilitate implementation of an EMR system. Each of the sections in the e-health readiness assessment tools were measured on a score of 1 to 5. We also assessed the medical records' staffs' digital literacy skills which consisted of 13 items each for the frequency of use and confidence with the use of computers and its applications using a 5-point Likert scale. The total scores for each of the instruments measuring the outcome variables (ORC and IRC) and the predictor variables (e-health preparedness and digital literacy) were determined and divided by the number of items on each scale. This gave a maximum obtainable mean score of 5 for each instrument. Other independent variables included the respondents' socio-demographic profile, (13 items). A reliability test was conducted for the study instruments with their Cronbach's alpha values reported in the result section. Data were collected using the Research Electronic Data Capture (REDCap).[22,23] See Supplement 1 for the study instruments.

Data analysis was done using Stata Version 17. Summarization of continuous variables such as the respondents' age, years of working experience, e-health readiness assessment scores, digital literacy scores, ORC and IRC scores was done. Respondents scoring ≥ 4 ($\geq 80\%$) of the 5 obtainable scores for each of the scales assessed were termed either prepared, ready for change or literate for the e-health preparedness, readiness for change and digital literacy assessments respectively, and their proportions presented in charts. Other categorical variables were presented as frequency distributions. Following significant Shapiro-Wilk tests of normality for the ORC ($p=0.046$), and IRC ($p=0.003$) data, Spearman's correlation statistic was used to determine the relationship between the ORC to EMR (ORC_{EMR}) and IRC to EMR (IRC_{EMR}). However, Shapiro-Wilk was not significant for the overall e-health preparedness score ($p=0.397$).

The outcome variables were ORC_{EMR} and IRC_{EMR} with dichotomous responses each, (ready or not ready). Simple and multiple binary logistic regression models were built with the predictors added simultaneously. Variables in the unadjusted models with p -values >0.2 were excluded from the multiple regression models with a level of significance set at a 95% confidence limit with ($p<0.05$).

Ethical approval was obtained from the Research and Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife, (IPHOU/12/1528). In addition, written informed consent was obtained from the respondents, and they were assured of the confidentiality of their responses.

RESULTS

Socio-demographic characteristics of the respondents

Sixty (75.0%) of the 80 medical records staff fully participated in the study with a male-to-female ratio of 7:8. The mean age of the respondents was 35.4 ± 6.9 standard deviation (SD) years with a range of 19 and 56 years of age. Only 6 (10.0%) of the respondents did not have a graduate degree. Their mean years of work experience at the institution was 5.5 ± 6.0 (SD). About half of the medical records unit staff surveyed had been promoted, and within an average of 2 years to the study. (See Table 1)

Table 1: Socio-demographic characteristics of respondents

Variables	Frequency (n= 60)	Percentages (%)
Age		
40 and below	46	76.7
41 and above	14	23.3
Mean age \pm Standard deviation	35.3 ± 6.9 (95%CI: 33.5 – 37.0)	
Sex		
Male	28	46.7
Female	32	53.3
Ethnicity		
Yoruba	45	75.0
Hausa	7	11.0
Igbo	4	6.5
Others	4	6.5
Religion		
Christianity	43	71.7
Islam	15	25.0
Others	2	3.3
Marital status		
Single	13	21.7
Married	41	68.3
Divorced/ Widowed	6	10.0
Educational qualification		
Technical school	6	10.0
OND	5	8.3
HND	27	45.0
BSc	18	30.0
MSc and higher	4	6.7
Cadre		
Clerical staff	12	20.0
Technical staff	10	16.7
Executives	13	21.7
Managers	8	13.3
Others	17	28.3
Income		
<₦50,000	13	21.7
₦50,000 – ₦69,000	12	20.0
₦70,000 – ₦99,000	14	23.3
\geq ₦100,000	21	35.0
Grade level		
1-6 (Junior staffs)	29	48.3
\geq 7 (Senior staffs)	31	51.7
Mean years of work experience	5.5 ± 6.0 (95%CI: 3.9 – 7.0)	
Ever been promoted		
Has been promoted	31	51.7
Has not been promoted	29	48.3
Years since last promotion	1.9 ± 1.4 (95%CI: 1.3 – 2.4)	

Table 2: Mean e-health preparedness, readiness for change and digital literacy scores (n=60)

Analytical categories	Scales	Mean ± S.D.	95% C.I.	Cronbach's alpha
Outcome variables	Organizational readiness for change	3.8 ± 0.8	3.6 – 4.0	0.914
	- Change commitment	3.7 ± 0.9	3.5 – 4.0	
	- Change efficacy	3.8 ± 0.8	3.6 – 4.0	
	Individual readiness for change	3.9 ± 0.6	3.7 – 4.0	
Predictors	Social readiness	2.9 ± 1.0	2.6 – 3.2	0.815
	Technological readiness	3.0 ± 1.1	2.8 – 3.3	0.859
	Core/ General readiness	3.2 ± 0.7	3.0 – 3.4	0.844
	Learning readiness	3.2 ± 1.0	3.0 – 3.5	0.733
	*Overall e-Health preparedness	3.2 ± 0.8	3.0 – 3.4	
	Frequency in digital literacy	3.7 ± 0.9	3.5 – 4.0	0.934
	Confidence in digital literacy	4.1 ± 0.9	3.8 – 4.3	0.944

*The average score for the sum of their core readiness, technological readiness, learning readiness and social readiness. Cronbach's alpha tested the reliability of the scales for of the study instrument

The level of digital literacy, e-health preparedness, organizational and individual readiness for change to an EMR system at the study facility and how they are related

The respondents studied had a little above-average score in most of the parameters assessed. Their perceived ORC_{EMR} system was 3.8±0.8SD. Their perceived organizational commitment to the change and change efficacy (shared belief in implementing a change to EMR) which both summed up to the ORC_{EMR} score, were also strongly and positively correlated, (rho=0.8; 95%CI: 0.7-0.9; p<0.001). Their IRC_{EMR} score was slightly higher than their perceived ORC_{EMR} score, with both positively but moderately correlated (rho=0.5; 95%CI: 0.3-0.7; p=0.0001).

Of the predictors, confidence in digital literacy had the highest mean score (4.1±0.9SD), while the least was the social readiness score (2.9±1.0SD). Their overall e-health readiness score (a sum of their core, technological, learning and social readiness) was (3.2±0.8SD). Also, their overall e-Health readiness score was significantly correlated with their ORC_{EMR} score (rho=0.3; 95%CI: 0.0-0.5; p=0.032) but not with their IRC_{EMR} score (rho=-0.0; 95%CI: -0.3-0.2; p=0.897). Most of the scales had a Cronbach's alpha >0.8 except for learning readiness. (See Table 2)

In Figure 1, <50% of the respondents perceived that their organisation was prepared and ready for a change to an EMR system. Only 25 (41.67%) perceived their organization as ready for a change to the use of an EMR system. Also, barely half of the respondents themselves, 32 (53.3%) believed in and would support the change to an EMR system. As regards their e-health preparedness, core readiness 7 (11.7%) was the least while learning readiness was the best with only 17 (28.3%). Thirty-one (51.7%) of the respondents frequently engaged in digital literacy activities such as the use of

computers, the internet, social media platforms such as Facebook, Instagram, and Twitter in their work and personal life. However, only 40 (66.7%) reported being confident in the use of these digital literacy activities and platforms.

Factors associated with their organizational and individual readiness for change to an EMR system

In Tables 3 and 4, associated factors of ORC_{EMR} and IRC_{EMR} respectively are presented. In the unadjusted model, core readiness had a statistically significant 10.7 times greater odds of determining the ORC_{EMR} as perceived by the respondents, (OR 10.7; 95%CI: 1.2-96.0, p=0.034). Also, technological readiness had a statistically significant 7.8 times greater odds of determining their ORC_{EMR} (OR 7.8; 95%CI: 1.5-40.7; p=0.015). However, after controlling for the confounders, these findings were no longer statistically significant in the adjusted model. (See Table 3)

The unadjusted model in Table 4 showed that male respondents who were ≤ 40 years old, with a shorter duration of work experience and who had never been promoted significantly reported being ready for a change to an EMR system at the facility. In the adjusted model, the male staff at the medical records unit of the study facility had 48.3 times greater odds of reporting IRC_{EMR} compared to the female staff, (Adjusted odd ratio (AOR) 48.3; 95%CI: 0.0-3.8; p=0.045). However, after adjusting for the interaction between the age of the respondents and their gender, the significant association between gender and IRC_{EMR} was lost. The interaction between their promotion status and age was also controlled for leading to the loss of the initial significant association found between those who had never been promoted and the respondents' IRC_{EMR}.

Table 4: Predictors of individual readiness for change to EMR systems at study facility

Variables	Simple binary logistic regression			Multiple binary logistic regression		
	Crude Odds Ratio	95% C.I.	P-value	Adjusted Odds Ratio	95% C.I.	P-value
Age (years)						
≤40 years	3.9	1.1 – 14.3	0.041	6.9	0.1– 375.1	0.343
>40 year	Ref	-	-	Ref	-	-
Sex						
Male	3.1	1.1 – 8.9	0.037	48.3	1.1-2131.4	0.045
Female	Ref	-	-	Ref	-	-
Ethnicity						
Yoruba	3.4	0.1 – 35.5	0.302	-	-	-
Hausa	7.5	0.5 - 122.7	0.158	-	-	-
Igbo	3.0	0.2 – 59.9	0.472	-	-	-
Others	Ref	-	-	-	-	-
Education						
Technician	Ref	-	-	-	-	-
OND	0.7	0.1 – 7.4	0.741	-	-	-
HND	0.9	0.2– 5.4	0.935	-	-	-
B.Sc	2.0	0.3 – 13.1	0.469	-	-	-
M.Sc	1.0	0.1 – 12.6	1.000	-	-	-
Cadre						
Clerical staff	Ref	-	-	-	-	-
Technical staff	0.4	0.1 – 2.5	0.346	-	-	-
Executives	1.2	0.2 - 5.6	0.848	-	-	-
Manages	1.0	0.2 – 6.0	1.000	-	-	-
Others	2.4	0.5 – 11.2	0.265	-	-	-
Work experience (years)	0.9	0.8 – 1.0	0.021	1.1	0.9 – 1.4	0.467
Ever promoted						
Yes	Ref	-	-	Ref	-	-
No	6.4	2.1 – 19.7	0.001	5.4	0.0-1150.5	0.538
Technological readiness						
Ready	1.4	0.1 – 5.5	0.644	-	-	-
Not ready	Ref	-	-	-	-	-
Learning readiness						
Ready	1.9	0.6 – 6.1	0.270	-	-	-
Not ready	Ref	-	-	-	-	-
Social readiness						
Ready	1.5	0.2 – 7.1	0.579	-	-	-
Not ready	Ref	-	-	-	-	-
Digital literacy frequency						
Frequent	1.1	0.3 – 3.1	0.809	-	-	-
Not frequent	Ref	-	-	-	-	-
Digital literacy confidence						
Confident	1.2	0.3 – 3.6	0.715	-	-	-
Not confident	Ref	-	-	-	-	-
*Male # age				0.1	0.0 – 3.8	0.188
**Ever promoted # age				2.3	0.0– 402.7	0.757

*Male # age- assessed interaction between gender and respondents' age. ** Ever promoted # age- interaction between age and respondents' promotion status.

Table 4: Predictors of individual readiness for change to EMR systems at study facility

Variables	Simple binary logistic regression			Multiple binary logistic regression		
	Crude Odds Ratio	95%C.I.	P-value	Adjusted Odds Ratio	95%C.I.	P-value
Age (years)						
≤40 years	0.9	0.3 – 3.1	0.918	-	-	-
>40 year	Ref	-	-			
Sex						
Male	0.8	0.3 – 2.3	0.726	-	-	-
Female	Ref	-	-			
Ethnicity						
Yoruba	0.6	0.1 – 4.3	0.570	-	-	-
Hausa	2.5	0.2 - 32.2	0.482			
Igbo	1.0	0.1 – 16.0	1.000			
Others	Ref	-	-			
Religion						
Christian	0.9	0.1 – 4.8	0.923	-	-	-
Islam	0.4	0.0 – 7.3	0.508			
Others	Ref	-	-			
Cadre						
Clerical staff	Ref	-	-	-	-	-
Technical staff	1.4	0.2 – 7.6	0.696			
Executives	0.4	0.1 - 2.4	0.325			
Manages	0.8	0.2 – 5.3	0.852			
Others	1.6	0.4 – 7.0	0.551			
Work experience (years)	0.9	0.9 – 1.0	0.296	-	-	-
Ever promoted						
Yes	Ref	-	-	-	-	-
No	1.3	0.5 – 3.8	0.571			
Core readiness						
Ready	10.7	1.2 – 96.0	0.034	7.0	0.7 – 69.7	0.097
Not ready	Ref	-	-	Ref	-	-
Technological readiness						
Ready	7.8	1.5 – 40.7	0.015	5.6	0.9 – 34.0	0.059
Not ready	Ref	-	-	Ref	-	-
Learning readiness						
Ready	1.9	0.6 – 5.9	0.269	-	-	-
Not ready	Ref	-	-			
Social readiness						
Ready	5.2	1.0 – 28.4	0.057	4.7	0.8 – 28.8	0.096
Not ready	Ref	-	-	Ref	-	-
Digital literacy frequency						
Frequent	1.8	0.6 – 5.0	0.277	-	-	-
Not frequent	Ref	-	-			
Digital literacy confidence						
Confident	2.1	0.7 – 6.6	0.199	1.6	0.6 – 6.1	0.506
Not confident	Ref	-	-	Ref	-	-

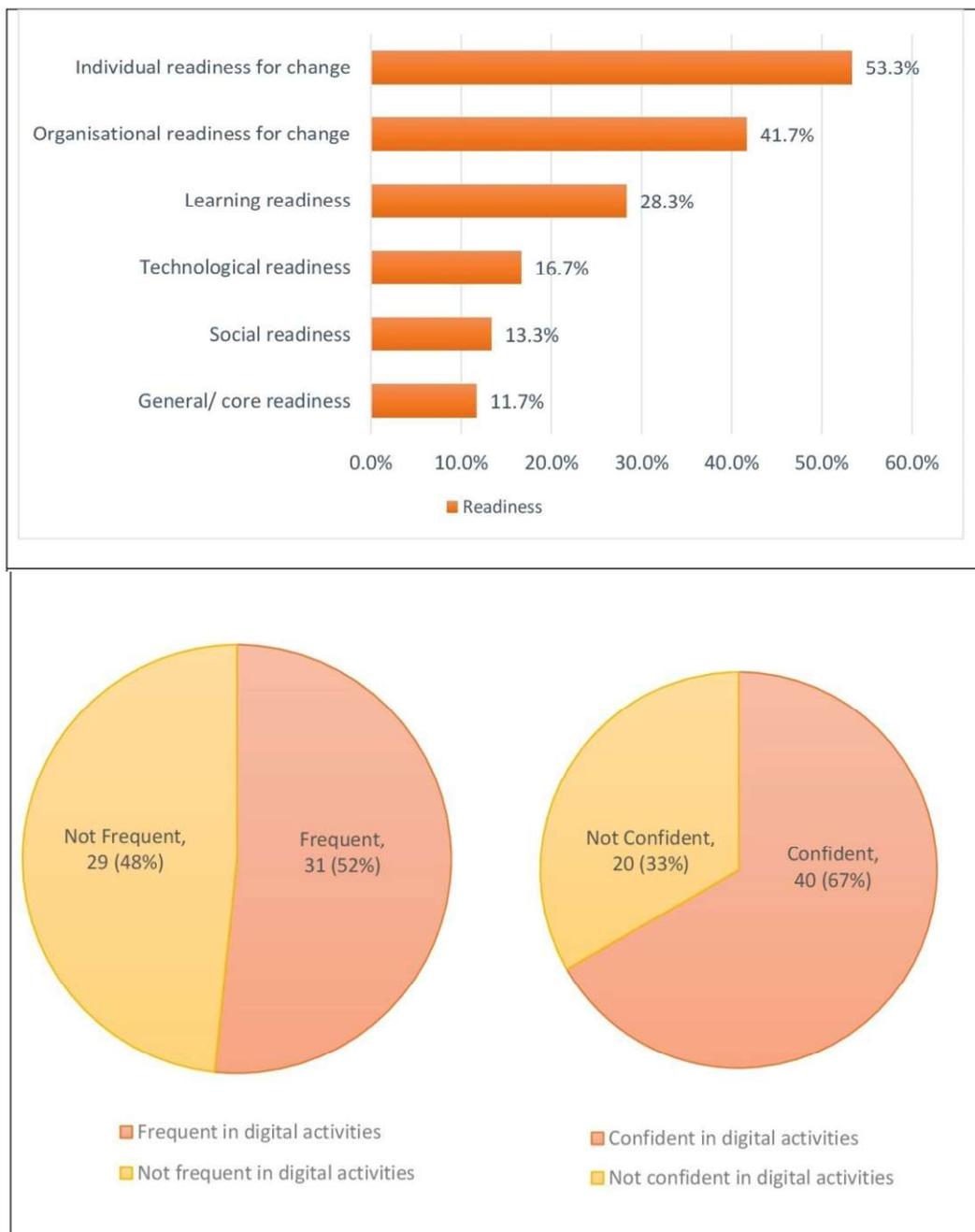


Figure 1: Respondents' digital literacy, e-health preparedness and readiness for change to an EMR system

DISCUSSION

From this study, we found low mean scores in the overall e-health readiness and its sub-categories assessed, but high frequent use and confidence in digital literacy. The respondents' perceived ORC_{EMR} and IRC_{EMR} mean scores were high, with both significantly moderately but positively correlated. However, less than half of the medical records staff agreed that their organization was ready for the change to

EMR while barely above half agreed they were individually ready for the change. None of the factors assessed could significantly predict their ORC_{EMR} and IRC_{EMR} .

Level of e-health preparedness at the study facility as perceived by the medical records' staff

Our findings showed a lower mean core readiness score ($3.2 \pm 0.7SD$) compared to what was found among 350 health

providers from two hospitals in Ghana ($3.7 \pm 0.8SD$), [24] and from the 17 health providers in Afghanistan. [25] However, it was similar to the $3.3 \pm 0.3SD$ found among 101 public health care workers in Mauritius with health records staff inclusive. [26] Only 11.7% of our respondents perceived their organization and its staff were core-ready for the change to EMR. However, this was low compared to the 67.2% found among the 350 health providers in Ghana. [24] The low scores from our study may imply that there was no significant dissatisfaction with the paper-based medical record (PBMR) system at the study facility, with their EMR needs unidentified nor prioritized, and no definitive implementation plan in place for the change to an EMR system. However, our study is limited with the power of the study.

Less than one-fifth of the respondents perceived their organization was technologically ready for a transition to an EMR system at the study facility. This could imply unavailability or poor functionality of the requisite soft and hardware infrastructure, or inadequate resources to support the EMR system at the study facility. The provision of necessary infrastructure is usually cost-intensive and often lags in the implementation process of EMR systems. [27] Our finding was low compared to the 48.8% of 262 primary health care (PHC) workers in Sudan who reported technological readiness at the country's PHC facilities. [28] Though, there is a gross difference in the size of the populations studied, the staff at their PHC facilities were readier than the medical record unit staff at the tertiary health facility in our study.

More than a quarter of our respondents perceived their organization was learning-ready for a change to the EMR system. This could mean that at the time of conducting the study, there were EMR training plans in place with the possible involvement of staff at the medical records and the information, Communication and Technology (ICT) units of the institution. Training is often a common activity in many implementation processes. The staff at the medical records unit may also be the first in line of those to be trained, hence, are more aware of training plans compared to other staff at the institution. Nonetheless, almost 75% of the respondents saw a gap in the learning readiness at the study facility. This finding was unlike the 51.3% of 262 PHC workers in Sudan who perceived their facilities as learning-ready. [28]

Societal readiness also fared poorly as part of the e-health readiness at the study facility. This implied that the EMR system was yet to be used in patient referral, or in communicating with staff in other departments/units of the study health facility. This is not surprising as societal readiness would expectedly get better established after a significant increase in the EMR operationalization at the facility. A similarly low societal readiness mean score ($3.3 \pm 0.4SD$) was found among 101 public health workers in Mauritius. [26] Overall, the e-health readiness mean score in our study was much lower compared to the 4.7 found among the public health workers in Mauritius. [26] An improvement

in e-health preparedness would increase the organization and its staff's readiness to own and lead the change to an EMR system.

Medical records' staff frequency of use and confidence in digital literacy

Our respondents demonstrated a high level of digital literacy as seen in their frequent and confident use of devices such as computers, social media platforms and the like. This suggests they would be comfortable with operating the EMR systems at the institution. Similarly, >50% of 197 non-clinical staff at a tertiary health facility in Australia were frequent users and confident in the use of digital devices such as computers, email and social media, except for Microsoft Access. [29]

Level of organizational and individual readiness for change to an EMR system at the study facility as perceived by the medical records' staff

Notwithstanding the low level of e-health readiness at the study health facility, there was a fairly high mean score in their ORC_{EMR} ($3.8 \pm 0.8SD$). Similarly, a high ORC mean score of 3.9 (47.24 total score/12 items on the scale) was found among 37 health providers as a test of the feasibility of implementing electronic lung cancer patients reported outcomes among lung cancer patients at a health facility in Sydney. [30] However, only <50% of our respondents perceived that their health facility was ready for a change to an EMR system.

The mean score of IRC_{EMR} in our study ($3.9 \pm 0.6SD$) was similar to the findings in a study assessing the role of technological readiness in mediating IRC to the affective attitude to change among 178 Indonesian public workers with a mean score of 4.2 (104.19/25 items in the scale). However, barely above half of the medical records staff studied were willing to commit to the change to an EMR system at the facility, cope with the change and its effect on the operation of the medical record system as expected of a high individual readiness for change score.

Factors associated with their perceived organizational and individual readiness for change to an EMR system at the study facility

None of the factors assessed was significantly associated with the medical records staff's perceived ORC_{EMR} and IRC_{EMR} . However, from our findings, the higher the age, the lesser the likelihood they would adopt the EMR system, even though this finding was not significant. We ruled out gender influencing the uptake of EMR systems from our findings. This suggests that either sex should be allowed to participate and lead an EMR implementation process. However, younger staff could be a readier population to uptake EMR during the implementation process.

Strengths and limitations of the study

To the best of our knowledge, our study is the first to relate the e-health preparedness and readiness for change to EMR system in the same empirical study, and from critical stakeholders to the purpose of the study. Despite the total sampling done, the number of respondents eventually studied limits the power and generalizability of the study findings.

In conclusion, there was low e-health preparedness but high ORC and IRC to EMR systems as perceived by the staff at the medical records unit of our study facility. A change in the e-health preparedness would significantly increase the ORC to EMR, and this would subsequently improve the IRC, with the staff owning and leading the change to EMR. Hence, more efforts should be targeted at strengthening e-health preparedness.

Ethical approval: The ethical approval was obtained from the Institute of Public Health, Obafemi Awolowo University, Ile-Ife (HREC No: IPH/OAU/12/1528).

REFERENCE

- Institute of Medicine (US) Committee on Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Second. Washington (DC), United States of America: National Academies Press (US); 2001.
- Manca DP, Greiver M. Do electronic medical records improve quality of care? *Can Fam Physician* 2015;61:846–50.
- Williams F, Boren SA. The role of electronic medical record in care delivery in developing countries. *Int J Inf Manage* 2008;28(6):503–7.
- Jawhari B, Ludwick D, Keenan L, Zakus D, Hayward R. Benefits and challenges of EMR implementations in low resource settings: A state-of-the-art review. *BMC Med Inform Decis Mak [Internet]* 2016;16(1):1–12. Available from: <http://dx.doi.org/10.1186/s12911-016-0354-8>
- Stewart C. Share of office-based physicians with EMR/EHR systems in the United States from 2001 to 2021 [Internet]. *Statista* 2023 [cited 2024 Mar 20]; Available from: <https://www.statista.com/statistics/252083/office-based-physicians-with-emr-ehr-systems-in-the-us-2001-2021/>
- Adler-milstein BJ, Desroches CM, Kralovec P, Foster G, Worzala C, Charles D, et al. Electronic Health Record Adoption In US Hospitals: Progress Continues, But Challenges Persist. *Health Aff* 2015;34(12):2174–2180.
- Kose I, Rayner J, Birinci S, Ulgu MM, Yilmaz I, Guner S, et al. Adoption rates of electronic health records in Turkish Hospitals and the relation with hospital sizes. *BMC Health Serv Res [Internet]* 2020;20(967):1–16. Available from: <https://doi.org/10.1186/s12913-020-05767-5> ARESEARCH
- Akwaowo CD, Sabi HM, Ekpenyong N, Isiguzo CM, Andem NF, Maduka O, et al. Adoption of electronic medical records in developing countries—A multi-state study of the Nigerian healthcare system. *Front Digit Heal* 2022;4(November):1–18.
- Woldemariam MT, Jimma W. Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: A systematic review. *BMJ Heal Care Informatics* 2023;30(1):8–10.
- Kruse CS, Kothman K, Anerobi K, Abanaka L. Adoption factors of the electronic health record: A systematic review. *JMIR Med Informatics* 2016;4(2):1–13.
- Attah AO. Implementing an electronic health record in a Nigerian secondary healthcare facility. Prospects and challenges [Internet]. UiT-The Arct. Univ. Tromso, Norway. 2017 [cited 2024 Mar 20]; Available from: <https://munin.uit.no/bitstream/handle/10037/12245/thesis.pdf?sequence=2&isAllowed=y%0Ahttps://munin.uit.no/handle/10037/12245>
- Abdulkadir AY, Aiyedun TA, Shoretire KA, Abubakar D, Anka MK, Ologunde KW. Paper-Based Medical Records: the Challenges and Lessons Learned from Studying Obstetrics and Gynaecological Post-Operation Records in a Nigerian Hospital. *TAF Prev Med Bull [Internet]* 2010;9(5):427–32. Available from: <http://ezproxy.net.ucf.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=aph&AN=54903609&site=eds-live&scope=site>
- Ajayi SA. Implementation of Electronic Medical Records for Service Delivery in Selected Southwest Nigeria State University Teaching Hospitals [Internet]. 2022 [cited 2024 Mar 20]; Available from: *Implementation of Electronic Medical Records for Service Delivery in Selected Southwest Nigeria State University Teaching Hospitals*
- Yusuf S, Hafeez-Baig A, Soar J. Change management and adoption of health information technology (HIT)/eHealth in public hospitals in Ghana: A qualitative study. *Appl Comput Informatics* 2022;18(3–4):279–89.
- Weiner BJ. A theory of organizational readiness for change. *Implement Sci [Internet]* 2009 [cited 2018 Aug 9];4(67):1–9. Available from: <http://www.implementationscience.com/content/4/1/67>
- Vakola M. What's in there for me? Individual readiness to change and the perceived impact of organizational change. *Leadersh Organ Dev J* 2014;35(3):195–209.
- Mekonnen M, Bayissa Z. The Effect of Transformational and Transactional Leadership Styles on Organizational Readiness for Change Among Health Professionals. *SAGE Open Nurs* 2023;9:1–8.
- Adjorlolo S, Ellingsen G. Readiness Assessment for Implementation of Electronic Patient Record in Ghana : A Case of University of Ghana Hospital. *J Health Inform Dev Ctries* 2013;7(2):128–40.
- Mauco KL, Scott RE, Mars M. Validation of an e-health readiness assessment framework for developing countries. *BMC Health Serv Res* 2020;20(1):1–10.
- Khoja S, Scott RE, Casebeer AL, Mohsin M, Ishaq AFM, Gilani S. e-Health readiness assessment tools for healthcare institutions in developing countries. *Telemed e-Health* 2007;13(4):425–31.
- Shea CM, Jacobs SR, Esserman DA, Bruce K, Weiner BJ. Organizational readiness for implementing change : a psychometric assessment of a new measure. *Implement Sci* 2014;9(7):1–15.
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG.

- Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* [Internet] 2009;42(2):377–81. Available from: <http://dx.doi.org/10.1016/j.jbi.2008.08.010>
23. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O’Neal L, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform* [Internet] 2019;95(December 2018):103208. Available from: <https://doi.org/10.1016/j.jbi.2019.103208>
 24. Abdulai A-F, Adam F. Health providers’ readiness for electronic health records adoption: A cross-sectional study of two hospitals in northern Ghana. *PLoS One* [Internet] 2020;15(6):e0231569. Available from: <http://dx.doi.org/10.1371/journal.pone.0231569>
 25. Durrani H, Khoja S, Naseem A, Scott RE, Gul A, Jan R. Health needs and eHealth readiness assessment of health care organizations in Kabul and Bamyan, Afghanistan. *East Mediterr Heal J* 2012;18(6):663–70.
 26. Beebeejaun MR, Chittoo H. An Assessment of e-Health Readiness in the Public Health Sector of Mauritius. *Int J Sci Basic Appl Res* [Internet] 2017;35(1):193–210. Available from: <https://doi.org/10.1186/s12913-023-10450-6>
 27. Choi JS, Lee WB, Rhee PL. Cost-benefit analysis of electronic medical record system at a tertiary care hospital. *Healthc Inform Res* 2013;19(3):205–14.
 28. Yassen E, Atia IA, Manhal GAA, Elzein M, Mohamed M, Siddig M, et al. Readiness of managers and health care workers for e-Health: A cross-sectional study in Khartoum primary health care centers, Sudan. *BMC Health Serv Res* [Internet] 2023;23(1399):1–10. Available from: <https://doi.org/10.1186/s12913-023-10450-6>
 29. Kuek A, Hakkennes S. Healthcare staff digital literacy levels and their attitudes towards information systems. *Health Informatics J* 2020;26(1):592–612.
 30. Girgis A, Bangboje-Ayodele A, Rincones O, Vinod SK, Avery S, Descallar J, et al. Stepping into the real world: a mixed-methods evaluation of the implementation of electronic patient reported outcomes in routine lung cancer care. *J Patient-Reported Outcomes* 2022;6(1):1–14.