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Infrastructural and Training Barriers to Electronic Medical Record Use Among Nurses at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria

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ABSTRACT

Background: Electronic Medical Records can improve nursing practice, but effective use depends on overcoming infrastructural and organizational challenges which are severe in resource limited Nigeria.

Objective: To identify perceived EMR challenges among nurses at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria.

Methods: This descriptive cross-sectional study involved registered nurses selected via stratified random sampling. The sample size (248) was calculated using the Taro Yamane formula. Of 248 questionnaires distributed, 231 were completed and returned (response rate: 93.1%). Data were collected using a structured, self-administered 15-item questionnaire rated on a 5-point Likert scale. The instrument showed good internal consistency (Cronbach's $\alpha = 0.85$). Mean scores of 3.50 or higher indicated agreement with a challenge.

Results: Most significant challenges were: insufficient computer workstations (mean = 3.71, SD = 1.23; 68.4%), lack of internet connectivity (mean = 3.61, SD = 1.12; 64.5%), frequent system downtime (mean = 3.60, SD = 1.10; 63.2%), insufficient ongoing training (mean = 3.51, SD = 1.14; 58.9%) and data security concerns (mean = 3.50, SD = 1.23; 57.6%). Participants disagreed that the system was not user-friendly (mean = 2.25; 68.0%) and colleagues were unsupportive (mean = 2.02; 74.5%). The remaining eight items fell within the neutral range (2.50–3.49), though percentage agreements revealed substantial heterogeneity in experiences.

Conclusion: Significant infrastructural and training-related barriers persist. Inadequate hardware, unreliable internet, system downtime, insufficient ongoing training and data security concerns are the primary obstacles to optimal EMR use. Hospital administration should prioritize increasing computer workstations, ensuring internet redundancy, implementing quarterly refresher training, and strengthening data security protocols.

Keywords: Electronic Medical Records; EMR challenges; barriers; nurses; infrastructure; training; Nigeria; NAUTH Nnewi



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INTRODUCTION

Implementation and continued use of Electronic Medical Records (EMRs) requires overcoming multiple technical, organizational, and human barriers that may hinder effective use even in the presence of EMR systems and awareness of their usefulness among nurses.¹ User frustration, decreased efficiency, workarounds that undermine data integrity, and possible adverse effects on patient safety are some of the challenges that may arise.

Research has found that there are various impediments to EMR adoption and effective use globally. In a thorough scoping review, Jimma and Enyew³ discovered that technical, financial, time, legal, organizational, psychological and social barriers are significant barriers in various healthcare environments. These obstacles work at the individual (e.g., computer literacy and attitudes), organizational (e.g., training and support) and environmental (e.g., infrastructure and policy) levels⁴.

Babatope et al.⁵ in Nigeria, found that low financial resources, poor infrastructure, incompetence, and resistance to change are some of the factors that slow the adoption of EMR and its optimum use. These problems are exacerbated by unstable power supply, low internet connectivity, and competing demands on scarce healthcare resources⁶.

The users of EMR in the hospital setting are mostly nurses, and they have the highest time spent on direct patient care documentation compared to any other group of professionals. Ogbeide et al.⁷ found the following as barriers to electronic documentation among nurses in Lagos public hospitals: poor user experience, training requirements, inadequate user-friendly interface, absence of IT support, fear of use, time constraints, and leadership. Other issues were poor internet connectivity, poor power supply, inaccessibility of technicians when the system was down, slow and faulty devices, and inadequate number of devices compared to the number of nurses.

Venkatesh et al. developed the Unified Theory of Acceptance and Use of Technology (UTAUT), which is a helpful theoretical framework⁸. The theory has four major constructs, which are performance expectancy (the belief that the technology will enhance job performance), effort expectancy (perceived ease of use), social influence (perceived pressure to use the technology by others), and facilitating conditions (availability of organizational and technical infrastructure). The main problems associated with

EMR use are those that impact facilitating conditions (e.g., hardware, internet, and technical support unavailability), effort expectancy (e.g., system complexity and bad usability), but they can also affect performance expectancy (e.g., system slowness extends tasks).

In Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, despite the implementation of EMR, initial findings indicate that nurses encounter some challenges such as lack of training opportunities, technical issues, and inadequate infrastructures. Nevertheless, there has been no systematic empirical evidence on the nature and magnitude of these challenges. Hospital management will not be able to create specific interventions without evidence on certain barriers. Thus, the aim of the study was to determine the perceived barriers that nurses face when utilizing EMRs at NAUTH, Nnewi.

MATERIALS AND METHODS

Study Design: The study adopted a descriptive cross-sectional design. This design is deemed appropriate because it allows data to be collected from a sample population at a single point in time under natural conditions, without manipulating any variables.

Study Area: The study was conducted at NAUTH's permanent site at Akamili, Umudim, Nnewi, Anambra State, Nigeria, between February and August 2025.

Population of the Study: The target population comprised 651 registered nurses working at NAUTH who were involved in direct patient care and required to document patient information as part of their routine duties. The Nurses included in the study were registered nurses currently practicing at NAUTH with at least six months of work experience (to ensure familiarity with the EMR system). Nurses who were involved in direct patient care and provided written informed consent. While registered nurses on leave (annual, maternity, or study leave), student nurses, interns, temporary nursing staff, night shift nurses (due to scheduling constraints) and those who did not consent to participate were excluded from the study.

Sample Size Determination: The sample size for the study was determined using the Taro Yamane formular for a finite population (Yamane, 1967). The formula is

$$\frac{N}{1 + N(e)^2}$$

Where

n = the sample size sought

N = population size
e = Level of significance (0.05)
1 = Unity (a constant)
n = 247.76 = 248
n = 248

Sampling Technique: A stratified random sampling technique was employed to ensure adequate representation from all clinical departments. First, the nursing population was stratified by clinical department: Medicine, Surgery, Paediatrics, Obstetrics/Gynaecology, Accident/Emergency, Intensive Care Unit, and Outpatient Departments. The required number of participants from each department was calculated proportionally based on departmental population size. Then, simple random sampling was used to select participants from within each stratum. Of 248 questionnaires distributed, 231 were completed and returned (response rate: 93.1%) completed.

Instrument for Data Collection: The structured, self-administered questionnaire was used to gather data. Section B focused on the obstacles to EMR use and included 15 items on a 5-point Likert scale (Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1). The tool was based on the validated EMR challenge assessment instruments and was modified according to the UTAUT model, which encompasses the infrastructure, technical performance, training, support, usability, and social factors.

Validity of the Instrument: Face and content validity were determined by checking with the research supervisor and three experts at the Department of Nursing Science, Anambra State College of Nursing Sciences, Nkpor. Content Validity Index (CVI) was computed; the mean of the I-CVI of all the items was 0.87 which is good content validity. They included their feedback to enhance clarity, relevancy, and comprehensiveness.

Reliability of the Instrument: A pilot study was done on a different sample of 25 nurses (10 percent of the main study sample size, not included in the main study) in the Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka. The test-retest reliability was determined in a period of two weeks. Paired t-test showed that there was no significant difference in mean scores in Time 1 and Time 2 ($p = 0.32$), which means that the results remained stable over time. The intraclass correlation coefficient (ICC) of absolute agreement was 0.85 (95% CI: 0.690-0.93) which is a good test-retest reliability. The main study sample ($N = 231$) was used to evaluate internal consistency of the 15-item challenge

scale by calculating Cronbachs alpha, which resulted in 0.85 (95% CI: 0.81-0.89), which is a good internal consistency.

Statistical Analysis: The analysis of data was done with SPSS version 28.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies, percentages, mean scores, and standard deviations) were used to answer the research questions. The rule of decision of mean scores was: <2.50 = disagreement (challenge not present), 2.50-3.49 = neutral and 3.50-5.00 = agreement (challenge present). This cut-off point was chosen since 3.50 is 70 percent of the highest score of 5.00, which is a widely used cut-off point in health studies. This cutoff is a heuristic, descriptive threshold and not a clinically validated cutoff; this weakness is recognized in the discussion.

Ethical Approval: Ethical approval for this study was obtained from the Anambra State College of Nursing Sciences' Nkpor Ethical Review Board. The approval Number is ANSCONS/NK/ETH/01/2025/15, dated January 15, 2025). The research was conducted in line with the ethical provisions of the Helsinki Declaration of 1975 as it was amended in 2013. Each participant was informed and provided written informed consent before enrolment. The participants were guaranteed of voluntary participation, anonymity and strict confidentiality of their responses. The freedom to pull out any time without adverse effects was well conveyed.



RESULTS

Table 1: Demographic Characteristics of Participants (N = 231)

Demographic Variable	Frequency (n)	Percentage (%)
Age		
20-29 years	82	35.5
30-39 years	65	28.1
40-49 years	46	19.9
50-59 years	38	16.5
Gender		
Male	13	5.6
Female	218	94.4
Highest Nursing Qualification		
RN (Registered Nurse)	64	29.1
B.N.Sc. (Bachelor of Nursing Science)	124	56.4
M.Sc. Nursing	12	5.5
PhD Nursing	6	2.7
Other (Post-basic certificates)	14	6.3
Years of Professional Experience		
Less than 1 year	27	11.7
1-5 years	77	33.3
6-10 years	43	18.6
11-20 years	41	17.7
More than 20 years	43	18.6
Self-Assessed Computer Literacy		
Poor	18	7.8
Average	122	52.8
Good	64	27.7
Excellent	25	10.8

Table 1 showed that the largest age group was 20–29 years (82, 35.5%), followed by 30–39 years (65, 28.1%). Females constituted 94.4% (n = 218). Most of them had a Bachelor of Nursing science degree (124, 56.4%). The highest number was 1-5 years of professional experience (77, 33.3%). Computer literacy rated by the individual was mainly average (122, 52.8%), with 27.7% of them rating themselves as good and 10.8% as excellent.

Table 2: Challenges Encountered in Using Electronic Medical Records (N = 231)

Challenge Item	Mean	SD	% Agree/ Strongly Agree	% Disagree/ Strongly Disagree	Remark
Insufficient number of computer workstations or devices	3.71	1.23	68.4	12.1	Agree
Lack of reliable internet connectivity	3.61	1.12	64.5	14.7	Agree
Frequent system downtime or slow response speed	3.60	1.10	63.2	13.9	Agree
Insufficient ongoing training or refresher courses	3.51	1.14	58.9	16.5	Agree
Concerns about security and privacy of patient data	3.50	1.23	57.6	18.2	Agree
Lack of adequate technical support	3.45	1.16	54.1	20.3	Neutral
Difficulties integrating EMR into existing workflows	3.16	1.18	42.0	31.2	Neutral
Resistance from some colleagues	3.15	1.19	41.6	31.6	Neutral
EMR system causes frustration due to complexity	3.10	1.15	39.4	33.8	Neutral
Power supply unreliability	3.00	1.41	38.1	36.8	Neutral
EMR system frequently overloaded or "freezing"	2.93	1.14	34.2	40.7	Neutral
EMR documentation takes too much time away from patient care	2.90	1.28	33.3	42.0	Neutral
Inadequate customization for nursing needs	2.90	1.36	32.9	41.6	Neutral

EMR system is not user-friendly or intuitive	2.25	1.09	14.7	68.0	Disagree
Colleagues are not supportive of EMR use	2.02	1.19	9.5	74.5	Disagree

Decision Rule: Mean ≥ 3.50 = Agree (Challenge present); Mean 2.50–3.49 = Neutral; Mean < 2.50 = Disagree (Challenge not present)

Table 2 presented the mean scores, standard deviations, and percentage agreements for challenges. Five items met the threshold for agreement (mean ≥ 3.50). In descending order: insufficient computer workstations (mean = 3.71, 68.4% agreement), lack of reliable internet connectivity (mean = 3.61, 64.5% agreement), frequent system downtime (mean = 3.60, 63.2% agreement), insufficient ongoing training (mean = 3.51, 58.9% agreement), and data security concerns (mean = 3.50, 57.6% agreement). Participants disagreed with two items: that the EMR system is not user-friendly (mean = 2.25; 68.0% disagreement) and that colleagues are unsupportive (mean = 2.02; 74.5% disagreement).

The remaining eight items fell within the neutral range (2.50–3.49). However, percentage agreements and standard deviations reveal substantial heterogeneity. For example, lack of technical support (mean = 3.45) showed 54.1% agreement, and power supply unreliability (mean = 3.00, SD = 1.41) showed 38.1% agreement with a large standard deviation, indicating variation across departments.

DISCUSSION

This research determined the main issues that nurses face when utilizing EMRs at NAUTH, Nnewi. One important methodological lesson came out: the use of mean scores to conclude on the presence or absence of a challenge can be deceptive. Eight out of fifteen items were in the neutral range but when the entire distribution of responses was considered, three patterns could be seen: (a) true barriers to a large minority (e.g., power supply unreliability, where a large minority agreed and a similar proportion disagreed); (b) challenges endorsed by the majority and pulled below a threshold by neutral responses (e.g., lack of technical support, where a clear majority agreed) and (c) items where the disagreement was the dominant pattern (e.g., usability and peer support). Thus, the discussion below explains each finding in terms of the central tendency and the pattern of agreement.

Based on this two-fold criterion, the results indicate that infrastructural shortages (the lack of enough computers, unstable internet), technical problems (system failures), training shortages (the lack of continuous training), and reliance on the criterion used power inadequacy and the lack of technical support are major obstacles to large percentages of nurses. Only the system usability and peer support were not identified as a challenge in the sample.

Infrastructural Challenges: Hardware, Connectivity, and Power

The most rated challenge was insufficient computer workstations and there was a high level of agreement among the sample. This implies that there is always more demand of EMR access than hardware. This observation concurs with the research by Ogbeide et al.,⁷ who found a lack of devices to be a significant obstacle among the nurses of Lagos. Poor computer-to-nurse ratios in a

high-volume tertiary hospital with multiple shifts compel nurses to wait until terminals, share devices, or delay documentation practices that may cause transcription errors and lead to overtime and fatigue.

The absence of a good internet connection was also supported by a solid majority, which is indicative of an unresolving infrastructure deficit in most Nigerian healthcare facilities. Akwaowo et al.,¹⁰ discovered that the availability of infrastructure affected the adoption of EMR in various states, and the current result proves that the reliability of connectivity is a significant obstacle to operations. Periodic connectivity disruptions disrupt real-time documentation, deny access to real-time data in case of an emergency, and can lead to data synchronization issues.

The unreliability of power supply is an example of the risk of the mean-only interpretation. Even though the central value was within the neutral range, a significant minority of the nurses concurred that power supply was a challenge, and a similar percentage disagreed. The largest variation in responses is the largest of all items, which suggests that there is a great deal of heterogeneity between units. This trend does not imply that power supply is not an issue but it is a significant obstacle to more than one-third of nurses (probably those in wards with unreliable backup generators or broken UPS systems) but not others.

Technical Challenges: System Downtime and Performance

A major challenge was frequent system downtime or low response speed, and a strong majority agreed, which aligns with Jimma and Enyew,³ who cited technical barriers as a key barrier. Delays in response lead to more documentation and downtime during medication administration or emergency care may lead to delays in access to important patient information.

EMR system that was often overloaded or freezing had a different trend: a significant minority said that this was a challenge, a majority said it was not, and the rest were indifferent. This division indicates that system freezing is a significant obstacle to approximately one-third of nurses (perhaps those working on older hardware in busy units during peak shifts) but not to the majority.

Training and Support Challenges

The lack of continuous training was able to meet the agreement threshold by both standards, and a strong majority supported this challenge. This is in line with Ayamolowo et al.,¹¹ (sponsored training linked with increased EMR use), Alkasasbeh et al.,¹² (training programs as a key determinant), and Ogbeide et al.,⁷ (nurses as a challenge in identifying training needs). Initial training is not enough since updates to the system need new learning, new staff need to be trained, skills are lost over time and advanced functions are not used without continuous training.

Lack of adequate technical support presents a critical case where a mean-only rule would incorrectly classify this as neutral. Nevertheless, there was a definite majority in support of this as a challenge with only a few minority opposing. This points to a key weakness of arbitrary thresholds: an item may be supported by the majority of respondents but be below a cutoff because of neutral responses dragging the average down. With a dual criterion (majority agreement OR central tendency above threshold), absence of technical support is rightly recognized as a major obstacle.

Data Security and Privacy Concerns

Security and privacy of patient data concerns were found to meet both criteria of agreement with a definite majority agreeing. This is consistent with Akwaowo et al.,¹⁰ who discovered that perceived risk and data security issues adversely affected EMR adoption in Nigeria. These issues can be expressed in terms of reluctance to record sensitive data (e.g., mental health, reproductive health, HIV status) or security-threatening activities, including sharing passwords.

Factors Clearly Not Identified as Challenges

Participants did not agree with the fact that the EMR system is not user-friendly and did not agree with the fact that colleagues do not support the use of EMR. In contrast to the neutral items where responses were not homogeneous, these two items were definitely below the threshold of disagreement, with large majorities disagreeing. An easy to use system means less cognitive

load and a supportive peer culture means easier adoption in line with the social influence construct of UTAUT.

Interpretation of Neutral Findings

The neutral results of this research have a significant methodological implication. The initial presumption that neutral central values are factors that are not supported as significant challenges is wrong and may be misleading. Rather, three different patterns were observed:

True heterogeneity masked by the mean: In the case of unreliability in power supply and freezing of the system, the neutral central value showed almost equal numbers of nurses who agreed and those who disagreed. This shows that the factor is a significant obstacle to certain nurses/departments and not others.

Majority agreement with central value below threshold: For lack of technical support, a clear majority endorsed the challenge, but neutral responses pulled the central value just below the cutoff. This item is misclassified by a mean-only decision rule.

True neutrality or uncertainty: There are those items that can be a true indication that nurses do not have strong opinions, maybe because of inconsistent experiences or ignorance. However, without qualitative data, this cannot be assumed

Mapping Challenges to UTAUT Constructs

The challenges identified can be mapped to the identified challenges using the UTAUT framework, with the majority of them falling under facilitating conditions (lack of adequate hardware, unreliable internet, system downtime, inadequate training, and using the corrected interpretation lack of technical support and power supply unreliability affecting a significant minority). There were no barriers of effort expectancy (usability) and social influence (peer support), which are valuable positive results. The issues of data security are associated with the performance expectancy (fear that security problems may reduce clinical benefits). The UTAUT model hypothesizes that enhancing enabling factors through the addition of computers, enhanced connectivity and backup power, and continued training and technical assistance would boost EMR utilization and satisfaction.

Clinical Implications

These challenges have different clinical implications across departments because of the heterogeneity reported in neutral items. Inadequate access to computers can slow the identification of clinical deterioration. System downtime can make it impossible to access allergy or medication lists in real time in case

of an emergency. Poor training can result in incomplete documentation. Since the power supply reliability and system freezing are significant barriers to some units but not others, interventions should be focused: units where power is a documented barrier might require upgrades to generators or UPSs; units where technical support is weak may require dedicated IT coverage at peak times.

Comparison with Other Nigerian and International Studies

Their dominance in the infrastructure and training issues is consistent with other Nigerian studies. 7, 10, but the finding that usability and peer support are not challenges is unique to NAUTH compared to other cross-sectional surveys of EMR barriers and needs to be reflected in future cross-sectional surveys.

Strengths

The sample size ($n = 231$) exceeded the minimum required, with an excellent 93.1% response rate minimising non-response bias. Stratified random sampling by department enhanced representativeness. The instrument had a good validity ($CVI = 0.87$) and reliability (Cronbach's 0.85). The UTAUT framework was conceptually coherent. The fifteen-item scale enabled the identification of particular barriers in a granular manner. Lastly, the clear analysis of percentage agreements and standard deviations in addition to means, which was triggered by the neutral results is a methodological strength that ought to be a norm.

Limitations

There are a number of limitations on interpretability and generalisability. The single-site design restricts the ability to generalise to other hospitals in Nigeria that use other EMR systems or resources. Self-reported data are subject to recall and social desirability bias. The night shift nurses and those on leave could have been excluded and this could have eliminated nurses who had very different experiences with challenges. The inclusion criterion of six months was not empirically validated. Observed associations may be inflated by common method variance.

One of the main shortcomings, as noted by the neutral results, is the dependence on any one classification rule. This paper shows that mean thresholds are sufficient to misclassify the challenges that majorities (technical support) or heterogeneity (power supply) endorses. Although we have done this by reporting percentage agreement and standard deviations, the best way to do this, which is using multiple a priori criteria or not using

thresholds at all should be employed in future studies. The cross-sectional design does not allow evaluating changes over time, and no objective data (system audit logs, hardware inventories, actual downtime or outage records) were gathered to confirm perceived difficulties. Lastly, the exact causes of heterogeneity in neutral items are speculative as there is no qualitative data or subgroup analysis by department or shift.

CONCLUSION

In this study, the authors found that nurses at NAUTH, Nnewi, have considerable difficulties with the utilization of EMRs, which are mainly associated with infrastructural shortcomings (a lack of computers and unreliable internet), technical (system downtime), training (the lack of continuous training), and data security concerns. One of the methodological implications is that the neutral mean scores (2.503.49) cannot be directly interpreted as not a challenge, because the analysis of the percentage agreements has shown that the lack of technical support was supported by a majority (54.1) and power supply unreliability by more than a third (38.1) with significant departmental heterogeneity. The only factors that were evidently not perceived as a challenge were system usability and peer support, which is a solid basis to overcome the identified barriers.

Authors' Contributions: JNJ and UCO conceptualized the study and designed the study protocol. Data collection and analysis were conducted by BOO and AU, while supervision and validation were performed by JNJ and UCO. All authors (JNJ, UCO, BOO, and AU) were involved in writing and revising the manuscript for intellectual content. All authors also read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Ethical Approval: Ethical approval for this study was obtained from the Anambra State College of Nursing Sciences, Nkpor Ethical Review Board with approval number ASCONS/NK/ETH/01/2025/15 dated 15th January, 2025.

Informed Consent: Written informed consent was obtained from each participant before enrolment into the study. Participants were assured of their voluntary participation and right to withdraw at any time without consequences. Confidentiality and anonymity were strictly maintained throughout the research process, and no identifying information was included in the data analysis or reporting.

Declaration of Helsinki: The study was conducted according to the ethical principles of the Helsinki Declaration of 1975, as revised in 2013.

Availability of Research Data: The authors are available and ready to supply anonymized data upon reasonable request through the corresponding author.

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Conflicts of Interest; The authors have no conflicts of interest to declare.

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