


Assessing the efficient use of the lightwave health information management system for health service delivery in Ghana

Edward Agyemang,¹ Kobina Esia-Donkoh,¹ Addae Boateng Adu-Gyamfi,¹ Juabie Bennin Douri,¹ Prince Owusu Adoma,² Emmanuel Kusi Achampong ³

To cite: Agyemang E, Esia-Donkoh K, Boateng Adu-Gyamfi A, *et al.* Assessing the efficient use of the lightwave health information management system for health service delivery in Ghana. *BMJ Health Care Inform* 2023;**30**:e100769. doi:10.1136/bmjhci-2023-100769

Received 23 March 2023
Accepted 07 August 2023



© Author(s) (or their employer(s)) 2023. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Department of Population and Health, University of Cape Coast, Cape Coast, Ghana

²Department of Health Administration and Education, University of Education, Winneba, Ghana

³Department of Medical Education and IT, University of Cape Coast, Cape Coast, Ghana

Correspondence to

Dr Emmanuel Kusi Achampong; eachampong@ucc.edu.gh

ABSTRACT

Background In achieving the WHO's Universal Health Coverage and the Global Developmental Agenda: Sustainable Development Goal 3 and 9, the Ministry of Health launched a nationwide deployment of the lightwave health information management system (LHIMS) in the Central Region to facilitate health service delivery. This paper assessed the efficient use of the LHIMS among health professionals in the Central Region.

Methods A non-interventional descriptive cross-sectional study design was employed for this research. The study used stratified and simple random sampling for selecting 1126 study respondents from 10 health facilities that use the LHIMS. The respondents included prescribers, nurses, midwives and auxiliary staff. Descriptive statistics (weighted mean) was computed to determine the average weighted score for all the indicators under efficiency. Also, bivariate (χ^2) and multivariate (ordinal logistic regression) analyses were conducted to test the study's hypotheses.

Results Findings revealed that the LHIMS enhanced efficient health service delivery. From the bivariate analysis, external factors; sex, educational qualification, work experience, profession type and computer literacy were associated with the efficient use of the LHIMS. However, training offered prior to the use of the LHIMS, and the duration of training had no association. At the multivariate level, only work experience and computer literacy significantly influenced the efficient use of the LHIMS.

Conclusion The implementation of LHIMS has the potential to significantly improve health service delivery. General computing skills should be offered to system users by the Ministry of Health to improve literacy in the use of computers. Active participation in the use of LHIMS by all relevant healthcare professionals should be encouraged.

INTRODUCTION

The WHO considers health information systems to be one of the six essential building blocks of any health system because they provide reliable information to aid in decision-making throughout the health system.^{1 2} Relatedly, the recent global development agenda also sees health information

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The WHO considers health information systems to be one of the six essential building blocks of any health system because they provide reliable information to aid in decision-making throughout the health system. Despite the benefits of electronic health records (EHRs), there are lower adoption and utilisation rates in lower-middle and low-income countries.

WHAT THIS STUDY ADDS

⇒ A non-interventional descriptive cross-sectional study design was employed for this research. It was revealed that sex, educational qualification and training prior to the use of lightwave health information management system (LHIMS) were not statistically significant to health professionals' use of the LHIMS-EHR. However, their years of work experience and computer efficacy have a significant effect on the efficient use of the system.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ In terms of the educational qualification of health professionals and the effect it has on the usability of the LHIMS, policy-makers will need to ensure that the health professionals they engage at their facilities have the required educational qualifications to work and use the LHIMS at the facility. Also, in terms of computer efficacy, policy-makers need to ensure that the health professionals they engage at their facilities have some level of computing knowledge.

systems as one of the critical health delivery components that contribute to achieving goal 3 (good health and well-being) and goal 9 (industry, innovation and infrastructure) of the Sustainable Development Goals.³⁻⁶

In Africa, medical information recording has evolved over the years; from the period of cave recordings, where records were stored on tablets of stone to an age where the paper system was introduced.⁷ Until the latter part of the 20th century, a paper-based record

management system was the primary method of storing health records and other documents.⁸ Although it can be tailored to the needs of each hospital and health-care provider without requiring any technical changes, the introduction of the electronic health record (EHR) system has made paper-based records less effective in healthcare delivery. The limitations associated with the use of the paper-based system now make the EHR system the appropriate option.^{9–11}

Even though EHR systems have evolved into a viable option, there are major drawbacks to their implementation in Africa. For instance, there are lower adoption and utilisation rates in lower-middle and low-income countries.^{12–13} The implemented EHR systems in Africa focus on only a few health conditions such as HIV care, home-based care, injury surveillance, tertiary care, and maternal and reproductive health.^{14–17}

To improve healthcare quality and accelerate the health service delivery processes in Ghana, the Ministry of Health (MoH) published the Health Sector Information and Communication Technology (ICT) Policy and Strategy charts in 2005. It was guided by the Ghana ICT for Accelerated Development policy to increase the adoption of ICT in the health sector.¹⁸ Due to this, some health facilities implemented an EMR system meant for solo practice. The health facilities that used the EMR systems have frequently changed systems due to challenges such as poor report generation, the inability of the system to mimic the daily transactions performed during service delivery (work domain saturation) and clinicians' inability to type on a keyboard while attending to patients. Even though the information generated by the EMR could be shared across departments within one health facility, it was not able to share patient information across multiple providers. As a result of the challenge, some facilities used the system together with paper records as they couldn't fully implement a paperless system.

Due to these challenges, the MoH developed a new policy document in 2009 to aid in the implementation of a national EHR system, a common platform to be used by all health professionals in health facilities across the country. This new implementation was expected to streamline admission, discharge and transfer processes, and be integrated into the claims management system of the National Health Insurance Scheme for billing.¹⁹

Lightwave health information management system (LHIMS) is a web-based software platform that is capable of transmitting health information for use by authorised health service providers and supporting administrative functions such as managing records, making clinical orders, inputting information, storing and retrieval to assist in decision-making during and after the time of care in Ghana.²⁰ It is a comprehensive system with several components including National Health Insurance Authority (NHIA) claims, patient records, administrator, antenatal care, laboratory management, alerts and communication, appointment and scheduling, and radiology. The implementation of LHIMS started in 2017

in the Central Region of Ghana. Adoption is still in the early stages, and it is only about 10% of healthcare facilities have adopted the use of LHIMS.

It has been theorised by Davis²¹ in the Technology Acceptance Model that external factors such as age, gender, organisational factors, etc influence the perceived usefulness of EHR Systems. Also, Al-Rayes *et al.*²² hypothesised that physicians' use of the EHR system is significantly influenced by their age, work experience and medical specialty. This paper, therefore, assesses health professionals' capacity to use LHIMS-EHR efficiently for health service delivery in Ghana.

MATERIALS AND METHODS

Study design

A non-interventional descriptive cross-sectional study design was employed for this research. The population for the study was all the health professionals in the Central Region of Ghana. However, the accessible population was limited to only the health professionals practising at the facilities using the LHIMS for service delivery in the Central Region of Ghana. The reason for targeting this section of health professionals only is that they have been practising with the LHIMS for service delivery at their various health facilities and, it is assumed that these health professionals will have the requisite knowledge of the LHIMS and that they will be able to provide the resourceful knowledge the study seeks to unravel about the LHIMS. In the early stages of implementation, some facilities stopped using the LHIMS because they faced challenges and eventually stopped using it. Other health facilities changed to alternative EHRs.

Sampling technique

A sample size formula was used to estimate 1126 sample size for the survey. A stratified probability sampling approach was used.

Data analysis

Weights of 1, 2, 3, 4 and 5 were assigned to all the 5-point likert scale; strongly disagree (SD), disagree (D), neutral (N), agree (A) and strongly agree (SA), respectively. The weighted mean formula from Manyange and Abuga²³ was employed to compute the weighted average (WA) scores. The weighted mean formula²⁴ was employed to compute the WA scores. The formula is mathematically written as $WA = \frac{\sum wx}{\sum w}$, where w represents the weights and x represents the values. After the computation, the WA scores were interpreted based on the following parameters; 1.0–1.79=SD; 1.80–2.59=D; 2.60–3.39=N; 3.40–4.19=A; 4.20–5.00=SA.

For the bivariate and multivariate analysis, principal component analysis was used as a dimension reduction technique to obtain a factor score for the dependent variable (efficiency). In IBM Statistical Package for the Social Sciences, the result was further examined using the orthogonal rotation approach (Varimax). The

Table 1 Descriptive statistical analysis of the efficient use of LHIMS by respondents

| Statement | SD | D | N | A | SA | Weighted average | Interpretation |
|---|----|-----|-----|-----|-----|------------------|----------------|
| | 1 | 2 | 3 | 4 | 5 | | |
| I can use the LHIMS without written instructions | 47 | 135 | 247 | 574 | 123 | 3.52 | Agree |
| Using the LHIMS helps me provide the appropriate service for the patient | 52 | 169 | 267 | 501 | 137 | 3.45 | Agree |
| It is easy to get the LHIMS to do what I want it to do | 29 | 98 | 206 | 595 | 198 | 3.74 | Agree |
| I can complete a task quickly using the LHIMS | 28 | 76 | 227 | 584 | 211 | 3.78 | Agree |
| Interaction with the LHIMS requires less mental effort | 22 | 75 | 216 | 616 | 197 | 3.79 | Agree |
| Learning to operate the LHIMS was easy for me | 31 | 116 | 253 | 549 | 177 | 3.64 | Agree |
| LHIMS requires fewer steps possible to accomplish a task | 38 | 132 | 247 | 562 | 147 | 3.58 | Agree |
| I am familiar with the items on the screen of the LHIMS | 42 | 124 | 217 | 581 | 162 | 3.62 | Agree |
| An increased time is required to enter patient information | 37 | 137 | 213 | 561 | 178 | 3.63 | Agree |
| LHIMS is simple to use | 28 | 106 | 213 | 598 | 181 | 3.71 | Agree |
| I can recover from mistakes quickly and easily when using the LHIMS | 22 | 54 | 252 | 611 | 187 | 3.79 | Agree |
| Using the LHIMS gives me more control to handle patient treatment/service on time | 33 | 105 | 229 | 583 | 176 | 3.68 | Agree |
| Using the LHIMS reduces the time spent by a client at the Unit | 61 | 149 | 209 | 519 | 188 | 3.55 | Agree |

Source: Agyemang, 2021.
 Weighted average = $\sum wx / \sum w$.
 Interpretation: 1.0–1.79=SD; 1.80–2.59=D; 2.60–3.39=N; 3.40–4.19=A; 4.20–5.00=SA.
 A, agree; D, disagree; LHIMS, lightwave health information management system; N, neutral; SA, strongly agree; SD, strongly disagree.

Kaiser-Meyer-Olkin measure of sampling adequacy was greater than 0.5 for all measured constructs. Bartlett's sphericity test was significant ($p=0.05$), and the construct's eigenvalue was greater than 1, accounting for more than 50% of the variance in every construct with individual item loads greater than 0.4.

The study further employed Brooke's (1986) System Usability Scale to categorise the dependent variables to make the factor score reflect a natural setting. Respondents with a factor score of less than 30% were categorised as 'low', those with scores above 30% but not more than 70% were defined as 'moderate', and those with a score of more than 70% were classified as 'high'. This categorisation made it possible to run a χ^2 test for the bivariate analysis and ordinal logistic regression analysis for the multivariate using the proportion of odds (OR) to interpret the differences in the use of LHIMS.

RESULTS

Descriptive statistics of respondents' efficient use of LHIMS

The questions in the descriptive analysis were adapted from the Computer System Usability Questionnaire designed by International Business Machines (IBM) and the Isometric questionnaires.

Table 1 shows the descriptive statistical analysis of the efficient use of the LHIMS for health service delivery by respondents in the Central Region. In order to determine the average weighted score for all of the indicators under efficiency, a 5-point Likert scale ranging from SD,

D, N, A and SA were assigned weights of 1, 2, 3, 4 and 5, respectively.

Bivariate analysis of sociodemographic characteristics and efficient use of LHIMS

In table 2, a χ^2 test of independence was performed to examine the relationship between respondents' sex, age, educational qualification and years of work experience and the efficient use of LHIMS.

Professional characteristics and efficient use of LHIMS

Kaipio *et al*²⁵ postulate that there are significant differences between nurses' and physicians' experiences of the usability of EHR systems. Consequently, in table 3, a χ^2 test of independence was conducted to examine the relationship between the respondents' professional type and the institution where the professional was trained (training institution) and the efficient use of LHIMS.

Training and computer efficacy and the efficient use of LHIMS

In table 4, a χ^2 test of independence was conducted to assess the association between respondents' training status prior to the use of the LHIMS, duration of the training and computer efficacy and the efficient use of LHIMS.

Multivariate analysis of the efficient use of LHIMS by respondents

In table 5, multivariate analysis was performed to assess the influence of sociodemographic characteristics of

Table 2 Bivariate (cross-tabulation) analysis of sociodemographic characteristics and efficient use of LHIMS by respondents

| Variable | Efficiency | | | P value |
|---------------------------------|------------------|----------------------|------------------|---------|
| | Inefficient | Moderately efficient | Highly efficient | |
| Sex | Freq. (%) | Freq. (%) | Freq. (%) | |
| Female | 186 (26.9) | 282 (40.8) | 223 (32.3) | 0.022 |
| Male | 148 (34.0) | 172 (39.5) | 115 (26.4) | |
| Age | | | | |
| 20–29 | 160 (30.0) | 225 (42.20) | 148 (27.80) | 0.610 |
| 30–39 | 148 (29.20) | 196 (38.70) | 163 (32.10) | |
| ≥40 | 26 (30.20) | 33 (38.40) | 27 (31.40) | |
| Educational qualification | | | | |
| Certificate holder | 43 (33.1) | 51 (39.2) | 36 (27.7) | 0.004 |
| Diploma/Higher National Diploma | 125 (27.4) | 166 (36.3) | 166 (36.3) | |
| Degree | 166 (30.8) | 237 (44.0) | 136 (25.2) | |
| Years of work experience | | | | |
| ≤1 year | 120 (32.8) | 148 (40.4) | 98 (26.8) | 0.040 |
| 2–5 years | 157 (30.0) | 215 (41.1) | 151 (28.9) | |
| ≥6 years | 57 (24.1) | 91 (38.4) | 89 (37.6) | |

Source: Agyemang, 2021.
LHIMS, lightwave health information management system.

respondents (age, sex, educational qualification and years of work experience), professional characteristics (professional type, place of training and institution of training) and training/computer efficacy (training status, duration of training and computer efficacy) on the efficient use of the LHIMS. In model 1, ordinal logistic regression analysis was fitted to assess the relationship between respondents' sociodemographic characteristics (age, sex, educational qualification and years of work experience) on the efficient use of the LHIMS. In model 2, controlling for sex, educational qualification and years of work experience of respondents, ordinal logistic regression was fitted to assess professionals' characteristics (professional type and training institution the respondent attended). In

model 3, accounting for sex, educational qualification, work experience and training of professionals prior to EHR use, ordinal logistic regression was fitted to assess computer efficacy and the efficient use of the LHIMS.

DISCUSSION

According to the MoH,²⁶ it is becoming increasingly evident that many developing countries, including Ghana, would struggle to meet all the global targets required to improve their health sector. As a result, a national e-health system, the LHIMS, was necessary for the health sector to improve service efficiency and function as the country's EHR and a biosurveillance system.²⁶

Table 3 Bivariate (cross-tabulation) analysis of professional characteristics and efficient use of LHIMS by respondents

| Variable | Efficiency | | | P value |
|---|------------------|----------------------|------------------|---------|
| | Inefficient | Moderately efficient | Highly efficient | |
| Professional type | Freq. (%) | Freq. (%) | Freq. (%) | |
| Prescribers | 86 (34.0) | 116 (45.8) | 51 (20.2) | 0.003 |
| Nurses and midwives | 212 (29.0) | 281 (38.4) | 239 (32.7) | |
| Auxiliary | 36 (25.5) | 57 (40.4) | 48 (34.0) | |
| Training institution | | | | |
| MOH training institution (NMTC, CoH, community) | 187 (29.7) | 261 (41.5) | 181 (28.8) | 0.543 |
| University | 147 (29.6) | 193 (38.8) | 157 (31.6) | |

Source: Agyemang, 2021.
LHIMS, lightwave health information management system; MoH, Ministry of Health.

Table 4 Bivariate (cross-tabulation) analysis of training/computer efficacy and LHIMS efficiency for health service delivery by respondents

| Variable | Efficiency | | | P value |
|----------------------|------------------|----------------------|------------------|---------|
| | Inefficient | Moderately efficient | Highly efficient | |
| Training | Freq. (%) | Freq. (%) | Freq. (%) | |
| Yes | 303 (30.2) | 414 (41.2) | 287 (28.6) | 0.011 |
| No | 31 (25.4) | 40 (32.8) | 51 (41.8) | |
| Duration of training | | | | |
| Never trained | 34 (27.9) | 55 (45.1) | 33 (27.0) | 0.263 |
| 1–2 days | 178 (28.6) | 248 (39.9) | 196 (31.5) | |
| 3–4 days | 66 (36.9) | 62 (34.6) | 51 (28.5) | |
| 5 days or more | 56 (27.6) | 89 (43.8) | 58 (28.6) | |
| Computer efficacy | | | | |
| Beginners | 83 (34.6) | 112 (46.7) | 45 (18.8) | 0.000 |
| Advanced users | 251 (28.3) | 342 (38.6) | 293 (33.1) | |

Source: Agyemang, 2021.
LHIMS, lightwave health information management system.

Table 5 Ordinal logistic regression analysis of sociodemographics, professional characteristics and training/skill on the efficient use of LHIMS by respondents

| Variable | Model 1 | Model 2 | Model 3 |
|---------------------------------------|-------------------------|-------------------------|-------------------------|
| | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| Sociodemographic | | | |
| Sex | | | |
| Female | 1.286 (1.021 to 1.62)* | 1.276 (1.013 to 1.609)* | 1.199 (0.947 to 1.518) |
| Male | 1.00 | 1.00 | 1.00 |
| Educational qualification | | | |
| Certificate | 0.96 (0.67 to 1.374) | 0.92 (0.641 to 1.321) | 0.879 (0.611 to 1.265) |
| Diploma/Higher National Diploma (HND) | 1.336 (1.052 to 1.698)* | 1.288 (1.01 to 1.641)* | 1.245 (0.976 to 1.589) |
| Degree+ | 1.00 | 1.00 | 1.00 |
| Work experience | | | |
| ≤1 year | 0.621 (0.458 to 0.842)* | 0.622 (0.458 to 0.844)* | 0.628 (0.462 to 0.852)* |
| 2–5 years | 0.714 (0.537 to 0.95)* | 0.721 (0.541 to 0.96)* | 0.724 (0.544 to 0.965)* |
| ≥6 years | 1.00 | 1.00 | 1.00 |
| Training/skill | | | |
| Status of training | | | |
| Yes | | 0.691 (0.48 to 0.994)* | 0.715 (0.496 to 1.031) |
| No | | 1.00 | 1.00 |
| Computer efficacy | | | |
| Beginner | | | 0.689 (0.525 to 0.904)* |
| Advanced users | | | 1.00 |

Source: Agyemang, 2021.
1.00=reference category; sample (N)=1126.
p<0.05.
LHIMS, lightwave health information management system.



Findings from the study revealed that the LHIMS enhances service delivery efficiency. The health professionals who participated in the study indicated that using the LHIMS lessens a patient's time spent at the unit and facilitated quick task execution, as well as assists in giving the patients the proper care. Admittedly, these results are consistent with the 2005 and 2010 National E-Health Strategy Policy's objective²⁷ and with the international standard, HealthIT.Gov²⁸ which suggests that an EHR system should offer quick access to patient records and efficient job execution in addition to providing accurate, full and up-to-date patient information at the point of care. The findings show that the LHIMS has these features and is now deployed and used widely within the health sector of Ghana. However, results from Hodgson *et al.*²⁹ research reported inefficiencies of EHRs adoption such as system users being permanently connected to a computer and using multiclick diagnostic chart navigations which make the use of EHR systems by health professionals undesirable. However, the findings from our study indicated the contrary. The reasons that might account for the differences in literature may be due to several factors including, the type of EHR software deployed, the design of the system interface, personal factors such as age, sex, work experience, training prior to system use and type of profession.³⁰ For instance, Shanafelt *et al.*³⁰ argue that several factors influence the efficient use of EHR systems. According to the technology acceptance model by Davis,²¹ external factors such as age, gender and organisational factors are theorised to influence the perceived usefulness (efficiency) of an EHR system. As a result, this current study hypothesised that health professional's efficient use of the LHIMS is influenced by sociodemographic characteristics (age, sex, educational qualification and years of work experience), professional characteristics (staff category, place of training and institution of training) and computer self-efficacy. The results of the multivariate analysis for sociodemographic characteristics (age, sex, educational qualification and years of work experience) of health professionals and the efficient use of EHRs revealed that age, sex and educational qualification had an insignificant effect on the efficient use of EHR. However, years of work experience were the only sociodemographic characteristic that was found to have a statistically significant influence on the efficient use of LHIMS. The results agree with the findings from Adedeji *et al.*,³¹ Khairat *et al.*³² and Bae and Encinosa.³³ Adedeji *et al.* in their study found a significant association between the use of EHR and age, availability of computer systems, years of working experience and training of users.³¹ The results of their study are in contrast with that found in this study except in terms of years of work experience which was found to have no significant effect on efficiency in the use of EHR among health professionals.³¹ Khairat *et al.* in their study examined how doctors' performance, efficiency, perceived workload, happiness and usability of the EHR differed depending on their age, gender, professional function and years of experience with the EHR.³²

They found some differences in efficiency among male and female physicians.³² The data showed that female physicians are more efficient in using EHRs as they used the EHR's general search bar and filters, which resulted in a more efficient search, and this means that differences in sex among health professionals play a role in their efficient use of EHR.³² This finding contrasts with the one obtained in this study. However, even though sex, in general, was found to have no significant effect on the efficient use of EHR, the results, show that females in practice will be able to use the LHIMS-EHR more efficiently as compared with their male colleagues. This somewhat contrasting analysis may be due to the bivariate analysis which showed that the sex of health professionals has an association with their efficient use of EHR.

Bae and Encinosa³³ in their study revealed that age and years of work experience matter in the efficient use of an EHR system.³³ They found that older physicians who have more years of experience in the field were better at integrating EHR into clinical practice as compared with younger physicians with just a few years of work experience.³³ Their study, therefore, provides support for the finding that years of work experience have played a major role in the efficient use of LHIMS by health professionals but contrasts with the finding that the age of health professionals does not affect how efficiently they use EHR. These findings indicate that not all external factors (age, sex and education) in the technology acceptance model by Davis²¹ may predict differences in the efficient use of the LHIMS and the variation in the literature is dependent on the type of EHR software adopted.

Aside from social demographic characteristics, the multivariate analysis of professional characteristics and efficient use of the LHIMS revealed an insignificant association between professional type and the institution where health professionals receive their training and efficient use of the LHIMS. However, the bivariate analysis of professional type and efficiency in the use of the LHIMS showed a significant association between the two. This means that the professional characteristics of health professionals do not affect how efficiently respondents used the LHIMS taking into consideration other variables such as age, sex, education and years of work experience. Similar findings are noted in the works of Nandikove *et al.*³⁴ The researchers indicated no significant differences among professional types concerning the use of the EHR system in Kakamega County, Kenya.³⁴

The multivariate analysis of training/computer efficacy showed that computer efficacy had a significant effect on the efficient use of LHIMS whereas training was found to have no significant effect. This means that health professionals cannot use the LHIMS efficiently without computer efficacy. However, whether they receive training on using EHR systems does not greatly enhance their efficiency. Contrarily, Butcher found different results on training and professional type.³⁵ According to Butcher, health professionals who received training in EHR systems used relatively less time working in the EHR

systems as compared with when they had not received any training.³⁵

However, the bivariate analysis showed a significant relationship between the two even though the multivariate analysis revealed there is no causal relationship between the two. It can therefore be inferred that even though training does not significantly affect health professionals' efficiency with LHIMS, it can go a long way to improve their proficiency in the use of the system. This may be because health professionals may not be able to use EHR systems most optimally as they may not have received any prior training on EHR systems in their training institutions. It may also be that the training was not effective since most respondents received just a day of training and some did not receive training at all but relied on their colleagues for support in using the LHIMS. Both situations necessitate training specific to the EHR system being used at their health facility for improved proficiency.

The results of the study pertaining to service delivery efficiency revealed that sociodemographic characteristics and the computer efficacy of health professionals are very important factors if they are to use the LHIMS efficiently. This implies that hospital governing bodies and health administrators will need to make sure that all health professionals that will be posted or hired have taken some general computing courses as, without it, efficient use of the LHIMS at the facility level will be significantly affected. Also, the MoH and its Agencies including hospital managers need to ensure that new entrant of health professionals with little or no work experience are to be trained and paired with experienced system users of the LHIMS. This is to ensure that the inefficiencies identified with the use of EHR systems by other researchers will not be experienced at the centre as they have serious repercussions for patients as well as the institution.

CONCLUSION

It can be implied from the results of descriptive statistics, LHIMS deployment has enhanced service efficiency. The bivariate analysis revealed that there is an association between training prior to the use of the LHIMS and the efficient use of the system. However, at the multivariate level, training prior to the use of LHIMS was not statistically significant but computer efficacy and years of work experience were statistically significant. This result implies that not only should health professionals be trained on the use of the LHIMS but for professionals to be more efficient in the use of the LHIMS, they should be trained in general computing skills to improve their computer efficacy. Also, findings imply that health professionals with more work experience need to support their colleagues with little work experience in using the LHIMS to enhance the overall efficiency of the institution. Also, aside from the general training given to all the health professionals at a health facility, health professionals can seek individualised IT training based on their professional type and information needs for optimum proficiency in

the use of the LHIMS by way of increased confidence in all healthcare activities and overall time reduction in the system among health professionals.

Contributors 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, EKA, POA and JBD reviewed and edited the manuscript. The final version of the manuscript was approved by all contributing authors. EKA is the guarantor for this study.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and 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 gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Not applicable.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Emmanuel Kusi Achampong <http://orcid.org/0000-0001-7861-7535>

REFERENCES

- World Health. Health information systems 2025. In: *Healthcare Information Management Systems: Cases, Strategies, and Solutions*. 2008: 579–600.
- Adler-Milstein J, DesRoches CM, Kralovec P, *et al*. Electronic health record adoption in us hospitals: progress continues, but challenges persist. *Health Affairs* 2015;34:2174–80.
- Asi YM, Williams C. The role of Digital health in making progress toward sustainable development goal (SDG) 3 in conflict-affected populations. *Int J Med Inform* 2018;114:114–20.
- Howden-chapman P, Chisholm E. Goal 3. ensure healthy lives and promote well-being for all at all ages. In: *A New Era in Global Health*. 2018: 81–126.
- Kruk ME, Gage AD, Arsenault C, *et al*. High-quality health systems in the sustainable development goals era: time for a revolution. *Lancet Glob Health* 2018;6:e1196–252.
- Wesonga CA, Kulohoma B. Correction to: Prioritising health systems to achieve Sdgs in Africa: A review of scientific evidence. *Africa and the Sustainable Development Goals* 2020:113–21.
- Christian D. *The Paleolithic and the beginnings of human history (Part II) - The Cambridge World History*. Sydney: Cambridge University Press, Macquarie University, 2015: 311–476.
- McHugh R. Developing paper record management processes. In: *Record Nations*. 2016. Available: <https://www.recordnations.com/2016/04/developing-paper-record-management/>
- Ariffin NA bt N, Ismail A bt, Kadir IKA, *et al*. n.d. Implementation of electronic medical records in developing countries: challenges & barriers. *IJARPED*;7.
- Liao M-C, Lin I-C. Performance evaluation of an information technology intervention regarding charging for inpatient medical materials at a regional teaching hospital in Taiwan: empirical study. *JMIR Mhealth Uhealth* 2020;8:e16381.
- Clarke MA, Schuetzler RM, Windle JR, *et al*. Usability and cognitive load in the design of a personal health record. *Health Policy and Technology* 2020;9:218–24.
- Kumar M, Mostafa J. Electronic health records for better health in the Lower- and middle-income countries: A landscape study. *LHT* 2020;38:751–67.

- 13 Akhlaq A, McKinstry B, Muhammad KB, *et al.* Barriers and Facilitators to health information exchange in Low- and middle-income country settings: A systematic review. *Health Policy Plan* 2016;31:1310–25.
- 14 Akanbi MO, Ocheke AN, Agaba PA, *et al.* Use of electronic health records in sub-Saharan Africa: progress and challenges. *J Med Trop* 2012;14:1–6.
- 15 Katurura MC, Cilliers L. Electronic health record system in the public health care sector of South Africa: A systematic literature review. *Afr J Prim Health Care Fam Med* 2018;10:e1–8.
- 16 Kavuma M. The usability of electronic medical record systems implemented in sub-Saharan Africa: A literature review of the evidence. *JMIR Hum Factors* 2019;6:e9317.
- 17 Jawhari B, Ludwick D, Keenan L, *et al.* Benefits and challenges of EMR Implementations in low resource settings: a state-of-the-art review. *BMC Med Inform Decis Mak* 2016;16:116.
- 18 Alhassan RK *et al.* Nhis act 852, 2012. *Ghana Med J* 2012;49:76–84.
- 19 Ministry of Health Ghana. National E-health project with bio-surveillance (early warning) system - Ministry of health. 2019. Available: <http://www.moh.gov.gh/national-e-health-project-with-bio-surveillance-early-warning-system/> [Accessed 21 Jul 2020].
- 20 Boadu RO, Lamptey MA, Boadu KAO, *et al.* Healthcare providers' intention to use technology to attend to clients in Cape coast teaching hospital, Ghana. *Biomed Res Int* 2021;2021:5547544.
- 21 Davis F. Technology acceptance model (TAM). 1989.
- 22 Al-Rayes SA, Alumran A, AlFayez W. The adoption of the electronic health record by physicians. *Methods Inf Med* 2019;58:63–70.
- 23 Manyange M, Abuga I. Full length research paper investigating the financial knowledge management in selected Ngo. In: *S In Yei County, Republic of South Investigating The Financial Knowledge Management In Selected Ngo ' S In Yei County, Republic Of South Sudan,* no. July 2015. 2020.
- 24 Manyange MN, Abuga IM, Nyambane DO. Investigating the financial knowledge management in selected Ngo's in Yei County, Republic of South Sudan. 2015. Available: <http://www.ijirr.com>
- 25 Kaipio J, Kuusisto A, Hyppönen H, *et al.* Physicians' and nurses' experiences on EHR usability: comparison between the professional groups by employment sector and system brand. *Int J Med Inform* 2020;134.
- 26 Chief of Staff launches electronic medical records system - Graphic Online. *Ministry of Health*. 2017. Available: <https://www.graphic.com.gh/news/general-news/chief-of-staff-launches-electronic-medical-records-system.html>
- 27 National E-health project with bio-surveillance (early warning) system - Ministry of health. Available: <https://www.moh.gov.gh/national-e-health-project-with-bio-surveillance-early-warning-system/> [Accessed 31 May 2022].
- 28 Office of the National coordinator for health information technology, "What are the advantages of electronic health records? HealthIT.gov, 2019.
- 29 Hodgson T, Burton-Jones A, Donovan R, *et al.* The role of electronic medical records in reducing unwarranted clinical variation in acute health care: systematic review. *JMIR Med Inform* 2021;9:e30432.
- 30 Shanafelt TD, Dyrbye LN, Sinsky C, *et al.* Relationship between clerical burden and characteristics of the electronic environment with physician burnout and professional satisfaction. *Mayo Clin Proc* 2016;91:836–48.
- 31 Adedeji P, Irinoye O, Ikono R, *et al.* Factors influencing the use of electronic health records among nurses in a teaching hospital in Nigeria. *J Health Inform Dev Ctries* 2018;12:2. Available: <https://www.jhidc.org/index.php/jhidc/article/view/174>
- 32 Khairat S, Coleman C, Ottmar P, *et al.* Physicians' gender and their use of electronic health records: findings from a mixed-methods usability study. *J Am Med Inform Assoc* 2019;26:1505–14.
- 33 Bae J, Encinosa WE. National estimates of the impact of electronic health records on the workload of primary care physicians. *BMC Health Serv Res* 2016;16:172.
- 34 Nandikove PN, Tenambergen W, Njuguna RS. Technical factors affecting electronic medical record system information use: A case of Kakamega County referral hospital outpatient Department health service delivery model view project. *IOSR Journal of Nursing and Health Science* 2018.
- 35 Butcher L. A UC Davis program focuses on training to increase efficiency, ease stress associated with EHR compliance. *Neurology Today* 2019;19:41–4.