




# Effective use of electronic health records system for healthcare delivery in Ghana

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## ABSTRACT

**Introduction:** In the pursuit of improving effective health service delivery, developing nations including Ghana are progressively integrating electronic health record systems into healthcare frameworks. This research explored the proficient utilization of an EHR called the Lightwave Health Information Management System used by healthcare professionals in Ghana.

**Material and Methods:** A descriptive cross-sectional study design and a multi-stage sampling technique (stratified and simple random sampling) were used to recruit 1126 respondents for this study. Weighted averages were computed to determine scores for all the indicators measuring the effectiveness construct.

**Results:** The study found that LHIMS improved productivity, patient data gathering, sharing of patient information among service providers, care continuity, data exchange among facilities, decision-making, and coordination/organization of care. Also, health professionals' work experience, educational qualification, and training status were statistically significant predictors of effective use of the LHIMS at the multivariate level. Age and professional type were statistically significant only at the bivariate level.

**Conclusion:** The study concludes that incorporating the LHIMS improves healthcare professionals' effectiveness in gathering patient information while reducing the likelihood of errors by promptly notifying them of any inaccuracies. The study emphasized the importance of training for effectively using the LHIMS.

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## INTRODUCTION

The lifeblood of contemporary medicine is information and EHRs are meant to serve as a circulatory system. Without this system, no single doctor or healthcare institution can provide best-in-class care [1]. EHR assists hospitals in improving care coordination, streamlining day-to-day clinical processes, and saving money and time. Also, when EHR systems are properly implemented, they have the potential to improve healthcare quality by increasing adherence to guidelines, reducing medication errors, and reducing adverse drug effects [2].

Although several studies on the impact of EHR implementation have been published and appear to

provide promising data, the evidence on EHR effects has been disputable and some reported contradictory results. For instance, Han et al. [3] observed that the implementation of EHR was associated with an unexpected increase in mortality. EHR systems continue to be blamed for contributing to rising rates of physician burnout, a deteriorating patient-health-provider relationship, and generally inconveniencing providers [2].

Following the enactment of the Meaningful Act in 2009, various researchers in analyzing high levels of individual and organizational performance in health care delivery have modified the usual assessment of EHR where frequency and duration of care were studied to the measurement of effective use or meaningful use [4]. Many studies have measured the

effective use of EHR [5-11].

For instance, Rittenhouse et al. [11] studied meaningful use and medical home functionality in primary care practice. The study adapted indicators from the National Centre for Health Statistics on the National Ambulatory Medical Care Survey (NAMCS) to assess the extent of adoption of health IT meaningful use elements. In the study, the number of elements affirmed by each responding physician was used to create an index of health IT meaningful use adoption. The six-item index was used as a variable in measuring meaningful use [11]. The study found that whilst 95 per cent of family medicine-affiliated practices employed electronic health records (EHR) in 2018, there was a substantial difference in whether those EHRs matched meaningful-use criteria.

Also, Yuan et al. intended to ascertain if the widespread use of current EHRs in the United States had resulted in enhanced clinical treatment [12]. They used interrupted time-series analysis to look at the relationship between EHR deployment and Meaningful Use status with 11 process measures and 30-day hospital readmission and mortality rates for heart failure, pneumonia, and acute myocardial infarction. In the study, EHR platform use was associated with better performance measurements but did not improve meaningful use status (stage 1 and stage 2) irrespective of the period of utilization of EHR. The study also found that in several processes and outcome measures, EHR systems in hospitals in the US performed worse.

For some health professionals especially physicians, there are tangible reasons why EHR systems are considered ineffective in health service delivery. For instance, primary care physicians believe that technology is falling short, particularly when it comes to patient-provider interaction. As such, EHR systems are regarded by physicians as data storage systems rather than clinical tools for patient assessment. Also, the lack of effective EHR use is a result of the fact that health professionals are unable to recall the EHR system interface. EHR for health service delivery will be more effective if users can remember the system interface without external help [13].

According to the findings of Tornvall et al. nurses had a satisfactory response to the organized form of the EHR. This was because the structured form made recording easier, clinical choices were recorded, and patient care was evaluated [14]. After the implementation of a computer-based nursing documentation system, Mahler et al. showed an improvement in the quality of nursing documentation, as well as the fulfilment of legal criteria for documentation [15].

Salleh et al. observed that system quality and record quality influence the effective use of EHRs among health practitioners. In addition, there is a positive

relationship between service quality and effective use of EHRs among health practitioners, but the relationship is not statistically significant [16]. Adedeji et al. observed that age, gender, and social factors such as the internet and power influence the effective use of electronic health record systems. In comparison, lack of training is a critical barrier to the effective use of EHRs among healthcare workers [17].

The successful introduction of EHR has been linked to an emphasis on the use of information technology to improve clinical workflows and find solutions to clinical issues [18]. Contrary to the findings that socio-demographic characteristics such as age, sex and years of work influenced EHR use, the differences in EHR utilization were not correlated with differences in age, gender or previous computer experience as studied by Msiska et al. [19]. However, the use of EHR was hampered by hardware and communication issues, as well as a lack of training and administrative support.

To increase the effectiveness and quality of healthcare institutions, EHR systems are progressively deployed in developing countries' healthcare systems [20]. Various studies show that implementing an EHR system in the health sector has the potential to transform healthcare in terms of cost savings, medical error reduction, service quality improvement, patient safety, decision-making, time savings, and sharing of medical information [12, 21]. LHIMS is being implemented in the Ghanaian health sector to improve data sharing, and performance of health care professionals, and improve quality of care and decision making.

EHR is expected to transform the healthcare sector in terms of service delivery and quality of care. The challenge has always been whether the implementation of an EHR can transform the healthcare industry. The objective of this study was to assess the effective use of EHR-LHIMS for healthcare delivery.

## MATERIAL AND METHODS

### Study design

This research employed a descriptive cross-sectional study design. The participants encompassed all healthcare professionals within the Central Region of Ghana. However, only those actively utilizing LHIMS for providing services at their healthcare facilities during the study period were considered in the accessible population. This specific group was chosen due to their presumed familiarity with LHIMS, rendering them valuable resources for gaining insights into the system.

### Sampling technique

The study sampled 1126 healthcare professionals.

To guarantee the samples accurately reflected subgroups, a stratified probability sampling method and simple random were employed to homogeneously recruit study respondents.

**Data collection tools**

The study used both interviews and a structured questionnaire for data collection. The study was conducted in 2021.

**Data analysis**

Descriptive statistics (weighted mean) were computed to determine the average weighted score for all the indicators under the effectiveness latent construct. Also, bivariate analysis (chi-square) and

multivariate (ordinal logistic regression) analyses are conducted to test the study’s hypotheses.

**RESULTS**

The results showed in Tables 1 to 5. As it is clearly shown in Table 1, respondents agreed with all statements of effective use of LHIMS.

In Tables 2, 3, and 4, results of bivariate analysis of socio-demographic characteristics, professional characteristics, training/computer efficacy and effective use of LHIMS has shown.

Table 5 is including results obtained from ordinal logistic regression analysis of socio-demographics, professional characteristics and training/skill on the effective use of LHIMS.

**Table 1: The effective use of LHIMS**

Statement	SD	D	N	A	SA	Weighted Average	Interpretation
	1	2	3	4	5		
The use of the LHIMS has improved productivity	51	152	273	546	104	3.44	Agree
LHIMS improves the sharing of patient information amongst providers within the facility	19	107	284	605	111	3.61	Agree
LHIMS improves patient information gathering/collection	16	56	201	661	192	3.85	Agree
LHIMS enhances the continuity of care	20	72	198	621	215	3.83	Agree
LHIMS supports data sharing among other facilities	14	66	168	666	212	3.88	Agree
LHIMS reduces the risk of making errors by alerting users of errors made	44	133	337	493	119	3.45	Agree
The use of the LHIMS improves quality decision-making	26	81	284	614	121	3.64	Agree
LHIMS enhances the ability to coordinate /organisation of care	22	55	238	633	178	3.79	Agree
Using the LHIMS has improved my job performance	23	76	248	635	144	3.71	Agree
LHIMS has all the functions I expect within my area of practice	18	63	242	655	148	3.76	Agree
The functions in the LHIMS are well-integrated	14	66	168	666	212	3.88	Agree

**Table 2: Bivariate analysis of socio-demographic characteristics and effective use of LHIMS**

Variable		Effectiveness			p value
		Ineffective	Moderately Effective	Very Effective	
		Frequency (%)	Frequency (%)	Frequency (%)	
Sex	Female	207 (30.0)	272 (39.4)	212 (30.7)	0.659
	Male	126 (29.0)	183 (42.1)	126 (29.0)	
Age	20 - 29	176 (33.0)	228 (42.8)	129 (24.2)	0.001
	30 - 39	132 (26.0)	193 (38.1)	182 (35.9)	
	≥40	25 (29.1)	34 (39.5)	27 (31.4)	
Educational Qualification	Certificate Holder	49 (37.7)	50 (38.5)	31 (23.8)	0.042
	Diploma/HND	130 (28.4)	172 (37.6)	155 (33.9)	
	Degree	154 (28.6)	233 (43.2)	152 (28.2)	
Years of Work Experience	≤1 year	124 (33.9)	147 (40.2)	95 (26.0)	0.001
	2 to 5 years	157 (30.0)	219 (41.9)	147 (28.1)	
	≥ 6 years	52 (21.9)	89 (37.6)	96 (40.5)	

**Table 3: Bivariate analysis of professional characteristics and effective use of LHIMS**

Variable		Effective			p value
		Ineffective	Moderately Effective	Effective	
Professional Status	Prescribers	179 (28.5%)	264 (42.0%)	186 (29.6%)	.000
	Nurses and Midwives	154 (29.0%)	281 (38.4%)	239 (32.7%)	
	Auxiliary	36 (25.5%)	57 (40.4%)	48 (34.0%)	
Training Institution	MoH Training Institution	179 (28.5%)	264 (42.0%)	186 (29.6%)	0.459
	Public University	154 (31.0%)	191 (38.4%)	152 (30.6%)	

**Table 4: Bivariate analysis of training/computer efficacy and LHIMS effectiveness for health service delivery**

Variable		Effectiveness			p value
		Ineffective	Moderately Effective	Effective	
		Frequency (%)	Frequency (%)	Frequency (%)	
Training	Yes	305 (30.4)	416 (41.4)	283 (28.2)	0.001
	No	28 (23.0)	39 (32.0)	55 (45.1)	
Duration of Training	Never Trained	35 (28.7)	46 (37.7)	41 (33.6)	0.858
	1 to 2 days	183 (29.4)	248 (39.9)	191 (30.7)	
	3 to 4 days	56 (31.3)	77 (43.0)	46 (25.7)	
	5 days or more	59 (29.1)	84 (41.4)	60 (29.6)	
Computer Efficacy	Beginner	76 (31.7)	102 (42.5)	62 (25.8)	0.278
	Advanced User	257 (29.0)	353 (39.8)	276 (31.2)	

**Table 5: Ordinal logistic regression analysis of socio-demographics, professional characteristics and training/skill on the effective use of LHIMS**

Variable		Model 1	Model 2	Model 3
		OR (95% CI)	OR (95% CI)	OR (95% CI)
Work experience	≤ 1 year	0.524 (0.386, 0.712)**	0.527 (0.388, 0.717)**	0.530 (0.390, 0.721)**
	2 to 5 years	0.606 (0.455, 0.807)*	0.625 (0.469, 0.833)*	0.628 (0.471, 0.837)*
	≥ 6 years	1.00		1.00
Educational qualification	Certificate		0.683 (0.476, 0.98)*	0.667 (0.463, 0.960)*
	Diploma/HND		1.095 (0.866, 1.384)	1.072 (0.845, 1.359)
	Degree +		1.00	1.00
Status of training	Yes		0.521 (0.361, 0.753)*	0.528 (0.365, 0.763)*
	No		1.00	1.00
Computer efficacy	Beginner			0.864 (0.66, 1.131)
	Advanced Users			1.00

According to the results obtained from the multivariate analysis on how the socio-demographic characteristics (age, sex, educational qualification, and years of work experience) of health professionals affect their effective use of EHR, it was revealed that years of work experience and educational qualification had a significant effect on how effectively they use LHIMS-EHR. The sex and age of health professionals did not have any significant effect on how effectively they used EHR systems. This

means that health professionals' level of education and the number of years they have been working in the field contribute significantly to how effectively they make use of Electronic Health Record systems. However, age was found to have a significant association with the effective use of EHR even though it had no significant effect (Table 2).

The results obtained from the multivariate analysis on professional characteristics and efficiency of EHR revealed that professional type and the institution

where health professionals receive their training have no significant effect on how effectively they use the LHIMS. The results indicate that the professional characteristics of health professionals do not in any way affect the effective use of EHR systems. However, the professional type was found to have a significant relationship with the effective use of EHR even though it had no significant effect (Table 3). The multivariate analysis of training/computer efficacy and the effective use of LHIMS showed that training has a significant effect on how effectively health professionals use EHR. Therefore, without the right training, health professionals cannot use the LHIMS effectively (Table 4).

However, the duration of training and computer efficacy were found to have no significant effect on the effective use of EHR. This means that without any knowledge of general computing, health professionals can still use the LHIMS system effectively (Table 5).

## DISCUSSION

EHR implementation is necessary for hospitals to fulfil their full potential in terms of operational efficiency and patient care outcomes in this age of rapidly expanding e-health technology [22]. The descriptive statistics on the effective use of EHR showed that health professionals' productivity increased because of the use of the LHIMS. The collection of patients' data was also enhanced and the chances of making mistakes were reduced to a minimum. The LHIMS was also found to improve healthcare as well as performance. The LHIMS was also found to have all the features anticipated by the health professionals in their respective fields of duty. The LHIMS can therefore be considered a very helpful system to health professionals. Bajwa et al. study agrees that the implementation of EHR in health care delivery will lead to enhanced accuracy, speed, and effectiveness [22].

Healthcare quality may be improved by using an EHR system that is effectively implemented, enhancing time efficiency and guideline compliance as well as cutting down on medication prescription errors or adverse events [2]. From Adedeji et al. study, we deduce that prior training is an important factor if users of EHR systems are to use the systems in the most effective manner [17]. Training prepares health professionals for the effective use of EHR systems. Without training, health professionals may use EHR systems in an ineffective manner which will lead to the under-utilization of the system. They also found that sex was not a significant predictor of the effective use of EHR which is in line with the findings on sex in this study. Their study again revealed that age has a significant influence on the effective use of EHR systems [17]. It plays a major role in how health professionals use EHR systems for what they intend

in healthcare. The findings go against the results of the research that showed no significant influence of the age of healthcare workers on their competence in using EHR systems. They finally also found that academic qualification was no predictor of how effectively EHR systems are used which is in contrast with that of this study on educational qualification and the effective use of EHR in this study [17].

The number of years health professionals have been working in the field affects how effectively they use the LHIMS. Yehualashet et al. [20] in their study revealed that working experience had a significant effect on the effective utilization of electronic medical records (EMR) systems. They then found sex to have no significant impact on the effective utilization of EMR which agrees with this study. They also found educational qualification to have no significant influence on the effective use of EMR which is in line with this study. Finally, they found that age and computer literacy have a significant effect on the effective utilization of EMR systems which is in contrast with this study [20].

Msiska et al. discovered that variations in age, sex, and computer efficacy were not associated with variances in the use of EMR in their research on the factors influencing the adoption of EMR systems which are in line with the findings in this study. The results of their study also revealed that educational level and training have a significant impact on the effective utilization of EMR systems [19]. Singh et al. [23], Gagnon et al. [24], and Robinson et al. [25] in their research all agree with the finding that training significantly affects the effective utilisation of HER.

## CONCLUSION

The findings indicated that factors such as years of work experience, educational attainment, and pre-LHIMS training significantly influenced healthcare professionals' proficient utilization of LHIMS-EHR. Furthermore, the study confirmed that healthcare professionals perceive LHIMS as efficacious, as it encompasses essential functions and features necessary for their tasks, all seamlessly integrated. Moreover, LHIMS was found to enhance the efficacy of patient data collection and diminish the probability of errors by promptly notifying users of inaccuracies. The system also promotes the continuity of healthcare by enabling the seamless exchange of patient data across diverse facilities, facilitating effective coordination and organization of patient care, especially during transfers between facilities.

The study was limited to just one region and this can affect the generalization of the findings. Future research can consider the case study method for a more in-depth understanding of the effectiveness of the LHIMS.

## AUTHOR'S CONTRIBUTION

EA, KE-D, ABA-G, and EKA were responsible for the conception and design of the study. EA was responsible for the conception and design of the survey questions, and the acquisition, and interpretation of data. EA conducted statistical analyses and drafted tables and figures. EKA wrote the original manuscript of the paper. EA, KE-D, ABA-G, and EKA reviewed and edited the manuscript. The final version of the manuscript was approved by all contributing authors.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

## FINANCIAL DISCLOSURE

No financial interests related to the material of this

manuscript have been declared.

## ETHICS APPROVAL

The study was conducted in accordance with the guidelines of the University of Cape Coast Institutional Review Board (IRB), Ghana Health Service Ethics Review Committee (GHS-ERC) and the Cape Coast Teaching Hospital-IRB. Participants were given informed consent forms, assent forms, and a participant information sheet to respond to them first before the commencement of the data collection. The informed consent form addressed the following: the purposes of the study to the respondents, the respondents' assurance of having their confidential responses and identity kept anonymous was outlined, and their participation was voluntary as well as had the freedom to decline to participate anytime they felt uncomfortable continuing without penalty.

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