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Health professionals' perceptions of electronic health records system: a mixed method study in Ghana

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Abstract

Background Electronic Health Record systems (EHRs) offer significant benefits and have transformed healthcare in developed countries. However, their implementation and adoption in low- and middle-income countries (LMICs) remains low due to challenges and competing interests. Health professionals' perception of EHRs can influence their adoption and continued use. The objectives of this study are to explore the perception of health professionals regarding implemented EHR systems in three hospitals in Ghana and identify factors influencing their perception and satisfaction.

Methods In this study, we employed a concurrent mixed method design to collect data from study participants from May to June 2023. The quantitative part employed a descriptive-survey and the qualitative (in-depth interview) techniques was applied. After obtaining written informed consent from each respondent, a structured survey questionnaire was filled out by the health professionals from three hospitals. An a priori power calculation was used to determine the sample size for the quantitative component. Two hundred and sixty-three (263) health professionals completed the questionnaire from the three facilities. A purposive sampling technique was used to select fifteen [1] participants for the interviews. A semi-structured interview guide was used for the in-depth interviews. The interviews were audio recorded, transcribed, and coded into themes using QSR Nvivo 12 software before thematic content analysis.

Results Our findings revealed that 213 (80.99%) health professionals perceived the EHRs as beneficial to patients and were generally satisfied. An overwhelming majority, 197 (74.90%) of the health professionals, were satisfied with its use and expressed interest in continuing to use the system. The majority of health professionals viewed the EHRs to have improved their work and workflow processes and provided the desired results. However, few other health professionals were dissatisfied with the system because they viewed the EHRs as frustrating due to unstable internet connectivity and power supply. Other concerns were related to the privacy and confidentiality of patient information. They believe access to patient information should be on a need-to-know basis, and patient information should not be accessible to all other clinicians except those involved directly in their care processes.

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Conclusion The study revealed that health professionals have a positive perception of the implemented EHRs, are highly satisfied with them, and are interested in continuing to use them. However, health professionals' concerns about the unstable power supply, poor internet connectivity, security, and confidentiality of patient's information need attention, to mitigate their frustrations and boost their confidence in the system.

Keywords Electronic health records, eHealth implementation, Health professionals, Perception, Satisfaction, Ghana

Introduction

Electronic Health Record systems (EHRs) offer significant benefits and have revolutionized many health systems [2, 3]. They are recognized as a crucial component of an effective and efficient healthcare information system, contributing to positive health outcomes [4–6]. The implementation of EHRs provides numerous advantages, including the elimination of time-consuming tasks associated with paper-based systems, a reduction in medical errors and adverse drug effects, easy access to patient data, adherence to practice guidelines, improved quality of healthcare, and enhanced decision-making [3, 7–9].

While developed countries have successfully utilized EHRs to transform their healthcare systems [10, 11], the adoption and implementation of EHRs in many low- and middle-income countries (LMICs) remain limited. The health systems in these regions are often burdened with challenges and competing interests [11–14], which hinder the effective implementation of EHRs and lead to unintended consequences and unpredictable outcomes [11].

Health professionals' perceptions of EHRs significantly influence their adoption and continued use [15]. Studies have shown that EHRs can increase clinicians' workload, with additional documentation time being viewed as extra work, leading to dissatisfaction [1, 16–18]. This dissatisfaction is further aggravated by complex and poorly designed EHRs interface, which contribute to clinician burnout and increased in time spent on the system [19]. Additionally, inadequate knowledge, lack of proper training, and difficulties in familiarizing themselves with the EHR features [20] are commonly cited as reasons for negative perceptions [15, 21].

The drawbacks of EHRs can impact the efficiency of healthcare practices [1]. Disruptions in workflow processes and extended patient wait times can occur during system breakdown due to unstable internet connectivity [22], resulting in frustration and dissatisfaction among health professionals and patients alike [23, 24]. Concerns also arise regarding confidentiality, privacy, and security of patient information [25].

Despite these challenges, many health professionals appreciate EHRs streamlining documentation processes, aiding in drug prescription, improving diagnostics, and providing accurate patient information [24, 26]. Nonetheless, issues such as poor interoperability, and frequent downtimes due to limited infrastructure have raised concerns about the effectiveness of EHRs in LMICs and have hindered their widespread adoption.

In Ghana, several eHealth initiatives, including EHRs, have been introduced in the healthcare sector [27, 28]. These initiatives aim to transform healthcare delivery operations and management, and to promote evidence-based decision making [22, 29]. However, some of these systems have not met expectations, leading to dissatisfaction among health professionals and subsequent discontinuation of their use [27]. The literature suggests that health professionals' perceptions of EHR systems are pivotal to their sustainable use, yet the factors shaping these perceptions in specific contexts remain unclear. Therefore, it is crucial to explore and identify the factors that encourage the adoption and continuous use of EHRs. The objectives of this study are to (i) explore the health professionals' perceptions of the implemented EHRs, (ii) explore the factors influencing their perceptions and satisfaction with these systems, and (iii) propose ways to enhance the implemented EHRs for sustainable use.

Methods

All methods were carried out following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting a cross-sectional study [30].

Study design

This study employed a concurrent mixed-method approach. A complementary qualitative (in-depth interview) and quantitative (descriptive survey) techniques used were given equal importance, to comprehensively explore the health professionals' perception and unearth the factors that influence the perception and satisfaction of health professionals about the EHRs. The data was collected concurrently and analysed separately, but integration was done during the interpretation [31]. The measurement strategies employed for each objective are shown in Table 1.

The use of these methods allowed the researchers to benefit from the detailed, contextualized insights of the qualitative data; providing enough evidence to clarify the research questions. Also, the complexities and diversity of

Table 1 Study objectives and measurement strategy

No	Objective	Measurement strategy
i.	To explore the health professionals' perception about the implemented EHRs	Qualitative
ii.	To explore the factors that influence the health professionals' perception and satisfaction of the implemented EHRs	Quantitative
iii.	To suggest ways to improve the implemented EHRs for sustainable use.	Qualitative

the healthcare setting choose the mixed-method approach most suitable for this study which helps unearth, grey areas that hitherto would have been difficult to explain [32].

Study settings

The study was carried out in three hospitals in Ghana: namely the Princess Marie Louise Children's Hospital, in the Greater Accra region, the Saint Martin's Catholic Hospital, in the Ashanti Region and the Essikado Government Hospital in the Western Region. These hospitals provide generalized and specialized services.

Description of the EHRs

The evaluated EHRs have the following general characteristics: its patients' management component comprises functions used for performing activities such as patient admissions and discharges; searching and retrievals of information; documentation of personal information, medical history, etc. The clinical component is used for performing functions such as clinical documentation, consultations, and medical diagnosis, prescriptions, and it provides clinical decision support, etc. The security component has features to enhance the protection of patient data, enforce privacy and confidentiality, and enforce access control. Furthermore, the billing component is used for billing, coding, and accounting.

Study population and eligibility criteria

The targeted population was health professionals at the selected hospitals who work with the EHR system. These include doctors, nurses, biomedical scientists, pharmacists, and other allied health professionals.

Inclusion and exclusion criteria

Inclusion criteria

All health professionals from the selected hospitals who have been using the EHRs for six months or more for their routine work were included in the study. In this study, all 263 health professionals from the three selected facilities, who met the inclusion criteria were included for higher precision and accuracy.

Exclusion criteria

Excluded from the study were health professionals from the selected hospitals whose work procedures did not require the use of the EHRs or who had been using the EHRs for less than six months.

Sampling procedure and sample size determination

The sample size for the quantitative part of this study was determined based on an a priori power calculation [33, 34]. A minimum sample of 194 respondents was determined. This was expected to provide enough statistical power (0.80) to detect small-sized correlation coefficients (0.20) [33]. We made room for a larger sample size because it would increase the statistical power for detecting smaller effects and strengthen the robustness of our findings.

A priori power sample size calculation is denoted by:

$$N = \left\lfloor \frac{(Z_\alpha + Z_\beta)}{C} \right\rfloor^2 + 3$$

Where,

N = sample size.

α (two-tailed) = 0.05 (Threshold probability for rejecting the null hypothesis. Type I error rate).

β = 0.20 (Probability of failing to reject the null hypothesis under the alternative hypothesis. Type II error rate).

$r = 0.20$ (The expected correlation coefficient).

The standard normal deviation for $\alpha = Z\alpha = 1.9600$.

The standard normal deviation for $\beta = Z_\beta = 0.8416$

$$C = 0.5 \times ln\left\lfloor \frac{(1+r)}{(1-r)} \right\rfloor = 0.2027$$

$$\text{Therefore, Total sample size } = N = \left\lfloor \frac{(1.9600 + 0.8416)}{0.2027} \right\rfloor^2 + 3 = 194$$

Therefore, the estimated number of health professionals in the three hospitals whose work procedures require the use of EHRs was 370. The actual sample size used in this study was 263. The detail sample size for each facility is shown in Table 2.

In the qualitative part, fifteen [1] participants were purposively selected as respondents for the in-depth interviews. This number was believed to be enough to yield saturation of the required information as has been shown in other studies with similar design, which used fewer numbers [35, 36].

Data collection procedures

Survey

From May to June 2023, we collected data from study participants using a structured questionnaire (appendix 1) for the survey, which was filled out by the health professionals. This approach was adopted in order to avoid disruption to their schedules. The questionnaire includes questions on demographics characteristics of the respondent; Part 1 of the questionnaire contained 12 questions that assessed the perception of the health professionals on EHRs and Part 2 had questions to measure their satisfaction level. The third part had three open ended questions that assessed components of the EHRs that were liked most, or were of concern to the health professionals. It also captured their suggestions to improve the system.

Interview

An interview guide was used for the in-depth interviews. After obtaining the appropriate permission from the administrators of the hospitals, the identified potential respondents were then invited to take part in the study when they agreed and consented. A face-to-face interview was conducted in English by CH who was trained in qualitative research techniques and understood the import of the questions. The interviews were conducted in a serene environment within the hospitals in order not to disrupt services. The interviews were recorded using an audio tape recorder with consent of the study respondents. Participants shared their experiences and views about the EHRs and suggested how to address the issues encountered using it. The interviews lasted not more than 20 min.

Data management and analysis

Survey

All the questionnaires were checked for accuracy, completeness and legibility. Each questionnaire was assigned a unique identification number for quality control and recall purposes before being entered into an electronic data-capturing tool developed using EpiData 3.1 software. The data screens had in-build checks to minimize data entry errors. The data was exported and converted into STATA Version 15 for analysis. Descriptive statistics was used to summarize the data. The Cronbach's alpha was 0.82, indicating a good level of reliability. Individual Cronbach's alpha was also calculated for each of the study's dimensions. Cronbach's alpha for Health professionals' perception of the EHRs was 0.69 and 0.75 for Health professionals' level of satisfaction and continuous use of the EHRs. The tool's Content Validity Ratio (CVR) (60.0%) and Content Validity Index (CVI) (70.0%) were also determined. Fisher's exact was used to test the relationship between demographic characteristics and overall satisfaction with the EHR system. Bivariate logistics regression was used to determine the effect of Health professionals' perception of the EHRs on Health professionals' level of satisfaction with the use of the EHRs. The open-ended data was coded and analysed using Microsoft Excel 2016 and themes were derived accordingly.

Interviews

NKM and CH transcribed the interviews after repeatedly listening to them. This was done to ensure that qualitative principles for transcribing interviews were applied. The transcripts were edited by NKM, without changing the original meaning of statements. Using the study objectives and the themes in the interview guide, we developed a codebook, using a combination of the established categories based on the original research questions. The transcripts were prepared and imported into QSR Nvivo 12 software for data coding and analysis. The coding was done by critically reviewing each transcript and coding it into themes. Thematic content analysis was used to analyse the data. The emerging themes from the interviews were used to support the quantitative results. The results are presented as narratives supported by relevant quotes. The findings from both

Table 2 Distribution of estimated number of health professionals, expected sample size and the actual sample per facility

Name of facility	Estimated number of Health Professionals	Expected sample size	Actual sample	Percentage
Essikado Hospital	80	42	63	23.95
PML children Hospital	185	97	103	39.17
St Martins Hospital	105	55	97	36.88
Total	370	194	263	100.00

Source: The staff population of all the study centres was obtained from their 2022 annual reports

the qualitative and quantitative arms were first, described separately and thereafter combined to generate a more comprehensive understanding of the perception and factors influencing health professions' satisfaction with the EHRs.

Results

Perception of health professionals about the implemented EHRs

Finding from the qualitative in-depth interviews

The main themes (Perceived benefits of the EHRs, Perceived challenges of the EHRs, and Strategies for improvement and sustainable use of the EHRs); and sub-themes such as, (EHRs improves work and workflow, EHRs facilitates provision of quality care, Effect of poor infrastructure on EHRs, Provision of education and periodic training etc.), emerged from the qualitative in-depth interviews and are summarised in Table 3 below:

Perceived benefits of the EHRs

EHRs improves work and workflow

Health professionals perceived the EHRs to speed up work and facilitate easy report generation. They see it as beneficial to patients because it reduced patient waiting time to receive services. In their view, long queues to access services were relegated to the past. Respondents' views were expressed as:

> *"...the EHRs has improved work in terms of the fast-tracking the work and make reporting very easy" (IDI 4 with a Health Information Officer)".*

> *"...to patients, I think it [has] improved patient waiting time, first you come to the place and see patients waiting in a long queue just to get lab results, but now you wouldn't see that due to the EHRs" (IDI 3 with a Biomedical scientist).*

EHRs improves documentation and ease access to patient information

Furthermore, health professionals perceived the EHRs to improve easy access to patient information. They opined that laboratory investigations and other information needed to provide care for patients were well-kept and easily accessible. The views of respondents were expressed as:

> *"I am able to access almost all the patients' information within my care; their information about things I need to do for them, things the doctors or other professionals have done for them, [laboratory] investigations that need to be done or results of investigations that have been brought back ". (IDI 6 with a Nursing Officer)*

> *"It improves documentation and [its] easy to retrieve information. The information too is kept well; patient information is kept very well each time you want to review it..." (IDI 1 with a Dentist).*

EHRs facilitate provision of quality care

A lone voice re-echoed the benefits of the EHRs. The health professional asserted that since the EHRs provides quick access to patient information, it benefited both patients and health workers. In his view, patients receive prompt attention and health workers are able to make quick decisions or interventions, which benefits the patient. His view was expressed as:

> *"...since patient information is quickly accessible, quick interventions [decision] are made to save the patient" (IDI 6 with a Nursing Officer).*

> *"It is beneficial to the patients, since the patient information is easily accessible; prompt attention and interventions are given to them." (IDI 6 with a Nursing Officer).*

Table 3 Main and sub-themes on health professionals perceived benefits, challenges and suggested strategies for EHRs improvement and sustainable use

Main themes	Sub-themes
Perceived benefits of the EHRs	EHRs improves work and workflow
	EHRs improves documentation and ease access to patient information
	EHRs facilitates provision of quality care
	EHRs improves security of patient data
Perceived challenges of the EHRs	Effect of poor infrastructure on EHRs
	Unfriendly-user interface
	Privacy, confidentiality and security of patient information
Strategies for improvement and sustainable use of the EHRs	Provision of education and periodic training
	Improve privacy, confidentiality and security of patient information
	Improve internet connectivity and power supply
	Provision of a user-friendly system

EHRs improves security of patient data

Regarding the security of patient data, health professionals belief that staff having personal log-in credentials, which regulates access into the EHRs and other activities that they can perform is in itself security. This is how the respondent voiced out:

> *"When it comes to patient data, […] every lab person has a personal account; we know the time you log in and the time you log out [of the system], and any activity that is being done on the system is also being monitored. With that, I think there is security when it comes to the [EHRs]." (IDI 3, with a Biomedical Scientist").*

Analysis from the open-ended questions, Table 4, showed that patient management 114 (48.72%) and clinical components 105 (44.87%), were the components health professionals perceived as most useful. The least was the billing system, which accounted for only 5 (2.14%).

The reasons ascribed by the health professionals for liking the components of the EHRs are shown in Table 4. More than half of the health professionals, 146 (56.4%) perceived the EHRs to improve work. 26% 69 (26.0%) of the participants opined that the EHRs provide easy access to patient information. Other reasons adduced were that the EHRs improve diagnosis and reduce medication errors, hence preventing deaths, 25 (9.7%). EHRs improve the security of patient information, 12 (4.6%) was the least frequent reason given.

Perceived challenges of the EHRs

Effect of poor infrastructure on EHRs

Poor infrastructure influenced the operations of the EHRs. Health professionals think that it was difficult to use. Health professionals perceived the EHRs as frustrating due to unstable internet connectivity and erratic power supply that resulted in frequent down time. In their view, the EHRs increases the waiting period of clients when power outages occur. It slows down patient flow and services. The following are how they poured their frustrations:

> *"... when the system goes down, it makes it difficult to attend to a lot of patients and that slows down the flow of patients that are being taken care of." (IDI 2 with a clinician).*

> *"...when the system [network] goes down, it increases the waiting period of clients which bring tension in the hospital" (IDI 2 with a Medical Officer).*

> *"...when you have a bad network, it slows things; it can sometimes be frustrating but when you get a*

Table 4 Distribution of beneficial EHRs components, reasons for liking the components, concerns with the use of the EHRs, and suggestions for its improvement

Themes	Frequency	Percent (%)
EHRs components viewed as beneficial by health professionals		
Patient management	114	48.72
Clinical	105	44.87
Security	10	4.27
Billing system	5	2.14
Reasons why health professionals like the EHRs components		
Improves work & workflow	146	56.40
Improves documentation and easy access to accurate patient information	69	26.60
Provides quality care	25	9.70
Improves security of patients' data	12	4.60
Restricted working component	7	2.70
Reported issues health professionals had concern with using the EHR		
Poor internet connectivity	47	17.9
Unfriendly user interface	68	25.9
Privacy, confidentiality & security	40	15.2
Suggestions for improvement of the EHRs by themes		
Provision education and periodic training	38	14.67
Improve privacy, Confidentiality and security of patient information	50	19.31
Improve internet connectivity	63	24.32
EHRs interface	40	15.44
Provide adequate equipment	6	2.32

Data are presented as frequencies and percentages

very good network, I think it's good, it's great (IDI 3 with a sonographer).

Unfriendly user interface

Not all health professionals were happy with the EHR interface. Those in the imaging and sonographic department expected the EHR interface to fit their workflow to some extent. This is how they see it:

"…there should be an interface where we can upload ultrasound images, so once you do the scan you can upload the images, send it to a doctor; … they should give us an interface that we can [use to] upload ultrasound images and reports." (IDI3 with a sonographer).

Privacy, confidentiality and security of patient information

Privacy and confidentially concerns also influenced health professionals' perception of the EHRs. Some health professionals wished the system was revised so that patient information could be accessed on a need-to-know basis. They opined that anybody having access to the system sees everything without restrictions. This is how their concerns were expressed:

"I wish there could be a few revisions to the system, where we can have a password attached to some of the patient information on "need to know basis"; so that we don't have just anybody having access to the patients' information" (IDI 1 with a senior nursing officer).

"Well, I can't say there is much privacy in this, because once you get access to the patient attendance number, that's the OPD number; you can access every information you want about the patient; so confidentiality is something which is not there". (IDI 5 with a public health unit)

Analysis from the open-ended questions suggests that about 108 (41.1%) of the respondents [*figures not shown in Table 4*] had no concerns with using the EHRs. However, the majority of the health professionals had issues with it. Technological issues, such as poor internet connectivity 47(17.9%) and unfriendly user interface 68 (25.9%) constituted the majority of their grievances. Other concerns were related to privacy, confidentiality and security 40 (15.2%) of the patient information in the EHRs as shown in Table 4.

Quantitative results

Factors that influence the health professionals' perception and satisfaction

Healthcare professionals' socio-demographic characteristics and overall satisfaction with the use of the EHRs

The characteristics of the respondents and overall satisfaction with the use of the EHRs are shown in Table 5. A total of 263 health professionals participated in the study. Overall, the majority 197 (74.90%) of the health professionals were satisfied with the use of the EHRs, while 66 (25.10%) were dissatisfied with it. About half of them, 132 (50.19%) were below 30 years of age and more than a third, 94 (35.74%) were in the 30 to 39 years age group. 11%, 29 (11.03%) were in the 40 to 49 years group and the remaining, 8 (3.04%) were 50 years or older. Male respondents were 129 (49.05%), while females were 134 (50.95%). Out of the 263 health professionals, 132 (50.19%) had a bachelor's degree, 37 (14.07%) had a master's or doctor of philosophy (PhD) degree and 94 (35.74%) had a diploma.

About the total number of years spent in service, the majority of the health professionals, 118 (44.87%) have spent between 1 and 5 years in service, 52 (19.77%) have spent between 6 and 10 years in service, while 62 (23.57%) have spent between 6 months and 1 year working. Thirty-one (11.79%) have worked more than 10 years. With regards to the number of years of experience using EHRs, the majority 154 (58.56%) of the health professionals have between 6 months and 1 year experience using the EHRs system, 76 (28.9%) had between 6 and 10 years and 13 (4.94%) have more than 10 years working experience. Most of the participants 117 (44.49%) were from the nursing department followed by 107 (40.69%) from the allied health units. The physicians' department constituted about 6% 15 (5.7%) and the pharmacy unit and the laboratory department each constituted 12 (4.6%) percent respectively. The allied health units comprise of units such as Health Information Management, Dental, Ear Nose & Throat, Eye, Radiography and Sonography.

Regarding the relationship between socio-demographic characteristics and overall satisfaction with the use of the EHRs, age, gender, educational background, Number of years in service, Number of years in practice in the facility, Number of years of experience with EHRs and Professions had no statistically significant relationship with overall satisfaction with the EHR system (Table 5).

Health professionals' perception factors influencing overall satisfaction with the EHR system

Table 6 shows the health professionals' perception of the EHRs. Majority of the respondents, 219 (83.27%) confirmed that they had received training on the EHRs, while only 44 (16.73%) said that they did not received any training. Most of the staff, 190 (72.24%), perceived the system was easy to navigate and use as compared to 73 (27.76%) who thought otherwise. Again, most of the respondents, 203 (77.19%), were of the view that the information in the EHRs was presented clearly, while 60 (22.81%) were of the view that the presentation of information in the EHRs was not clear. The majority of the health professionals 213 (80.99%) perceived the EHRs as beneficial to patients

Table 5 Relationship between demographic characteristics of health professionals and overall satisfaction with the EHRs system

Characteristics	Number of Participant *n* = 263 (%)	Overall Satisfaction with the EHRs system		Fisher's exact *P*-value
		Yes *n* = 197 (74.9)	No *n* = 66 (25.1)	
Age-group				0.069
< 30 years	132 (50.19)	104 (52.79)	28 (42.42)	
30–39 years	94 (35.74)	70 (35.53)	24 (36.36)	
40–49 years	29 (11.03)	20 (10.15)	9 (13.64)	
50 + years	8 (3.04)	3 (1.52)	5 (7.58)	
Gender				0.776
Female	134 (50.95)	98 (49.75)	31 (46.97)	
Male	129 (49.05)	99 (50.25)	35 (53.03)	
Educational background				0.643
PhD/Masters	37 (14.07)	26 (13.20)	11 (16.67)	
BSc	132 (50.19)	98 (49.75)	34 (51.52)	
HND/Diploma	94 (35.74)	73 (37.06)	21 (31.82)	
Number of years in service				0.120
6 months – 1 year	62 (23.57)	49 (24.87)	13 (19.70)	
1–5years	118 (44.87)	88 (44.67)	30 (45.45)	
6 -10years	52 (19.77)	42 (21.32)	10 (15.15)	
10 + years	31 (11.79)	18 (9.14)	13 (19.70)	
Number of years in practice in the facility				0.305
6 months – 1 year	77 (29.28)	60 (30.46)	17 (25.76)	
1–5years	128 (48.67)	99 (50.25)	29 (43.94)	
6–10years	41 (15.59)	27 (13.71)	14 (21.21)	
10 + years	17 (6.46)	11 (5.58)	6 (9.09)	
Number of years of experience with EHRs				0.277
6 months – 1 year	154 (58.56)	115 (58.38)	39 (59.09)	
1–5years	76 (28.90)	56 (28.43)	20 (30.30)	
6–10years	20 (7.60)	18 (9.14)	2 (3.03)	
10 + years	13 (4.94)	8 (4.06)	5 (7.58)	
Professions				0.218
Nursing	117 (44.49)	81 (41.12)	36 (54.55)	
Physicians/Doctors	15 (5.70)	10 (5.08)	5 (7.58)	
Biomedical Scientists	12 (4.56)	11 (5.58)	1 (1.52)	
Pharmacists	12 (4.56)	10 (5.08)	2 (3.03)	
Allied health professionals	107 (40.68)	85 (43.15)	22 (33.33)	

Data are presented as frequencies and percentages

HND Higher National Diploma

while the remaining respondents 50 (19.01%) showed discerning views. On patient diagnosis, the majority192 (73.00%) of the respondents were of the view that the EHRs provided desirable results in diagnosing patients, others 71 (27.00%) held contrary views.

With respect to the factors influencing the overall satisfaction with the EHRs system; System easy to use and navigate, Information presented in the EHRs is clear, EHRs beneficial for your patient, EHRs provide desirable results in patient diagnoses had a statistically significant influence on the overall Satisfaction with the EHRs system. However, having training on the EHRs had no statistically significant relationship with overall Satisfaction with the EHRs system (Table 6).

Level of continuous use of EHRs factors influencing overall satisfaction of the EHRs system

Table 7 shows the health professionals' level of continuous use of the EHRs factors influencing overall satisfaction of the EHRs system. About 93% 245 (93.16%) of the health professionals rated the EHRs as comfortable. Whilst about 6% 18 (6.84%) said they were not comfortable. Also, 90% of the participants 237 (90.11%) were satisfied with the EHRs technical abilities as

Table 6 Health professionals' perception of the EHRs factors influencing their overall satisfaction of the EHRs system

Statements	Frequency $n=263$ (%)	Unadjusted OR	Robust Standard Error	95% CI	*P*-value
Have you received any training on the EHRs?					
No	44 (16.73)	Ref			
Yes	219 (83.27)	1.5	0.54	[0.74–3.04]	0.2627
Is the system easy to use and navigate?					
No	73 (27.76)	Ref			
Yes	190 (72.24)	5.71	1.77	[3.11–10.47]	< 0.0001**
Is the information presented in the EHRs clear?					
No	60 (22.81)	Ref			
Yes	203 (77.19)	6.99	2.27	[3.70–13.20]	< 0.0001**
Is EHRs beneficial for your patient?					
No	50 (19.01)	Ref			
Yes	213 (80.99)	7.38	2.52	[3.77–14.43]	< 0.0001**
Does the EHRs provide desirable results in patient diagnoses?					
No	71 (27.00)	Ref			
Yes	192 (73.00)	9.13	2.95	[4.85–17.18]	< 0.0001**

Data are presented as frequencies and percentages

SE Standard Error, *CI* Confidence Interval, *OR* Odds Ratio, *HND* Higher National Diploma, *EHRs* Electronic Health Record System

***p*-value<0.001 is statistically significant

Table 7 Health professionals' level of continuous use of EHRs factors influencing overall satisfaction with the EHR system

	Frequency $n=263$ (%)	Unadjusted OR	Robust Standard Error	95% CI	*P*-value
Are you interested in continuing to use the EHRs system?					
No	53 (20.15)	Ref			
Yes	210 (79.85)	29.59	11.92	[13.43–65.19]	< 0.0001**
How will you rate the comfort of using the EHRs and its procedures?					
Not comfortable	18 (6.84)	Ref			
Comfortable	245 (93.16)	31.20	23.96	[6.92–140.57]	< 0.0001**
How will you rate the technical ability of the EHRs?					
Dissatisfied	26 (9.89)	Ref			
Satisfied	237 (90.11)	7.25	3.21	[3.04–17.27]	< 0.0001**
How will you rate the security features of the EHRs in terms of protection of patient information?					
Dissatisfied	30 (11.41)	Ref			
Satisfied	233 (88.59)	8.13	3.43	[3.56–18.58]	< 0.0001**

Data are presented as frequencies and percentages

SE Standard Error, *CI* Confidence Interval, *OR* Odds Ratio, *HND* - Higher National Diploma, *EHRs* – Electronic Health Record System

***p*-value<0.001 is statistically significant

compared with less than 10% 26 (9.89%) who expressed dissatisfaction with it. Again, 233 (88.59%) of the health professionals rated the security features of the EHRs as protective of patient information. However, about 11% 30 (11.41%) showed discerning views about its security features as protective. However an overwhelming majority 210 (79.85%) expressed an interest in continuing to use the system as compared to 53 (20.15%) who were not keen on continuing to use it (Table 7).

In terms of the factors influencing overall satisfaction with the EHR system, variables such as interest in continuing to use the EHR system (OR = 29.59, $p < 0.0001$), comfort with using the EHRs and its procedures (OR = 31.20, $p < 0.0001$), technical ability of the EHRs (OR = 7.25, $p < 0.0001$) and security features of the EHRs

in terms of protection of patient information (OR = 8.13, $p < 0.0001$) had a statistically significant influence on the overall satisfaction with the EHRs system.

Suggestion to improve the EHRs for sustainable use

Several suggestions came up on how to improve the EHRs and sustain its use. The results from the qualitative interviews and the open-ended question in the survey has been fused together under the following themes for easy comprehension.

Improvement and sustainable use of the EHRs

Provision of education and periodic training

Health professionals believe that awareness about EHRs should start from the training institutions where students would get early exposure to the EHRs before they start work. In their view, periodic and decentralised training sessions should be organised for staff. This approach, they belief would avail the staff the opportunity to catch-up with working with the system which will result in fewer errors. They emphasised on special training sessions for staff who are computer phobia. Those already on the job, it was suggested should be provided with periodic training to update their knowledge on the EHRs. The respondents' views of were captured as below:

> *"…awareness! It should also be implemented at the training institutions so that they will be used to it before they start work. It should be part of the learning curriculum, so that they will know more about it." (IDI 5 with a nursing officer).*

> *"…the workers at the facility should be reoriented on the EHRs, probably every quarter, […] to improve our knowledge of the system, so that mistakes will not occur" (IDI 5 with a nursing officer).*

> *"…the training should be decentralized for all those who are supposed to work with the system, [for them] to get a better understanding of it" (IDI 4 with a health information officer).*

> *"Special sessions aside the training needs to be made for those who are IT phobia, so that they will know the basis of IT before using the system" (IDI 9 with a physician).*

Improve privacy, confidentiality and security of patient information

How to maintain high-security standards were suggested. Among the health professionals, it was advocated that only physicians should have unlimited access to patient information; whilst other clinical staff are restricted to accessing the information on a "need to know basis". Participants' *views from the open-ended questions are presented below*:

> *The system should have a high standard of security and confidentiality; Information should be saved automatically to prevent data from being missing; Patient information should be accessible to their physicians only; restrict how any clinician can access patient info; restricting patients' information to need to know basis to ensure safety of information.*

Improve internet connectivity and power supply

While health professionals see the EHRs as facilitating health care delivery, the erratic internet connectivity experienced eroded their faith in the system. Some of them suggested having a functional system but without the Internet. They suggested having an off-line mode, to be able to log-on and work when the internet was down. They also advocated having an IT specialist, who could readily address recurring IT issues. The views expressed by some respondents were captured as below:

> *"I think that the network connectivity should be checked, so that the system is fast". (IDI 2 with a clinician).*

> *"…sometimes our internet connections might not be working, but there should be a system that would allow us to log in and logout without internet connection. I think something should be done about it." (IDI 3 with a Biomedical Scientist).*

> *"…the presence of an IT specialist should be available, to assist and intervene, as well as work on the network when there is a breakdown, in order to use it smoothly." (IDI 6 with a nursing officer).*

An analysis of the open-ended responses re-echoed similar sentiments; where issues with the internet connectivity 63 (24.32%); privacy, confidentiality and security 50 (19.31%), and EHRs user-interface 40 (15.44%) were mentioned that if addressed, would improve the implementation process.

Provision of user-friendly system

The interface of the EHRs seemed unsuitable for some health professionals' work. This had some of them advocating form modification of the user-interface so that it could capture certain types of disease conditions and also be able to upload ultrasound images. Respondents' views were expressed as below:

"I think they need to modify the system so that if you want to type a certain condition you should be able to type it in..." (IDI 2 with a ENT specialist).

"I will recommend that with my field, I am a sonographer so there should be an interface where we can upload ultrasound images..." (IDI 3 with a Sonographer).

Provision of adequate equipment

Lack of adequate equipment was perceived to be affecting work. Having adequate functioning equipment it was suggested would improve work:

"...we need to get more computers because some of the units are not having enough computers" (IDI 2 with an ENT specialist).

"...they should make sure every ward[s] or every department has a computer, a working computer, one that is not faulty that work can be done" (IDI 2 with a staff nurse in consulting room).

However, analysis of the open-ended questions, suggests that only few 6 (2.32%) health professions think that availability of adequate equipment will result in improvement of the EHRs sustainable use (Table 4).

Discussion

This study answered two research questions related to health professionals' perception of the implemented EHRs and factors influencing their perception and satisfaction of the system.

Findings from our study suggested that a high proportion of health professionals have a positive perception of EHRs. Health professionals perceived the system as beneficial to them and their patients, because it improves work efficiency and workflow of care delivery, and provides the desirable output. This perception made the health professionals feel comfortable using the system. This is similar to the findings of the studies conducted in the USA and Ethiopia [26, 37]. The health professionals in the current study opined that the EHRs were easy to navigate and used its features for searching for information. In the present study, over 72% of participants perceived the EHRs as easy to use and reported desirable outcomes. This percentage appears higher than the findings from other studies conducted in the Gulf Cooperation Council countries and Saudi Arabia, where 61.8%, found EHRs easy to use and 60.2%, believed the EHRs provided accurate results [15, 25]. Health professionals perceived positively the implemented EHRs to have several benefits, including improved productivity, enhanced quality care, easy to search patient information, and helped finish work considerably faster compared to previous routines as reported in a national multicentre study in Saudi Arabia [25]. In our current study, two components of the EHRs (patient management and clinical functions) were mentioned as reasons liking the EHRs. About half the respondents mentioned that (48.72%, patient management) and (44.87%, clinical functions) were components perceived to be most useful by health professionals.

Although, an overwhelming majority (79.85%) of the respondents expressed overall satisfaction with the system, only half of this number rated the EHRs as satisfactory and would continue to use it, because of its security features, technical ability and comfort. The other half of the health professionals, who remained indifferent, might have harboured some unexplained resentment towards the EHRs. This can account for the low percentages recorded from the analysis of the reasons deduced in the open-ended questions, except for those who said they liked the system because it improves work and workflow. This shows that not all health professionals were wholly satisfied with the system, let alone to continue to use it.

The frustration faced by health professionals in using the system emanates from frequent downtime experienced due to erratic power supply or poor internet infrastructure. From our interviews, both patients and health professionals were affected equally, when the system was down. The resentment of health professionals towards the system were obviously emanating from what they could not do with the system. This finding is in congruent with those reported in studies the UAE and Saudi Arabia [15, 25]. Alanazi and colleagues further argued that, health professionals who have positive perception of the EHRs were of the view that the system offered several benefits and was overly useful [15]. It is therefore imperative to address the issues of poor infrastructure in these setting, for the EHRs to function as intended, thereby creating the right perspective about the EHRs for its sustainable use. This finding was also emphasised in the study conducted in Ethiopia [26].

Studies conducted in Ethiopia, United Arab Emirates (UAE) and the Netherlands have shown that generally, health professionals are dissatisfied with the implemented systems because of certain deficiencies in them, such as poor service quality output by the system [24, 26, 38]. In the case of the study conducted in the Netherlands, findings showed that, the new EHRs did not meet the expectations of about half of the respondents [38]. In the UAE however, despite the overall high satisfaction with the EHRs by health professionals, the significant barrier that was linked to nurses' dissatisfaction of the system, was lack of belief in the values generated by the EHRs for patient care [24]. The findings in the Ethiopia study however, reported low user satisfaction because of inadequate knowledge of the system [26].

In our study, about 8% of the respondents were unsatisfied with the EHRs' security features and its technical abilities even though majority of the respondents had expressed satisfaction with the system. This finding aligns with other earlier studies [15, 39]. Alharthi et al., in their studies in a Saudi Government hospital, argue that perception is a significant determinant of user acceptance and user satisfaction with health information technology [39]. Krousel-Wood, et al., in a multispecialty healthcare system study in the USA, asserts that health professionals' perception and overall satisfaction significantly decreased over time for variables such as clinical decision quality, easy access to patient information, computer access, adequate resources and productivity etc. [40]. In this current study, the proportion of health professionals who stated they were neutral and those who were satisfied, in terms of EHRs' technical ability, security features and comfortability was almost equal. Those who were neutral may have perceived certain features of the EHRs as not fully meeting their expectations, which is incongruent with findings by [15, 38]. In the current study, the overall satisfaction of health professionals with the EHRs remained very high and they expressed the interest in continuing to use it. This finding is similar to what Bani-Issa reported in their study in the UAE [24].

Some of the major factors, which influenced health professionals' satisfaction of the implemented EHRs were its ability to improve documentation processes, improve work and workflow, and provide the desired results. The primary responsibility of health professionals is to provide quality services to patients. Therefore, any processes that facilitates their work would be perceived positively. The health professionals expressed satisfaction with the current system when in their view, "*long queues to access services no longer exist and patient waiting time was reduced*". This finding is in congruent with other studies conducted in UAE and Ethiopia [24, 26], where health professionals expressed satisfaction with the EHRs' ability to ease documentation processes, aid in the prescription of drugs, improve diagnosing and provide accurate patients information.

There were other factors, which influenced health professionals' perception negatively and caused their dissatisfaction. For example, health professionals perceived the EHRs ability to ensure privacy and confidentiality of patient information as not satisfactory. Health professionals, especially the clinicians and nurses expressed strong displeasure about the EHRs inability to protect patient data from being accessed by third parties, such as colleagues who were not directly involved in the care processes of the patient from getting access. However, this view was opposed to that of the biomedical scientists, who vouched for the security of the system. This means that different users of the EHRs had different perception and level of satisfaction of it. The issues of privacy and security concerns were sources of frustration and caused dissatisfactions among health professionals confirming what other earlier studies have reported [15, 25].

Other factors that constituted barriers and court negative perception and dissatisfaction were unavailability of certain critical services, such as stable internet and continuous power supply. Unstable internet connectivity and erratic power supply had negative effects on the EHRs use. They were the major causes of unexpected interruptions in the provision of service. Health professionals and patients were frustrated when this occurs, because they have to wait for the system to be restored, in some case, the patient information was lost which affected the quality of services provided. These findings were similar to those reported in other studies where temporary loss of access or complete loss of information was attributed to power failure or system failures [12, 15, 25, 41].

Training has been highlighted in several studies as an essential component of EHRs implementations [12, 15, 25, 26]. The potential benefits of EHRs will continue to remain untapped, if health professionals are not adequately trained to use the system confidently. To achieve success in this regard, there should be conscious effort to encourage the use of the system. Training builds the confidence of the health professionals and makes them comfortable to use the system. Our study showed that, the majority of the health professionals received training, which is an important requirement needed to operate the system comfortably. It is worth noting that, the less than 17% (16.73%) who received no form of training is significant. Training factor, could explain why despite the significantly higher number (88.99%) of health professionals who perceived the EHRs to be beneficial for their patients and (79.85%) who expressed interest to continuing to use the EHRs, the number of health professionals who expressed overall satisfaction for the system was lower. This is because training improves the knowledge and familiarity of the health professionals on the use of the EHRs, which allows them to comfortably operate the EHRs [21]. Other researchers have opined that training on the EHRs reduces the amount of time health professionals spend on the system, it also builds their capabilities to use it [26, 42]. In this current study, various types of training were suggested that would boost their confidence to use the system efficiently. Periodic training would build health professionals confidence to use the system, and special training sections must be devoted to staff who are computer phobia and lacked computer skills. Training has been echoed in several other studies as the antidote to negative perceptions. The appropriate training that suits the health professionals should be adopted. This will minimize their level of frustration while preparing them to accept the system [12, 15, 25, 26, 43].

Study strengths and limitations

The strength of this study lies in the use of both qualitative and quantitative methods, which not only helped illuminated some of the grey areas, (such as the impact of training on overall satisfaction with the EHRs use) but also confirmed the findings, thereby strengthening our conclusions. This level of insight would not have been possible with only one method.

A limitation of this study was the small sample size that was used in the quantitative component; however, this was compensated for by the complementary qualitative data. The study hospitals were purposively selected because they had implemented an EHRs system around the same time and were easily accessible to the researchers.

Conclusion

EHRs systems in many LMICs continue to improve patients' safety and increase productivity among health professionals. The study revealed that health professionals' have a positive perception of the implemented EHRs, are highly satisfied with them, and are interested in continuing to use them. However, certain factors impede the successful adoption and continuous use of the system, which needs attention. Health professionals are concerned about the frequent downtime of the system due to erratic power supply and unstable internet connectivity. Getting a solution around this challenge would mitigate the health professionals' frustrations and boost their confidence in using the system. Patients will also benefit from a smooth running of the EHRs system. Medical practice is increasingly becoming information intensive, and physicians and other clinicians need to be able to share patient information for decision making. Therefore, the EHRs system should be able to enforce the privacy, confidentiality, and security of patient information through robust access control. These will build trust among the health professionals and encourage use.

Abbreviations

EHRs Electronic health records system
LMIC Low- and middle-income countries

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

NKM and GA conceived and designed the study, conducted the data analysis, and were responsible for interpretation of data and writing of the manuscript. NKM wrote the initial draft of the manuscriptNKM, GA, JK, SBJ, CO, CH, KA and HTA interpreted the data and reviewed the final draft of the manuscript. SBJ, CO, and CH participated in acquisition and analysis of the data. ROB reviewed the final draft of the manuscript. All authors read the article and substantially contributed to this paper and approved the final version.

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Availability of data and materials

Deidentified data may be available from the corresponding author upon request and subject to Ghana Data Protection Act and the Cape Coast Teaching Hospital Ethical Review Committee requirements.

Declarations

Ethics approval and consent to participate

Ethical clearance for the study was sought and obtained from the Cape Coast Teaching Hospital Ethical Review Committee with approval number *(CCTH-ERC/EC/2023/091)*. Permission to carry out the study in the selected facilities was also sought from the respective administrative heads. Written informed consent was obtained from each respondent. This was done without coercion, undue influence or misrepresentation of potential benefits and risk associated with participation in the study. The participants were adequately informed about their right to refuse to participate in the study and to opt out at any time, if they wished to do so. Steps was taken to minimize unnecessary distraction and disruption of work as well as strictly adhering to all Covid-19 protocols. No identifiable personal information such as name, designation or position held by the respondents was collected. Further, in order to ensure anonymity and confidentiality study participants were assigned codes. All the study procedures were carried out in accordance with appropriate guidelines and regulation (Declaration of Helsinki).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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