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Original Research

Effectiveness and Challenges: The Current Situation of Electronic Health Records (EHRs) to Improve Health Care Outcomes

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Abstract

In the Philippines, although software for Electronic Health Records (EHRs) is still new, knowledge about EHRs benefits is increasing. This study investigated the effectiveness of electronic health records to health care outcomes at selected health facilities in the National Capital Region (NCR) and CALABARZON regions of the Philippines. The effectiveness of the current EHRs in government and private health facilities were determined in terms of quality patient care, patient engagement, support team-based care, workload, and data liquidity; and the challenges facing health providers in the implementation of electronic health records were identified. The research utilized the descriptive, cross-sectional design. Three hundred seven (N=307) health providers from the medical, nursing, and paramedical departments were the study participants. A three-part adapted questionnaire was the main tool used for data collection. Mean, standard deviation, and Mann-Whitney & Kruskal-Wallis's tests were utilized for data analysis. The results revealed that in the Philippines, EHRs are moderately effective in improving health care outcomes. EHRs effectiveness is primarily achieved through better access and retrieval of health information. EHRs implementation poses major challenges in the Philippines' health facilities which are central to socio-economic and organizational factors. The more effective the use of EHR systems, the greater the challenges experienced by care providers and health facilities.

INTRODUCTION

The breakthrough of technology made it possible that health data and information be shared from one healthcare provider to another through electronic transmission. Modern tools have been made available by technology to the healthcare sector to enhance patient care.

The health sector, which is by its very nature data-intensive, is well suited for using technology for analytics to enhance health outcomes, address public health emergencies, and allocate resources effectively and fairly. Efforts to use digital health to progress toward universality have taken numerous forms, such as, increase the number of people contacted, provide bigger

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service coverage, and lessen financial constraints on individuals in need of health care.[1]

According to World Health Organization[2], 90% of eHealth strategies make reference to the goals of Universal Health Coverage (UHC), and more than half of WHO Member States now have an eHealth strategy. Policies for managing information are increasingly common in nations. There are now reported national electronic health record (EHR) systems in 47% of nations. Even though putting EHR programs into place is difficult and expensive, EHR have the potential to give clinical decision-makers complete access to information about every patient at the point of care, enhancing the standard and timeliness of care and, overall, supplying better data on the efficacy and coverage of interventions.

EHR systems are being more widely used in many developing nations, some of which have integrated EHR use into their national health strategies on a large-scale rather than just in isolated trial programs.[3] This initiative is particularly true in the Philippines. The Department of Health (DOH) has led the health sectors in recognizing the need for information and communication technologies (ICTs) for health or eHealth as one of the enabling strategic instruments not only to address the current disparities in service care delivery, and timely access to information for better decision making and intervention, but also, largely, to support and facilitate the achievement of the UHC.[4] The first electronic medical record system that is used widely in the Philippines was developed in 2004[5]

In 2019, the Philippines implemented Republic Act. No. 11223, also known as the Universal Healthcare Act, instituted universal healthcare for all Filipinos. It also recognizes the role of evidence-based decisions in developing and implementing better programs.[6] The scaling up and full adoption of electronic medical record (EMR) systems was strategically planned and supposed to be finished in 2020 as part of enhancing eHealth in the Philippines to support the universal health care (UHC) law. However, the Covid-19 pandemic delayed these strengthening initiatives.[7] Currently, there is no legislation to support eHealth in the Philippines. The Philippine E-Health and Services Act or House Bill No.7422, which aims to promote the delivery of medical services through information and communication technologies, is still pending. There are only two joint Memorandum Circulars released in 2020 and 2021 with guidelines on monitoring and evaluation of the use of telemedicine in Covid-19 response.[6]

An EHR is an electronic version of a patient's medical history that is maintained by the provider over time. It may include all of the key administrative clinical data relevant to that person's care under a specific provider, such as demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. The EHR automates information access and has the potential to make the clinician's workflow more efficient. Through a variety of interfaces, the EHR can also directly or indirectly support other care-related activities, such as quality control, outcomes reporting, and evidence-based decision support.[8] EHR systems are a crucial part of delivering universal health care, which guarantees that everyone has access to preventive, curative, rehabilitative, and palliative care services that are of sufficient quality to be effective and that don't put the user in financial hardship.[2] Electronic Medical Records (EMR) and Electronic Health Records (EHR) store medical records in computerized storages and are used by physicians to improve quality of care and contain costs.[9] Health providers frequently confuse electronic health records (EHRs) and electronic medical records (EMRs) frameworks because they both serve the same essential purpose in a constantly changing compliance and operational

environment; thus, the terms EHRs and EMRs are frequently used interchangeably in healthcare.[10,11] In this investigation, both EHRs and EMRs are used interchangeably.

Numerous studies have affirmed the significant benefits of EHRs in health care. These benefits were attributed to how health providers have used EHRs effectively to successfully meet the outcomes of care. There were several categories that were commonly used by authors to predict the effectiveness of EHRs use. These categories focused on various indicators relative to the provision of quality care, enhanced collaboration among health providers, and ensuring confidentiality in the use of digital information.[12] In this study, five categories were included: quality patient care, patient engagement, support team-based care, workload, and data liquidity. However, the extent of the effectiveness of EHRs was not optimally measured by these categories alone. The varied profiles of health providers and organizational issues in its implementation were remarkable.

Although software for EHRs in the Philippines is still new, knowledge about the benefits of EHRs is increasing. It is worth mentioning that the Philippines has already made progress, in a number of eHealth-related areas including leadership and governance, services and applications, standards and interoperability, infrastructure, legislation, policy and compliance, and workforce.[13] However, little is known about how beneficial it has been in terms of healthcare results.

In light of that, this study investigated the effectiveness of electronic health records to health care outcomes at selected health facilities in the National Capital Region (NCR) and CALABARZON regions of the Philippines and the challenges experienced by health providers in the implementation of EHRs. Specifically, the study answered the following research objectives:

1.To determine the effectiveness of the current EHRs in government and private health facilities in terms of quality patient care; patient engagement; support team-based care; workload; and data liquidity.
2. To identify the challenges in the implementation of electronic health records.
3. To determine the differences of the responses of health providers on the effectiveness and challenges of EHRs implementation when grouped according to the profile.

METHODS

The researchers utilized the descriptive, cross-sectional design to address the objectives of the study. The National Capital Region (NCR) and Cavite, Laguna, Batangas, Rizal and Quezon (CALABARZON) regions of the Philippines served as the locale of the study. The study was conducted in selected health facilities from these regions. They were specifically chosen based on easy accessibility of study participants, agreement of researchers and the health facilities, and practicality of data collection. Likewise, these health facilities have implemented the Electronic Health Records (EHRs) for more than one year.

Health providers from selected health facilities were the participants of the study. Based on the convenience sampling technique, a sample of three hundred seven (307) health providers from the medical department, nursing department, and paramedical department were the actual study participants. The sample size was obtained based on an effect size of 0.25 power probability of 0.95 and an alpha level of 0.05 using G*Power 3.1.9.2. To identify the study participants, the researchers used the following inclusion criteria: first, they are health providers from the medical department, nursing department, and paramedical department of selected government and private health facilities in the NCR and CALABARZON regions, Philippines; next, they have basic

knowledge of EHRs and its uses; and lastly, they have been using EHRs in their work for at least one year. Health providers who do not meet these criteria were excluded from the study sample.

A three-part questionnaire was the tool utilized for data collection. This tool was adapted from previous study of Amponin and Britiller[14], titled "Electronic Health Records (EHRs): Effectiveness to Health Care Outcomes and Challenges of Health Practitioners in Saudi Arabia." The first part of this questionnaire was slightly modified to ascertain the specific profile of the study participants. It included variables in terms of age, department, years of experience in using EHRs, and type of health facility. On the other hand, the second part consisted of items to measure the effectiveness of EHRs to health care outcomes. It covered five categories namely; quality patient care, patient engagement, support team-based care, workload, and data liquidity. The last part was a 10-item questionnaire developed to determine the challenges of health providers in the implementation of EHRs. Aside from content validation previously done with the questionnaire, the present study performed a pilot test to twenty (20) samples comparable to health providers who met the inclusion criteria. A test-retest reliability method was administered to the samples on two separate occasions with two weeks interval. The results of this test were analyzed on the basis of Cronbach's alpha coefficient values. The questionnaire was considered reliable for data collection consisting of the following scores for effectiveness; quality patient care *(0.728, acceptable)*, patient engagement *(0.793, acceptable)*, support team-based care *(0.886, good)*; workload *(0.842, good)*, and data liquidity *(0.724, acceptable)*; whereas for the challenges in the implementation of EHRs the result was *0.841* which was considered good. Further, to ensure high internal consistency, the researchers deleted one item originally included in the adapted questionnaire. The item, address patient's complex needs, was deleted from the category of quality patient care since it was considered by the pilot sample to not reliably measure the current EHRs in the Philippines.

After approval from appropriate authorities and securing an approval from the Ethics Review Board (ERB) of the Lyceum of the Philippines University with ERB# RERC Code: A1-2023-074, the questionnaire was prepared and distributed to the study participants through electronic or paper forms. The study participants were asked to select a choice from a 4-point Likert scale ranging from 1- (Not effective) to 4- (Highly effective) to determine the effectiveness of EHRs and from the scale ranging from 1- (Strongly disagree) to 4- (Strongly agree) to identify the challenges in EHRs implementation. There was a total of two hundred seven (207) study participants who answered the questionnaire in paper form while thirty-six (36) of them answered electronically through a link. During questionnaire distribution, the study participants were provided with the explanation of the purpose of the study and a cover letter to consent their participation in the study. After three months, the questionnaires were retrieved for tabulation of data and was analyzed with the Statistical Package for the Social Sciences (SPSS) Version 28 software. Numbers were assigned to the questionnaires to ensure anonymity of responses and data was shared only to those who were involved in the study to ensure confidentiality.

For data analysis, descriptive and inferential statistics were used. Frequency and percentage were used to present the profile of the study participants and mean was employed to determine the effectiveness and challenges in the implementation of EHRs. For the comparison of differences among responses, Mann-Whitney & Kruskal-Wallis's test was used to determine the effectiveness of EHRs based on the five categories and challenges in EHRs

implementation when grouped according to the profile of the study participants. Based on the findings, recommendations to improve health care outcomes through Electronic Health Records (EHRs) were proposed.

RESULTS

A total of three hundred seven (N = 307) study participants were included. They were health providers from selected government and private health facilities in the National Capital Region (NCR) and in the Cavite, Laguna, Batangas, Rizal, and Quezon (CALABARZON) regions of the Philippines.

Figure 1 summarizes the profile distribution of the study participants in terms of age, department, years of experience using Electronic Health Records (EHRs) and type of health facility.

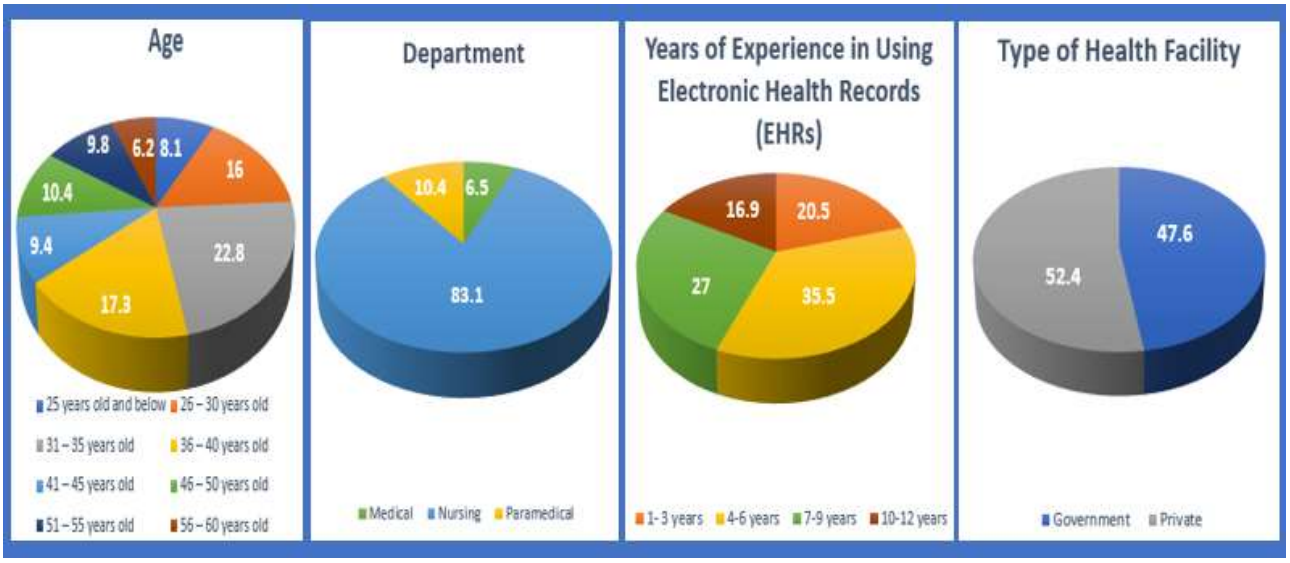

Figure 1: Percentage Distribution of Study Participants' Profile

Based on the findings, majority of the study participants were 31–35 years old *(22.8%)*, from the nursing department *(83.1%)*, with 4-6 years of experience in using electronic health records *(35.5%)*, and working in private health facilities *(52.4%)*.

Table 1 presents the effectiveness of Electronic Health Records (EHRs) to health care outcomes. The effectiveness of EHRs was identified in five categories: quality patient care, patient engagement, support-team-based care, workload, and data liquidity.

In terms of quality patient care, EHRs were moderately effective in improving health care outcomes based on the composite mean score of *3.42±0.448*. Among the items cited, only facilitating planning and continuity of care was assessed as highly effective *(3.60±0.547)*, while other items were considered moderately effective, such as enhancing patient safety and reducing medical errors *(3.46±0.561)*, reducing waiting times and delays in care *(3.31±0.581)*, and showing progress of treatments for fast recovery and decreasing length of hospital stay *(3.31±0.641)*.

Table 1
Effectiveness of the Electronic Health Records (EHRs) to Health Care Outcomes

Items	Mean	Std.	Verbal Interpretation
Quality Patient Care			
1. Facilitate planning and continuity of care	3.60	0.547	Highly Effective
2. Enhance patient safety and reduction of medical errors	3.46	0.561	Moderately Effective
3. Reduce waiting times and delays in care	3.31	0.581	Moderately Effective
4. Show progress of treatments for fast recovery and decreaselength of hospital stay	3.31	0.641	Moderately Effective
Composite Mean	*3.42*	*0.448*	*Moderately Effective*
Patient Engagement			
1. Facilitate patient's understanding of medical records andinformation	3.36	0.664	Moderately Effective
2. Improve relationship with health care professionals	3.39	0.634	Moderately Effective
3. Enhance compliance to medications and treatments	3.40	0.641	Moderately Effective
4. Encourage awareness and proper self-care	3.38	0.672	Moderately Effective
5. Assist in understanding information which facilitate informed consent and medical decisions	3.36	0.639	Moderately Effective
Composite Mean	*3.38*	*0.522*	*Moderately Effective*
Support Team-Based Care			
1. Help coordinate patient care	3.44	0.599	Moderately Effective
2. Afford joint clinical decisions based on shared data	3.39	0.634	Moderately Effective
3. Allow flexibility in multidisciplinary collaboration (e.g. managing referrals)	3.52	0.617	Highly Effective
4. Improve efficiency and quality of documentation among care providers	3.46	0.584	Moderately Effective
5. Enhance communication between health professionals	3.29	0.593	Moderately Effective
Composite Mean	*3.42*	*0.469*	*Moderately Effective*
Workload			
1. Ensure efficiency of clinical processes	3.33	0.599	Moderately Effective
2. Lessen mental workload and burnout	3.26	0.613	Moderately Effective
3. Reduce repetitive work	3.36	0.613	Moderately Effective
4. Limit cost and resources for health care	3.36	0.645	Moderately Effective
5. Save time and reduce the necessity for face-to-face communication	3.45	0.621	Moderately Effective
Composite Mean	*3.35*	*0.498*	*Moderately Effective*
Data Liquidity			
1. Enhance access and retrieval of data	3.20	0.880	Moderately Effective
2. Provide central system and storage of data	3.18	0.882	Moderately Effective
3. Allow data analyses and compare trends of data for researchpurposes	3.13	0.880	Moderately Effective
4. Ensure privacy and security of data	3.14	0.892	Moderately Effective
5. Facilitate regulatory compliance	3.17	0.871	Moderately Effective
Composite Mean	3.16	0.772	Moderately Effective

Legend: Mean/Composite Mean: 3.50 – 4.00 = Highly Effective; 2.50 – 3.49 = Moderately Effective; 1.50 – 2.49 = Fairly Effective; 1.00 – 1.49 = Not Effective; Std=Standard Deviation

On the other hand, the study participants revealed that, regarding patient engagement, EHRs were in general moderately effective in improving health care outcomes *(3.38±0.522)*. They claimed that EHRs can enhance compliance with medications and treatments *(3.40±0.641)*, improve relationships with health care professionals *(3.39±0.634)*, encourage awareness and proper self-care *(3.38±0.672)*, assist in understanding information that facilitates informed consent and medical decisions *(3.36±0.639)*, and facilitate patient's understanding of medical records and information *(3.36±0.664)*.

With support team-based care, EHRs were likewise moderately effective in improving health care outcomes *(3.42±0.469)*. EHRs were highly effective in allowing flexibility in multidisciplinary collaboration, such as in

managing referrals *(3.52±0.617)* but moderately effective in improving efficiency and quality of documentation among care providers *(3.46±0.584)* and in helping coordinate patient care *(3.44±0.599)*. Furthermore, the study participants stated that EHRs can moderately afford joint clinical decisions based on shared data *(3.39±0.634)* and enhance communication between health professionals *(3.29±0.593).*

Considering workload, EHRs were moderately effective in ensuring that health facilities improve health care outcomes based on the composite mean of *3.35±0.498*. EHRs save time and reduce the necessity for face-to-face communication (3.45±0.621). Similarly, EHRs reduce repetitive work *(3.36±0.613)* and limit cost and resources for health care (3.36±0.645). Also, it ensures the efficiency of clinical processes *(3.33±0.599)* and lessens mental workload and burnout *(3.26±0.613)*.

Lastly, with data liquidity, EHRs were overall indicated as moderately effective *(3.16±0.772)* in terms of enhancing access and retrieval of data *(3.20±0.880)*, providing central system and storage of data *(3.18±0.882)*, facilitating regulatory compliance *(3.17±0.871)*, ensuring privacy and security of data *(3.14±0.892),* and allowing data analyses and comparing trends of data for research purposes *(3.13±0.880)*.

Legend: 3.50 – 4.00 = Highly Effective; 2.50 – 3.49 = Moderately Effective; 1.50 – 2.49 = Fairly Effective; 1.00 – 1.49 = Not Effective

Figure 2: Summary of EHRs Effectiveness to Health Care Outcomes

Figure 2 shows a summary of the effectiveness of EHRs to health care outcomes. The findings revealed that EHRs were moderately effective in improving health care outcomes as to data liquidity *(3.45±0.522)*, quality patient care *(3.42±0.448)*, support team-based care *(3.42±0.469)*, patient engagement *(3.38±0.522)*, and workload *(3.35±0.498)*. Overall, it can be deduced from the findings that Electronic Health Records (EHRs) moderately improve health care outcomes *(3.40±0.492)*. Consecutively, the five categories of effectiveness suggested that EHRs enhance access and retrieval of data, facilitate planning and continuity of care,

allow flexibility in multidisciplinary collaboration, such as in managing referrals, enhance compliance with medications and treatments, and save time and reduce the necessity for face-to-facecommunication.

Table 2
Challenges in the Implementation of Electronic Health Records (EHRs)

Items	Mean	Std.	Verbal Interpretation
1. Lack of confidence in the use of EHR	3.23	0.918	Agree
2. Unable to access evidence-based tools that can be used to make decisions about patient care	3.09	0.847	Agree
3. Failure to update one's professional knowledge to keep pace with the current EHR based standard	2.95	0.811	Agree
4. Facilitating structured communication among health professionals	3.23	0.696	Agree
5. Computer consumes more time that paper-based system	3.02	0.965	Agree
6. Probable security breaches	3.16	0.795	Agree
7. Poor computer language and skills	3.06	0.884	Agree
8. Complexity of technology	3.20	0.791	Agree
9. Resistance to changing work habits	3.14	0.832	Agree
10. Unreliable internet and network connectivity	3.26	0.826	Agree
Composite Mean	*3.23*	*0.918*	*Agree*

Legend: Mean/Composite Mean: 3.50 – 4.00 = Strongly Agree; 2.50 – 3.49 = Agree; 1.50 – 2.49 = Disagree; 1.00 – 1.49 = Strongly Disagree; Std = Standard Deviation

Table 2 presents the challenges in the implementation of Electronic Health Records (EHRs). Generally, the study participants agreed that challenges were experienced in the implementation of EHRs *(3.23±0.918)*. Based from the findings, they agreed that in improving health care outcomes they were highly challenged in terms of unreliable internet and network connectivity *(3.26±0.826)*. In the same phase, the study participants agreed that EHRs implementation was challenging in facilitating structured communication among health professionals *(3.23±0.696)* and they lack the confidence in its use *(3.23±0.918)*. Moreover, complexity of EHRs technology was also identified as a major challenge *(3.20±0.791)*.

Table 3 shows the comparison of responses on the effectiveness of Electronic Health Records (EHRs) to health care outcomes when grouped according to profile.

The findings indicated that there was a significant difference in support team-based care when grouped according to department because the resulting p-value was less than the alpha level *(p=0.037)*. The study participants' responses vary statistically since the other categories generated no significant p-value scores. In the post hoc test conducted, it was found out that those who are in the medical department assessed the EHRs more effectively than those in the nursing and paramedical departments.

Statistical variations were also noted in terms of the type of health facility. There were highly significant differences on the responses of study participants according to data liquidity, as suggested by a p-value score of *<.001*. Equally, workload *(p=0.023)*, patient engagement *(p=0.033)*, and support team-based care *(p=0.040)* projected significant differences. Meanwhile, quality patient care revealed no significance since the computed p-value was greater than the alpha level *(p=0.127)*. The findings reveal that the responses vary significantly for those who are working in private health facilities.

Lastly, the responses specific to age and years of experience using the EHRs were not statistically related. All study participants' profiles have no significant difference in the

five categories of EHRs effectiveness to health care outcomes based on p-value scores of more than 0.05.

Table 4 displays the comparison of responses on the challenges in the implementation of EHRs when grouped according to profile. It was observed that there was a significant difference except when grouped according to age *(p=0.241)*. The study participants' department *(p=<.001)*, years of experience in using EHRs *(p=<.001)*, and type of health facility *(p=<.001)* were highly significant for the challenges in the implementation of EHRs. These findings suggested that the responses of the study participants differ statistically. Based on the pairwise comparison, it was observed that those who are in the medical department, have been using EHRs for 4–6 years, and working in private health facilities encountered more problems in the implementation of EHRs.

Table 3
Difference of Responses on Effectiveness of Electronic Health Records (EHRs) to Health Care Outcomes When Grouped According to Profile

Items	λ^2_c	p-value	Interpretation
Age			
Quality of Patient care	5.604	0.587	Not Significant
Patient Engagement	11.146	0.132	Not Significant
Support Team-Based Care	2.442	0.931	Not Significant
Workload	5.826	0.560	Not Significant
Data Liquidity	6.1	0.528	Not Significant
Department			
Quality of Patient care	1.03	0.597	Not Significant
Patient Engagement	0.552	0.759	Not Significant
Support Team-Based Care	6.617	0.037	Significant
Workload	4.005	0.135	Not Significant
Data Liquidity	5.852	0.054	Not Significant
Years of Experience in Using Electronic Health Record (EHR)			
Quality of Patient care	5.381	0.146	Not Significant
Patient Engagement	6.006	0.111	Not Significant
Support Team-Based Care	3.251	0.355	Not Significant
Workload	3.925	0.270	Not Significant
Data Liquidity	2.857	0.414	Not Significant
Type of Health Facility			
Quality of Patient care	10587	0.127	Not Significant
Patient Engagement	10112	0.033	Significant
Support Team-Based Care	10177	0.040	Significant
Workload	10002.5	0.023	Significant
Data Liquidity	9202	<.001	Highly Significant

Legend: Significant at p-value < 0.05

Table 4
Differences of Responses on the Challenges in the Implementation of Electronic Health Records (EHRs) When Grouped According to Profile

Items	λ^2_c	p-value	Interpretation
Age	9.161	0.241	Not Significant
Department	17.283	<.001	Highly Significant
Years of Experience in Using Electronic Health Record (EHR)	3841	<.001	Highly Significant
Type of Hospital facility	9219	0.001	Highly Significant

Legend: Significant at p-value < 0.05

DISCUSSION

In terms of effectiveness, the study participants claimed that EHRs were highly effective in facilitating planning and continuing care. Health providers can develop the most appropriate goal for a patient's care since EHRs can provide them with first-hand data on medical tests, interventions, and treatments. Moreover, resources such as supplies and equipment needed to facilitate patient interventions and management can be easily checked to see if they are available. They can also make modifications to care strategies because EHRs can provide information on health history and contraindications to treatments. Likewise, health providers observed the effectiveness of EHRs for continuity of care as EHRs allow them to share and communicate information faster and easier with other health providers or facilities for referrals. However, Hysong et al[15] suggested differently, proposing that despite facilitating transfer between patient care practitioners and subspecialists, e-referrals remain prone to coordination breakdowns.

To a moderate extent, health providers suggested EHRs to enhance compliance with medications and treatments. Giving medications and administering treatments require a more direct approach to care. The finding implies that health providers perceived these interventions as demanding direct interaction with patients to improve compliance. For example, a pharmacist who has checked the patient's medications through the system would still manually review her list several times before dispensing the medications, or a nurse, even with a busy schedule, would prefer to meet the patient face-to-face for health education even though materials are available online. With this, it can be inferred that health providers have not yet placed their full trust in EHRs, especially with the knowledge that most errors in health care occur due to negligence in medications and treatments. Upadhyay and Hu[16] confirmed that many clinicians underscored the importance of EHR in avoiding medical errors by improving data accessibility; nurses, on the other hand, had concerns regarding data accuracy. At a different point, it can be assumed that health providers always want to ensure safe care practices.

One of the primary features of EHRs is flexibility. Before, the usual practice when a nurse needed to clarify the physician's order was to use the telephone or meet the physician at the clinic. Now that information is available electronically, it can reach team care members with ease without the need to move from one unit to another or transport them to a faraway location. This means that the flexibility offered by EHRs is helpful to health providers who act as frontliners in care management. Based on the findings, it can be assumed that with EHRs, decisions are immediate and also supportive of routine interventions. To cite more, a laboratory technician or a nurse can report a large amount of data to physicians, preventing the need to go through a file of paper documents. Also, a radiographer can present high-definition images to assist specialists in making the correct diagnosis. Looking into these perspectives, the findings clearly affirmed previous empirical studies that EHRs increase clinical processes by enhancing collaboration among team care members. A study conducted in the Philippines on the EHR system in rural health units concluded that wireless access had enhanced the ability of nurses and doctors to perform follow-up visits, as patient historical information and data from prior visits are readily accessible and are faster than having to search through paper charts.[17]

In addition, the study participants indicated that EHRs are moderately effective in saving time and reducing the necessity for face-to-face communication. This finding supports the discussion about patient engagement. EHRs require health providers to take additional time to double-check the lists of

treatments or emphasize care through direct contact. Extra time and effort mean a burden in their work since it is known that those in the health care sector have a heavier workload than others. It is worth noting that numerous studies have affirmed that EHRs and other electronic tools contribute to dissatisfaction and burnout. Howard et al.[18] attested that EHRs on work burden differed among clinicians. EHRs may reduce some clinician work, such as prescribing, while increasing other work on charting and preventive care tasks. Also, Puccinelli-Ortega et al.[19] suggested that implementing a digital informed decision-making tool was perceived as additional work by clinic staff, making them less motivated to use the program. In contrast, according to Kawamoto et al.[20] a well-designed EHRs add-on app has the potential to improve patient care and have significance for clinician efficiency, while Salati et al.[21] recognized EHRs as saving time and human costs without compromising the quality of clinical data. Moreover, Rotenstein et al.[22] argued that although increased EHRs time is associated with burnout, it may represent a level of communication that enhances certain health outcomes.

Furthermore, the study participants noted that EHRs enhance access and retrieval of data. Among the many features of EHRs, this aspect was highlighted by most of the literature. Unlike paper-based systems, EHRs allow access to and retrieval of patient information in seconds. In the Philippines, an electronic medical record (EMR) system known as the Community Health Information Tracking System (CHITS) being used at the rural health level contributed to the effective and efficient delivery of health services through appropriate information and communication strategies and aided in health decision-making at the local level. This technology reduces patients' waiting times and improves monitoring of patient care through efficient data encoding and record retrieval. By utilizing CHITS, a patient's record can be searched only a few seconds after admission.[5] In another Philippine study, a charged medication report system offered benefits such as lessened paper use, organized patient summary reports, faster medication receipts, a smaller amount of waste, system efficiency, and improved productivity.[23]

In terms of the challenges in the implementation of EHRs, the study participants identified unreliable internet and network connectivity as the most challenging aspects of EHR implementation. Information technology, such as EHRs, greatly depends on a secure internet connection. If this resource is not available, it affects the full operation and reliability of the system. The study participants emphasized the necessity of the internet and how important network connectivity is to EHRs in improving health care outcomes. In early 2006, environmental issues were seen as barriers to EHRs adoption in developing countries such as the Philippines. In a study conducted by the WHO[24], lack of power supply in geographically isolated and depressed areas and lack of internet connection were challenges for national EHR adoption. These reasons were again pointed out after six years by the study of Premji, et al.[25] on the implementation of electronic health information systems in local community settings in the Philippines, emphasizing the provision of electricity in the countryside as fundamental to hastening the use of information systems and attesting that connectivity will further the progress of underserved communities. Additionally, a system that malfunctions for reasons of internet and network connectivity creates a stressful work environment for health providers. It may lead to repetition of work, increased medical errors, and inaccurate documentation. In 2019, Azcarraga & Peña[26] proved that internet connectivity remains a problem in the Philippines, and the low internet and smartphone penetration rates are well below the target numbers, leading to institutional rigidities and a decrease in productivity. In Africa,

epileptic power supply and poor internet service were classified as key social factors influencing the effective use of EHRs. These challenges have been recurrent and have become obstacles to the successful implementation of EHRs projects. [27] Therefore, vital socio-economic infrastructures have remained a crucial challenge to the attainment of meaningful use of electronic systems.

The next challenge in EHRs implementation was facilitating structured communication among health professionals. This implies that the majority of the study participants would still prefer in-person and unstructured communication. This kind of communication allows them to explore more alternatives and possibilities for providing care. Not only that, it can establish a more trusting and cohesive relationship among health providers. It only proves that human interaction is still regarded as an essential aspect of health care. According to Taylor et al. as cited by Ratwani[28] EHRs have fundamentally changed the social interactions between clinicians and between clinician and patient. EHRs have led to less face-to-face communication between team members, uncomfortable interactions between clinicians and patients, and decreased situation awareness. Aranaout[17] explained that with the use of EHRs, patient-provider communication was affected. Patients stated that some providers focus more on the computer screen than making eye contact or physical touch while serving patients. Furthermore, Gao et al.[29] posited that health professionals have not formed a positive attitude towards the sharing of information through e-health record systems. It was also pointed out by Vos et al.[30] that EHRs have, in some ways, constrained collaboration among health professionals. In order to actualize the collaborative affordances of EHRs more fully, health professionals need to be able to retrieve, understand, and trust each other's information.

Similarly, the study participants lack confidence in the use of EHRs. This lack of confidence can be attributed to the lack of trust of health providers in the use of the system, as previously discussed in Table 1. Definite evidence proves this perception, as the study participants claimed an all-agreed response to the listed challenges in EHRs implementation. Jimma and Enyew[31] affirmed that physicians are unsure whether EMRs are trustworthy. They argued that the majority of physicians who use EMR believe that storing patient information is riskier in terms of security and confidentiality than paper records.

Also considered a major challenge was the complexity of EHRs technology. Health care providers have been using the paper-based system for years. For this reason, a sophisticated and modern device can be complex and complicated for them to use. The complexity of technology was a key barrier to EMR, as suggested by previous studies.[9,32] Additionally, change and the transition from paper to electronic systems are expected to create barriers. Ajami and Arab-Chadegani[33] emphasized that one of the major restrictions to EHRs implementation was the attitudinal constraints and behavior of individuals, specifically their resistance to change. Previous studies highlighted user resistance as a primary issue with EHRs.[5,34–37] On the part of the health facilities, EHRs implementation warrants major challenges directing towards the capability of the organization to maintain highly expensive technology, establish a regulation in its use, and provide relevant training for the staff.

In terms of the differences of the responses on the effectiveness of EHRs to health care outcomes when grouped according to the profile, the study participants revealed a significant difference in support team-based care. Each health care provider performs unique roles on a team. This means that the implementation of EHRs may be different at some points than at others. As the finding proposes, physicians

benefit more from the use of EHRs compared to other team members. Physicians are regarded as key players who often lead the group in patient care. This proves that, among others, they have the biggest role in meeting health care outcomes. Since the nature of a physician's work focuses mainly on diagnosis and treatment, EHRs may be seen as an essential tool to fulfill these tasks. This further implies that the use of EHRs should satisfy the team members, specifically physicians; otherwise, EHRs may become ineffective in facilitating care. In the study of Hazazi and Wilson[38], physicians indicated that EHRs helped organize their work and positively influenced patient encounters in their primary health clinics. Physicians emphasized the multiple benefits of EHRs in terms of efficiency, including the accuracy of patient documentation and the availability of patient information. But, Mishuris and Linder[39] argued that EHRs continue to make physicians lives complicated as they are asked to take over more tasks that were previously done by office staff or are totally new to medical practice.

Considering the type of health facility, the study participants revealed that they can use EHRs effectively in private health facilities in terms of data liquidity, workload, patient engagement, and support team-based care. In the Philippines, private health facilities operate with fewer restrictions than those funded by the government. Although following similar health regulations and standards, government health facilities are expected to observe stricter compliance, while private health facilities are more flexible in formulating health protocols and implementing care procedures. This condition suggests that private health facilities may implement EHRs in accordance with their goals, the kind of patient population they serve, and the personnel who use them. According to Esquivel et al.[40], allowing for some flexibility in the referral process and monitoring communication outcomes are vital to effective EHRs implementation. The success of technology-enabled processes depends on their ability to be responsive to health providers' needs. Relating this to data liquidity, they can choose a system more helpful to their staff, like modifying features of their current EHRs to ensure that nurses can immediately retrieve information for a patient having follow-up care or that physicians can use stored data to compare treatments for a group of patients with the same health conditions. With EHRs that match the needs of the staff, ease in workload, better patient engagement, and more collaborative team members follow. Earlier studies have also shown that different user groups (e.g., physicians and nurses) have different job roles and responsibilities, leading to different needs and expectations of the clinical systems.[41]

On the other hand, in both health facilities, the study participants recognized no disparity in quality patient care through the use of EHRs. Despite the type of facility, EHRs can meet health care outcomes based on the quality of patient care that physicians, nurses, and other team members provide. Several literatures claimed otherwise. Bundschuh et al.[42] indicated that physicians working in different sectors have different needs and requirements for EHRs and Kaipio et al.[43], considering also the health sectors, showed notable differences between nurses' and physicians' experiences on usability of their EHR systems. Physicians were more satisfied than nurses with the technical quality and learnability of the EHR-systems, while nurses experienced the ease of use better and were more satisfied with collaboration aspects than physicians.

Likewise, the study participants affirmed that EHRs effectiveness is not measured in terms of age or the years of their use. EHRs are not limited to or bound to young and old users. This implies that a novice nurse with no experience in EHRs can effectively meet health care outcomes with proper

organizational support and training. Similarly, a clinician with less knowledge of the application of digital technology, such as EHRs will equally meet the goal of care. Contrary to these findings, Alanazi et al.[44] noted that younger and older professionals and years of experience in EHR use in the medical field have an important role in reducing medical errors. Age and experience were statistically significant in influencing the attitude of health care professionals towards the adoption of electronic health records. Additionally, Jamoom et al.[45] suggested that physicians with longer EHRs experience or with self-reported optimized EHRs were more likely to report positive impacts with the system.

In terms of the difference between the responses on the challenges in the implementation of EHRs when grouped according to profile, the study participants from the medical department experienced more challenges in EHRs implementation than those from the nursing and paramedical departments. Based on the previous assertion in Table 3, physicians are recognized as primary users of EHRs and their work is associated with diagnosis and treatment, which permits greater experience with EHRs. Therefore, it can be assumed that physicians may also have encountered the most common application problems and observed the main weaknesses of EHRs features. This finding was clearly attested to by Ajami and Bagheri-Tadi[46]. Despite the positive effects of using EMR in medical practices, the adoption rate of such systems is still low, and they meet resistance from physicians. To add more, Kaipio et al.[41] indicated that with EHR systems, physicians were not able to conduct their work in an efficient way. The physicians share the concern that EHRs lack properties such as availability of key functionalities and performance of routine tasks that are needed for key clinical care tasks with patients, and EHRs force the physicians to perform additional tasks or adapt new inappropriate work processes.

In addition, the findings indicated that health providers with 4-6 years of experience in EHRs encounter more challenges in improving health care outcomes. One third of the study participants belonged to this group; hence, the finding was expected. In another view, the study participants, during their first years of experience with EHRs have not yet encountered the problems of the system since they are in the period where they are still trying to familiarize themselves with the new system. Subsequently, in the years after this period, more problems and weaknesses were observed and identified. Conversely, Jamoom et al.[45] reported that physicians with at least 4 years of experience in EHRs use were able to provide better patient care. To add further, this time can be considered crucial for health facilities to reorient and retrain health providers to EHRs use. The organization may consider this period the best time to evaluate EHRs implementation.

Likewise, the findings confirmed that health providers working in private health facilities encounter more challenges with EHRs in improving health care outcomes. The findings affirmed that health outcomes are most likely achieved through EHRs in private health facilities. This assumption is endorsed since as more challenges are listed in the application of EHRs, more improvement strategies are formulated. Kaipio et al.[41], affirmed that there were marked differences between the EHRs within the private sector, public hospitals, and primary healthcare. EHR systems used in the private sector appeared more stable and responded more quickly to inputs, as well as providing better support for physicians' routine tasks.

Finally, the study participants revealed that all health providers of any age group can experience challenges in EHRs implementation. Kaihlanen et al.[47] suggested that information system stress due to poor EHR usability afflicts younger and older nurses alike. However, younger

nurses starting their careers may be more cognitively burdened if they find EHR systems difficult to use compared to older nurses. Adequate support in using the EHRs may be particularly important to young registered nurses, who have a lot to learn and adopt in their early years of practice. In order to tackle the adverse consequences, it is important that employers provide adequate support for the right groups and that educational institutions provide students with adequate training in the use of EHRs. System vendors have the primary responsibility to ensure the usability of their systems and to contribute to the quality of care and patient safety. Therefore, improvement plans and staff trainings should not be selective and dependent on the age of health providers. In order for the system to work effectively and for health care outcomes to be achieved, the entire organization should be involved.

CONCLUSION

In the Philippines, electronic health records (EHRs) are moderately effective in improving health care outcomes. EHRs effectiveness is primarily achieved through better access and retrieval of health information. Health care outcomes are improved when EHRs are used satisfactorily to facilitate planning and continuity of care and with multidisciplinary collaboration. EHRs implementation poses major challenges in the Philippines' health facilities. These challenges are central to socio-economic and organizational factors.

EHRs effectiveness varies significantly among physicians, nurses, and paramedicals, as well as between government and private health facilities. Trust in the use of information systems remains a critical issue among health providers. Physicians with adequate experience using EHRs and working in private health facilities are the key facilitators of EHRs. The effectiveness of EHRs in improving health care outcomes is best achieved within four to six years of implementation in private health facilities. The more effective the use of EHR systems, the greater the challenges experienced by care providers and health facilities.

The lack of empirical studies conducted in the Philippines to prove the effectiveness of EHRs on health care outcomes is seen as a major limitation of this study. Local evidence to clearly support the findings and make binding inferences about EHRs use is limited. Although most literature proved that the Philippines attained the initial phase in the adoption of a nationwide EHR system, concrete plans and strategies, particularly those of the government, to improve health care outcomes through EHRs, were not yet fully implemented.

Future studies to address the sustainability of a stable power supply and reliable network connectivity should be considered at the local and national levels. Careful identification of IT vendors that meet organizations' goals, formulation of effective policies in the use of IT, and comprehensive skill training to develop the confidence of staff personnel in information technology are essential requirements for health facilities. These initiatives will lead to the improvement of health care outcomes.

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