

Operational Challenges of Electronic Health Records use and their Implications for Patient Waiting Time and Healthcare Outcomes in University of Ilorin Teaching Hospital, Ilorin, Nigeria

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ABSTRACT

Background: Electronic health records (EHR) can reduce delays and improve care only when they work reliably and are used well. In Nigerian tertiary hospitals, infrastructure, skills and organisational factors may prevent EHR from delivering their expected benefits, yet these operational challenges are rarely quantified from the perspective of frontline professionals.

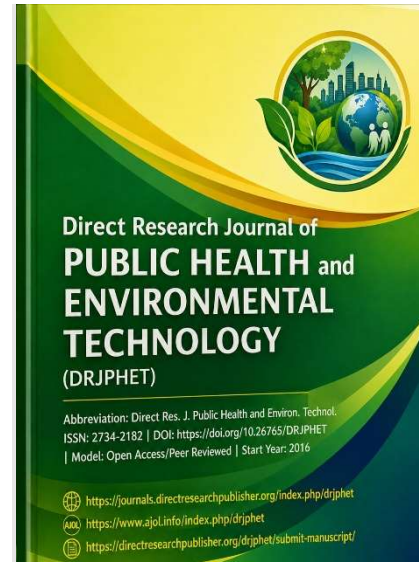
Objective: This study identified the operational challenges associated with EHR use at the University of Ilorin Teaching Hospital (UITH), Ilorin, and examined their implications for patient waiting time and healthcare outcomes.

Methods: A descriptive cross-sectional survey was conducted among healthcare professionals (nurses, doctors, Health Information Management staff, laboratory staff and pharmacists). A sample of 315 was determined from a population of 1,481 using the Taro Yamane formula. A validated questionnaire (Cronbach's $\alpha = 0.76$) was used, and 286 valid responses (90.8%) were analysed using frequencies, percentages, means, standard deviations and rank ordering against a criterion mean of 2.50.

Results: All operational challenge items exceeded the criterion mean (grand mean = 2.96). The most severe were inadequate internet connectivity ($M = 3.16$; 79.7% agreement), system downtime and technical issues affecting patient waiting time ($M = 3.14$; 80.1%), and frequent operational challenges in departments ($M = 3.12$; 81.1%). Insufficient training ($M = 3.00$; 74.5%) and data entry errors affecting clinical decisions ($M = 2.73$; 60.5%) followed. Resistance to EHR use was the least severe challenge ($M = 2.58$; 51.7%). Frequent downtime or slow loading ($M = 3.07$) and incomplete hospital-wide coverage ($M = 2.65$) were also reported.

Conclusion: EHR challenges at UITH are mainly infrastructural and technical, followed by human-capacity and data quality problems, rather than attitudinal. These challenges directly prolong patient waiting time and threaten the safety benefits of EHR. Investment in connectivity, power, technical support, training, data quality assurance and downtime procedures is recommended.

Keywords: Electronic health records; operational challenges; system downtime; internet connectivity; data quality; patient waiting time; Nigeria



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INTRODUCTION

Health information technology has been described as both a solution and a source of new problems in healthcare. Electronic health records (EHR) promise faster access to patient information, more legible documentation, better coordination and safer prescribing (Buntin, Burke, Hoaglin & Blumenthal, 2011; Menachemi & Collum, 2011). Yet the same systems can slow work when networks fail, when users are poorly trained, or when data are entered inaccurately. When an EHR stops working in a hospital that has abandoned paper folders, clinicians may be left without any record at all.

These risks are amplified in low-resource settings. Studies across sub-Saharan Africa consistently identify unreliable electricity, poor internet connectivity, inadequate hardware, limited technical support and shortages of ICT skills as barriers to effective EHR use (Akanbi et al., 2012; Odekunle, Odekunle & Shankar, 2017; Fritz, Tilahun & Dugas, 2015). In Nigeria, frequent power outages and costly, unstable internet services are a general feature of the operating environment for hospitals. Operational challenges matter not only because they frustrate users but because they translate directly into patient experience and safety. Downtime forces hospitals back to manual procedures, lengthening queues and delaying access to results (Larsen, Fong, Wernz & Ratwani, 2018). Inadequate training slows documentation and increases errors (Boonstra & Broekhuis, 2010). Inaccurate data can mislead clinical decisions (Bowman, 2013). Understanding which challenges are most severe is therefore a prerequisite for protecting the benefits that EHR are meant to deliver.

University of Ilorin Teaching Hospital (UITH), Ilorin, a federal tertiary hospital in North-Central Nigeria, has implemented EHR in several departments. Earlier analysis from the same study showed that EHR use at UITH is associated with reduced waiting time and better perceived outcomes. This paper focuses on the other side of the picture: the operational challenges that limit those gains.

Objectives

The study sought to:

1. Identify the operational challenges associated with EHR use at UITH.
2. Rank the challenges by severity as perceived by healthcare professionals.
3. Examine the implications of these challenges for patient waiting time and healthcare outcomes.

Research Questions

1. What operational challenges are associated with EHR use at UITH?
2. Which challenges are perceived as most severe?

3. How do these challenges affect patient waiting time and healthcare outcomes?

Literature Review

Barriers to EHR Adoption and Use

A substantial literature classifies the barriers to EHR adoption and use. Boonstra and Broekhuis (2010), in a systematic review focused on physicians, grouped barriers into eight categories: financial, technical, time, psychological, social, legal, organisational and change-process. Kruse, Kristof, Jones, Mitchell and Martinez (2016) identified cost, technical support, staff resistance, training needs and interoperability as the barriers most frequently reported internationally. Tsai et al. (2020), in a scoping review, found that while EHR implementation generally improved documentation and some quality indicators, usability problems, workload and technical issues were persistent concerns.

Studies from low-resource settings give greater weight to infrastructure. Fritz et al. (2015) identified reliable power, adequate network infrastructure, user training, local technical capacity and management commitment as success criteria for EHR in low-resource settings. Odekunle et al. (2017) attributed slow adoption in sub-Saharan Africa to high costs, poor infrastructure, limited computer literacy and weak policy. Akanbi et al. (2012) noted that many African EHR projects relied on donor funding and struggled with sustainability, power and connectivity.

Infrastructure, Connectivity and Downtime

EHR depend on electricity, local networks, internet links (for web-based or centrally hosted systems) and functioning hardware. Failure of any of these causes downtime. Larsen et al. (2018), analysing patient safety event reports in the United States, found that EHR downtime was associated with delays in care, inability to access records and laboratory results, and medication errors. During downtime, hospitals must revert to paper procedures, and transcribing information back into the EHR afterwards adds further work. In Nigeria, where grid electricity is unstable and internet services are expensive and intermittent, downtime is likely to be more frequent and prolonged.

Training and Human Capacity

Effective EHR use requires both general computer skills and system-specific training. Inadequately trained users take longer to complete tasks, use fewer of the system's features and make more errors (Boonstra & Broekhuis, 2010; Kruse et al., 2016). Adeleke, Lawal, Adio and

Adebisi (2015) reported significant information technology skill gaps and training needs among health information management professionals in Nigeria. Training that ends at go-live, without refresher sessions and on-the-job support, is a common weakness.

Data Quality

The value of EHR depends on the accuracy, completeness and timeliness of the data entered. Bowman (2013) identified errors arising from templates, copy-and-paste, default values, and wrong-patient entries as threats to information integrity. Ash, Berg and Coiera (2004) showed that system design can induce errors that would not occur on paper. Poor data quality affects patient safety directly through misleading information, and affects waiting time indirectly because clinicians must spend time verifying or correcting records.

Usability and Workload

Poorly designed interfaces increase clicks, screens and time per task. Ratwani et al. (2018) found usability and safety problems across EHR products in several United States hospitals. Sinsky et al. (2016) showed that physicians spend a large share of their working time on EHR and desk work, which may reduce time with patients. When documentation takes longer, consultations lengthen and queues grow.

Resistance to Change

Resistance arises when users perceive the new system as threatening their autonomy, increasing workload or offering little benefit (Boonstra & Broekhuis, 2010). Resistance is often a consequence of other problems, such as unreliable systems and inadequate training, rather than an independent cause. In settings where systems frequently fail, staff may reasonably prefer paper as a more dependable option.

Downtime Preparedness

Because some downtime is unavoidable, the literature emphasises preparedness. Larsen et al. (2018) found that safety events during downtime were often linked to the absence of clear procedures, such as how to order tests, record medications and communicate results while the system is unavailable. Recommended practices include maintaining printed downtime forms, keeping a regularly updated read-only copy of essential patient information (such as active medications, allergies and recent results), defining who decides when to switch to downtime procedures, training staff in these procedures, and reconciling paper records with the EHR when the system returns (Sittig & Singh, 2010). In settings where power and connectivity are unreliable, these procedures are not a

contingency but a routine requirement. A hospital that lacks them will experience each outage as a crisis, with consequences for waiting time and patient safety.

Theoretical Framework

The study is guided by the sociotechnical model of health information technology proposed by Sittig and Singh (2010). The model holds that EHR performance depends on eight interacting dimensions: hardware and software infrastructure; clinical content; the human-computer interface; people; workflow and communication; internal organisational policies, procedures and culture; external rules and regulations; and system measurement and monitoring. A problem in any dimension can undermine the whole system. This framework is suited to the study because the operational challenges examined span infrastructure (connectivity, downtime), people (training, resistance), clinical content and data (data entry errors) and organisation (coverage across departments, technical support).

Gap in Literature

Most studies of EHR barriers focus on adoption decisions or on physicians alone, and many come from high-income settings. Fewer studies examine the operational challenges experienced after implementation by a range of professionals in Nigerian tertiary hospitals, or link these challenges explicitly to waiting time and healthcare outcomes. This study addresses that gap.

METHODOLOGY

Design and Setting

The study adopted a descriptive cross-sectional survey design and was conducted at UITH, Ilorin, Kwara State. UITH is a federal teaching hospital providing a full range of specialist, outpatient, inpatient, emergency and diagnostic services, and has implemented EHR across several departments.

Population and Sample

The population was 1,481 healthcare professionals: nurses (745), doctors (475), Health Information Management staff (127), laboratory staff (71) and pharmacy staff (63). Using the Taro Yamane (1967) formula at $e = 0.05$, a sample of 315 was obtained and allocated proportionately: nurses 158, doctors 101, HIM 27, laboratory 15 and pharmacy 14. Respondents were drawn from professionals in each group who were available and willing to participate. Valid responses were received from 286 professionals (90.8%): 144 nurses, 92 doctors, 24 HIM staff, 14 laboratory staff and 12 pharmacy staff.

Table 1: Selected Characteristics of Respondents (N = 286)

Variable	Category	Frequency	Percentage (%)
Professional group	Nursing	144	50.3
	Doctors	92	32.2
	Health Information Management	24	8.4
	Laboratory	14	4.9
	Pharmacy	12	4.2
Gender	Male	128	44.8
	Female	158	55.2
Experience with EHR	Less than 1 year or none	47	16.4
	1–2 years	72	25.2
	3 years and above	167	58.4
Daily EHR use	Yes	226	79.0
	No	60	21.0

Table 2: Operational Challenges of Electronic Health Records Use at UITH (N = 286)

S/N	Challenge	SA n (%)	n	A n (%)	D n (%)	SD n (%)	Mean	SD	Rank
1	Inadequate internet connectivity has hindered efficient use of the EHR system	117 (40.9)	111	111 (38.8)	44 (15.4)	14 (4.9)	3.16	0.86	1st
2	System downtimes or technical issues have a significant impact on patient waiting times	110 (38.5)	119	119 (41.6)	43 (15.0)	14 (4.9)	3.14	0.85	2nd
3	EHR systems face frequent operational challenges in the department	102 (35.7)	130	130 (45.5)	40 (14.0)	14 (4.9)	3.12	0.82	3rd
4	Insufficient training is provided to healthcare providers on effective EHR use	92 (32.2)	121	121 (42.3)	53 (18.5)	20 (7.0)	3.00	0.89	4th
5	The EHR system has a high rate of data entry errors or inaccuracies that affect clinical decision-making	68 (23.8)	105	105 (36.7)	82 (28.7)	31 (10.8)	2.73	0.94	5th
6	Healthcare providers in the department are resistant to using EHR	58 (20.3)	90	90 (31.5)	40 (14.0)	40 (14.0)	2.58	0.97	6th
	Grand mean						2.96		Challenges present

Criterion mean = 2.50; higher mean indicates a more severe challenge.

Instrument

A structured, self-administered questionnaire was used. Six items addressed operational challenges of EHR use, and two items from the EHR availability section captured related operational conditions (frequency of technical issues and coverage across departments). Items were rated on a four-point Likert scale from Strongly Agree (4) to Strongly Disagree (1). Because challenge items are worded so that agreement indicates a problem, a higher mean indicates a more severe challenge. A mean of 2.50 or above was taken to indicate that the challenge was present.

Experts in health information management and medical statistics reviewed the instrument for content validity, and a pretest was conducted in a similar hospital. Cronbach's alpha was 0.76 (Nunnally, 1978).

Data Collection and Analysis

Questionnaires were administered over one week outside respondents' clinical duties. Data were analysed with SPSS version 25 using frequencies, percentages, means and standard deviations. Challenges were ranked by mean score and grouped into infrastructural and technical, human-capacity, data quality and attitudinal categories,

following the sociotechnical dimensions of Sittig and Singh (2010).

RESULTS

Respondents' Characteristics

As shown in Table 1, respondents were drawn from all five professional groups, with nurses and doctors forming the majority. Most had at least three years of EHR experience (58.4%) and used EHR daily (79.0%), indicating that their assessment of operational challenges was based on substantial first-hand experience.

Operational Challenges of EHR Use

As shown in Table 2, all six challenges exceeded the criterion mean (grand mean = 2.96). Inadequate internet connectivity was the most severe challenge (M = 3.16), endorsed by 79.7% of respondents. Four in five (80.1%) agreed that downtime and technical issues significantly affected patient waiting time, and 81.1% reported frequent operational challenges in their departments. Insufficient training was reported by 74.5%. Data entry errors that affect clinical decisions were reported by 60.5%. Resistance to EHR use was the least severe challenge (M

Table 3: Technical Reliability and Coverage of EHR at UITH (N = 286)

S/N	Statement	SA n (%)	A n (%)	D n (%)	SD n (%)	Mean	SD
1	Technical issues such as system downtime or slow loading occur frequently	110 (38.5)	105 (36.7)	51 (17.8)	20 (7.0)	3.07	0.92
2	All departments in the hospital currently use EHR	64 (22.4)	96 (33.6)	88 (30.8)	38 (13.3)	2.65	0.97

Table 4: Operational Challenges Grouped by Sociotechnical Dimension

Dimension (Sittig & Singh, 2010)	Challenge items	Mean range	Average mean	Severity
Hardware, software and infrastructure	Internet connectivity; downtime affecting waiting time; frequent operational challenges; frequent downtime or slow loading	3.07–3.16	3.12	Highest
People (skills and training)	Insufficient training	3.00	3.00	High
Clinical content and data	Data entry errors affecting clinical decisions	2.73	2.73	Moderate
Organisation (coverage)	Not all departments using EHR	2.65†	—	Moderate
People (attitude)	Resistance to EHR use	2.58	2.58	Lowest

†For coverage, the item is positively worded; 44.1% disagreement indicates the extent of the gap.

= 2.58); respondents were almost evenly divided, with 51.7% agreeing and 48.3% disagreeing.

Related Operational Conditions

As shown in Table 3, three-quarters of respondents (75.2%) reported frequent downtime or slow loading. Although just over half (56.0%) agreed that all departments use EHR, 44.1% disagreed, indicating that coverage across the hospital is incomplete.

Categorisation of Challenges

As shown in Table 4, grouping the challenges reveals a clear hierarchy. Infrastructural and technical problems were the most severe (average M = 3.12), followed by training gaps (M = 3.00), data quality (M = 2.73) and, lastly, attitudinal resistance (M = 2.58).

DISCUSSION

Infrastructure and Technical Reliability as the Dominant Challenge

The most severe challenges at UITH concern infrastructure: internet connectivity, downtime and frequent technical problems. This is consistent with the African EHR literature, which repeatedly places power and network reliability at the top of the list of barriers (Akanbi et al., 2012; Fritz et al., 2015; Odekunle et al., 2017). It also reflects the wider Nigerian environment of unstable electricity and costly intermittent internet services. The study provides direct evidence of how these problems affect patients: four in five professionals agreed that downtime and technical issues significantly increase patient waiting time. This agrees with Larsen et al. (2018), who documented delays in care and access to results during EHR downtime. When the system fails in a hospital that relies on it for registration and record retrieval, the time

savings that EHR normally provide are reversed. Staff must locate paper records (if they still exist), recreate information or ask patients to wait until the system returns. The coexistence of time savings on normal days and serious delays during outages may help explain why patients do not always perceive the full benefit of EHR. Downtime also threatens healthcare outcomes. Without access to records, clinicians may be unaware of allergies, current medications or recent results, increasing the risk of error. In Sittig and Singh's (2010) model, the hardware and infrastructure dimension underlies all others; weaknesses here constrain every other benefit of the system.

Training and Human Capacity

Insufficient training was the fourth most severe challenge, reported by three-quarters of respondents. This agrees with Boonstra and Broekhuis (2010) and Kruse et al. (2016), who identified training as a recurrent barrier, and with Adeleke et al. (2015), who found significant IT skill gaps among Nigerian health information professionals. Inadequately trained users navigate slowly, use fewer features and are more likely to make errors. Training therefore affects both waiting time, through slower documentation, and outcomes, through errors and underuse of safety features.

Data Quality

Three in five respondents reported a high rate of data entry errors affecting clinical decisions. This finding is significant for patient safety. As Bowman (2013) and Ash et al. (2004) emphasised, an EHR is only as reliable as the information entered into it. Errors may arise from rushed entry during busy clinics, poorly designed forms, inadequate training and re-entry of information after downtime. Data errors also cost time, because clinicians must verify and correct information before acting on it. The link between training gaps and data errors suggests that both should be

addressed together.

Resistance to Change

Resistance was the least severe challenge, and respondents were nearly evenly divided on whether colleagues resisted EHR. Combined with the high level of daily use (79.0%), this indicates that the main obstacle at UITH is not unwillingness to use EHR but the conditions under which it is used. This interpretation is consistent with Boonstra and Broekhuis (2010), who noted that resistance often results from technical and organisational problems. Where systems frequently fail and training is limited, some reluctance is understandable; fixing infrastructure and training is likely to reduce resistance further.

Incomplete Coverage

Over two-fifths of respondents disagreed that all departments use EHR. Partial coverage is itself an operational challenge, because patients moving between EHR-enabled and paper-based departments encounter mixed systems, duplicate documentation and delays in information transfer (Ohuabunwa, Sun, Jubanyik & Wallis, 2016). It also limits the completeness of the electronic record, weakening continuity of care.

Interdependence of the Challenges

The challenges identified in this study are not independent. Poor connectivity and power cause downtime; downtime forces staff to work on paper and re-enter data later, which increases the chance of data entry errors; frequent failures and inadequate training reduce confidence in the system, which may encourage resistance and irregular use; and irregular use leaves records incomplete, which further reduces the value of the system to other users. This cycle illustrates the central argument of the sociotechnical model that technical, human and organisational dimensions interact (Sittig & Singh, 2010). It also explains why isolated interventions, such as training without infrastructure improvement, are unlikely to succeed. Effective responses must address infrastructure, people and processes together.

The interdependence also connects the challenges to patient experience. On a day of stable connectivity, a patient may pass through registration and consultation quickly because records are instantly available. On a day of network failure, the same patient may wait while staff search for paper records or wait for the system to return, and clinicians may make decisions with incomplete information. From the patient's point of view, the unpredictability of service may be as frustrating as long waits, and inconsistent access to information may compromise the continuity of care that EHR are intended to secure.

Comparison with International Experience

The ranking of challenges at UITH differs from that typically reported in high-income settings. Reviews from North America and Europe tend to emphasise usability, documentation burden and clinician burnout (Ratwani et al., 2018; Sinsky et al., 2016; Tsai et al., 2020), whereas infrastructure is rarely the leading concern. At UITH, infrastructure and technical reliability dominate, and usability-related issues are overshadowed by the more basic question of whether the system is available at all. This contrast underlines the importance of context in EHR evaluation and supports Fritz et al.'s (2015) argument that success criteria in low-resource settings must give priority to power, network and local technical capacity.

CONCLUSION

EHR use at UITH faces significant operational challenges. The most severe are infrastructural and technical: inadequate internet connectivity, downtime and frequent technical problems, which professionals agree directly increase patient waiting time. Insufficient training and data entry errors that affect clinical decisions follow. Resistance to EHR is the least severe challenge, suggesting that the problem lies mainly in the conditions of use rather than in staff attitudes. Unless these challenges are addressed, they will continue to erode the time savings and quality improvements that EHR are designed to deliver.

RECOMMENDATIONS

The study recommends that:

1. UITH should provide reliable, redundant internet connectivity and stable power supply (including uninterruptible power supplies and backup generation) for all EHR service points.
2. A dedicated EHR technical support team should be established with defined response times for system failures.
3. Formal downtime procedures and backup forms should be developed, and staff trained to use them, so that patient care continues during outages.
4. Regular, role-specific EHR training and refresher courses should be provided for all professional groups, with on-the-job support.

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