ORIGINAL ARTICLE

Nurses' Satisfaction with Adopting a Homegrown Public Tertiary Hospital Electronic Medical Record during the Pandemic

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ABSTRACT

Background and Objective. There are mixed reports on nurses' satisfaction with electronic medical records (EMR) in literature, and facilitators and barriers to its adoption were reported frequently. A Philippine public tertiary hospital developed an EMR to facilitate remote access to patient charts outside its COVID-designated areas during the pandemic. This study aims to assess nurses' satisfaction with EMR use in order to improve their user experience. The Delone and McLean Information System (D&M IS) Success Model was used as its framework. This offers a unique perspective to EMR adoption by accounting for the effects of the pandemic.

Methods. A descriptive, cross-sectional, quantitatively driven, concurrent mixed-methods design was employed. Nurses from the hospital were recruited for the survey (n=353) and the focus group discussions (n=14). Ethical approval was obtained prior to its conduct. Analysis was done through descriptive statistics, multiple linear regression, and thematic analysis. Data were integrated to appreciate the differences in their experiences from the point of adoption up to their current experiences.

Results. Nurses initially faced challenges with the EMR when it was introduced, but improvements and continuous use have led to their current high satisfaction. Despite mandatory use and high usage scores, some daily tasks are still done manually. Use, length of service, number of patients handled, designation, and area of assignment were found to be associated with satisfaction. Thematic analysis highlighted several adoption prerequisites in this setup, including assessment of user competence and experience, and the provision of training, structural necessities, and organizational support.

Conclusions. This study found high use and satisfaction scores, aligning with the D&M IS Success Model, despite initial adoption challenges. Recommendations include maintaining high EMR use and improving efficiency, communication, and collaboration. Emphasis was placed on the provisions of better training and continuous feedback gathering.

Keywords: electronic health records, health information systems, nurses, pandemics, Philippines

INTRODUCTION

The COVID-19 pandemic has pushed many institutions globally to adopt digital technologies, such as electronic medical records (EMR), to enable timely, convenient, efficient, and safe health service delivery with less risk of virus transmission through virtual care. Several institutions recognize the importance of adopting health information systems to make health data readily available for healthcare providers, allowing sharing and remote access to real-time data for risk assessment, triage, health management, and follow-up with patients during the outbreak.[1-6] Ultimately, the digital transformation of health during the pandemic was highly influenced by the need for social distancing, even during a clinical encounter.[3-8]

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The University of the Philippines-Philippine General Hospital (UP-PGH), led by Dr. Homer Co, Coordinator for Health Services, has developed the Computerized Registry on Admissions and Discharges (RADISH) as a hospital information system initially for maximizing the bed utilization of the hospital by monitoring the patient census of each unit. During the pandemic, it eventually evolved into an EMR to facilitate remote access to patient charts outside COVID-designated areas. Over the years, several iterations were made to align the previous paper-based documentation system with the EMR.

The strategies utilized by the institution in EMR adoption were not well documented because of the rapid nature of development and implementation. Furthermore, the exact use of the EMR by the institution and its effects on users' work during the pandemic remain unknown and undocumented. It is interesting to understand how users of the system managed with minimal resources and minimal training in EMR adoption while simultaneously coping with the burden of the pandemic.

This study used the Delone and McLean Information System Success Model (D&M IS Success Model) as its theoretical framework. According to this model, information quality, system quality, and service quality can either positively or negatively affect "intention to use" and "user satisfaction." "Intention to use" and "user satisfaction" could then result in net benefits, which could also manifest as positive or negative.[9] The model is shown in Figure 1.

This model needs to define the recipient of the benefits since it recognizes that what is beneficial to one group of people (e.g., nurses) may be different to another (e.g., physicians and administrators).[9] This study focused on the "net benefits" of the information system as experienced by the nurses in the institution.

Nurses have the opportunity to significantly impact the quality and consistency of health data because of their extensive involvement in patient care. Their understanding and successful use of EMR are expected to significantly influence an institution's efforts in reducing healthcare costs and improving patient health, safety, and quality of care.[11] Following these, they were made the focus of this study for their crucial role in EMR implementation success.

There are some contrasting views on EMR use and satisfaction based on the literature review.[12-16] In UP-PGH, this has not been widely explored since RADISH was just recently developed. With its fast adoption due to an urgent need, some of the most important aspects of system development have been bypassed. These aspects include, but are not limited to, systems analysis and design, identification of and consultation with key stakeholders, and sufficient user training. There is a need to know if factors like these influence EMR adoption so that efforts can be made to address possible issues and prevent them from further happening in the future.

This gap in knowledge could help the institution achieve a positive work environment in the long run since understanding this informs them on how to improve EMR use and satisfaction. It was found that an increase in EMR use and satisfaction increases job satisfaction among nurses.[17] An increase in nurses' job satisfaction, on the other hand, was found to improve quality of care, commitment to the workplace, workplace environment, emotional status, and accountability.[18,19]

There have been multiple anecdotal reports and suggestions from nurses on how they would like to implement the EMR. These have been brought up in some online forums, orientations, and verbal discussions. However, no formal reports consolidating these inputs have been documented as of this writing. This paper hopefully addresses this.

Significance of the Study

There were several studies examining nurse satisfaction with EMR implementation. This study offers a unique perspective on this matter by taking into account the effects of the pandemic during implementation. Only one study was found to have done this in the past, but not in the Philippine context.[12] This study presents lessons learned on how to successfully transition from a paper-based to an electronic medical record during an unexpected scenario, such as the pandemic, with limited resources in an institution with limited background or exposure to health information technologies.

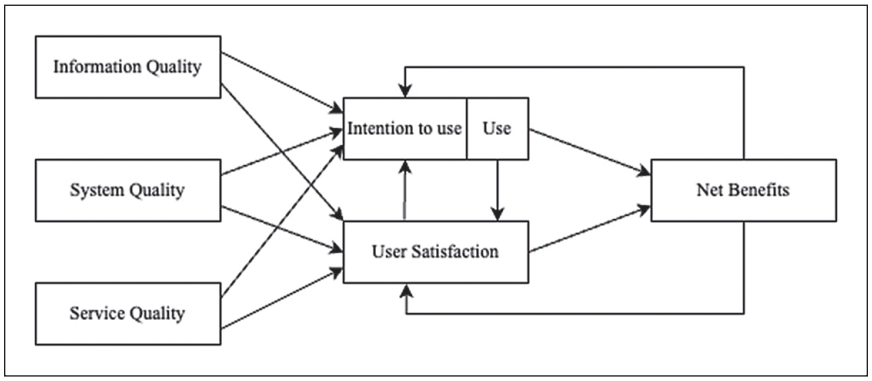

Figure 1. The updated Delone and McLean Information System Success Model.[10]

This paper helps hospital administrators modify the system by learning how the EMR is currently being used and determining whether or not it is being used as intended. Assessing user satisfaction helps determine how crucial the need for system modification is. These, together with the reported data on areas that need improvement, guide these administrators on which updates to prioritize in order to improve user satisfaction. Furthermore, the results of the study may be used to formulate programs and strategies that may address the identified barriers to implementation, maximize and promote the identified facilitators, determine training needs according to user characteristics, and enhance satisfaction by maximizing its use and finding ways to achieve other uses of data. Ultimately, system improvement and modification could enhance usability and significantly influence the institution's efforts to reduce healthcare costs and improve patient health, safety, and quality of care, following the results of a similar study.[11]

UP-PGH, being a national tertiary public hospital and end-referral center, serves a diverse range of patients from across the country, each with unique and complex medical needs. Enhancing and optimizing the hospital's operations is crucial to ensuring efficiency, especially when dealing with a large number of patients despite limited resources. This study contributes to the achievement of this objective by informing modifications that will enhance data quality and system utility. This study gathered insights from nurses' experiences and their satisfaction with the hospital's EMR system to accomplish this. In turn, patients may indirectly benefit from this by receiving better care from well-informed management and efficient service delivery.

Objectives of the Study

This study aims to assess nurses' satisfaction with the use of a public tertiary hospital EMR in order to improve their user experience. Specifically, this study aims to assess the use and satisfaction of nurses with the EMR, determine the association of nurses' EMR use and demographic characteristics with user satisfaction, describe the facilitators and barriers encountered by users in EMR adoption, and identify recommendations to improve nurses' satisfaction with EMR use.

Data Variables and Definitions

According to the literature review, some factors could influence the level of user satisfaction. These factors, however, could also influence the extent of EMR use, potentially causing misinterpretation when testing our independent variable (use) and dependent variable (user satisfaction) for association. These were collectively referred to as a confounding variable and were composed of scores on EMR quality.

On the other hand, some factors could not be influenced by EMR use but could still influence user satisfaction. These were referred to as the covariates and are composed of the participants' demographic characteristics. Both of these variables do not assume a causal relationship with the independent or dependent variables. The associations among these factors will be used to describe the overall experiences of nurses with EMR implementation during the pandemic. The conceptual framework used for this study is illustrated in Figure 2.

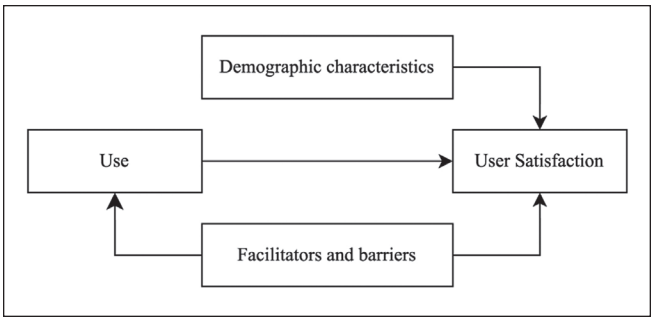

Figure 2. Conceptual framework.

Demographic Characteristics

This includes age, sex, educational background, designation, length of service in the institution, area of assignment, average number of patients handled in a shift, comfort level of using computers, prior experience with EMR other than RADISH, and training received for the use of the EMR. For the types of training, the following definitions were used:

- ***No training*** – self-directed learning; learning on the job while using RADISH
- ***On-the-job training*** – learning through the assistance of coworkers and/or supervisors
- ***In-service training*** – learning through the assistance of authorized personnel, which may be from the DNET or the IT office; may be done through one-on-one trainings, group trainings, or video presentations

Facilitators and Barriers to User Satisfaction

These were measured by assessing the overall quality of the EMR and averaging the scores of these 13 Quality of EMR system items. Responses from the focus group discussions that aim to focus on their experiences during the initial implementation of the EMR in 2020 were also elicited and analyzed using thematic analysis.

EMR Use

This was measured by evaluating the extent to which the users use the EMR to accomplish their daily tasks and averaging the scores of these 12 EMR use items. Frequencies of use were elicited for this subscale.

User Satisfaction

This was measured by averaging the scores of the nine user satisfaction items from the survey. The items elicited how users think the EMR helps them with their work

performance and quality improvement. It was also measured based on how it is being seen as a valuable tool for users and the hospital.

METHODS

Study Setting

This study took place at UP-PGH, an end-referral center and a national tertiary university hospital in the Philippines. This facility was relevant to the study since this was where RADISH, the EMR being studied, was developed and implemented. As a homegrown EMR, its implementation can be different from that of other EMRs on the market, and it cannot be contrasted with other EMRs. Additionally, staying with one institution addressed the study's restrictions on time, human, and financial resources.

RADISH has grown from a simple admissions and discharge registry program in 2016 to the multi-functional system that it is today. Some of the added features include an EMR, a warehouse module, a disease and procedure coding module, a generator for clinical forms, an operating room scheduler, linked laboratory results from another system, and social health insurance submissions using RADISH data. At the moment, several departments and divisions of UP-PGH have RADISH access and use. For the Department of Nursing, although everyone has the same type of access, use varies depending on the area of assignment and designation. The differences in use were deemed relevant in selecting the respondents for this study.

Population and Sampling Technique

The following inclusion criteria were used for recruitment:

1. Staff nurses (Nurse I and Nurse II) and charge nurses (Nurse III) in the clinical areas of UP-PGH. They were included since they use RADISH heavily as an EMR to perform their nursing tasks.
2. Employed not later than the year 2020 to elicit their experiences from the initial implementation of RADISH.
3. With at least a month of experience using the EMR to ensure significant use.

Survey

There were 692 staff nurses and charge nurses who were eligible to participate in the study, with a minimum sample size requirement of 358 participants to achieve 80% power with a 5% level of significance in a multiple linear regression analysis with 12 variables (1 independent variable of interest, 10 covariates, and 1 confounder) to determine significant factor(s) associated with user satisfaction with a small-to-medium effect size (Cohen's f2 = 0.05). With a 20% non-response rate, the final computed sample size is 430 participants.

The required number of nurse respondents for each area was obtained using stratified random sampling. The only stratum that was used for sampling is the area of assignment since this could affect how nurses use the EMR for documentation, considering the average number of patients, patients' level of acuity, and nursing workload. Each nurse was assigned a number starting from "1" up to the maximum number of nurses on each of the lists of nurses from the units. The numbers per list were arranged using a website called Research Randomizer (www.randomizer.org) to guide the investigator in identifying who among the nurses was the priority for participant recruitment. In the event that a nurse was unable to respond to the questionnaire within two weeks or declined to take part in the study, the investigator chose another member of staff from the same unit, using the same prioritization guide.

Focus Group Discussion

The study used purposive sampling in the selection of participants for the focus group discussion (FGD). Those who expressed willingness to participate through the informed consent form of the survey were considered for recruitment. Nurses known to the investigator were supposed to be excluded to avoid any possible ethical concerns. However, with the limited number of interested participants, the investigator had no choice but to include them in the recruitment. To ensure that they are comfortable and unguarded during the discussion, assistance was sought from another nurse outside the institution to serve as the moderator.

The investigator ensured that there was a mix of characteristics based on sex, designation, and length of service among the participants for each FGD session. The plan was to conduct each FGD with five nurses. However, with a very small pool of participants and difficulty in scheduling, each FGD consisted of only two to four nurses.

Study Design

This study employed a descriptive, cross-sectional, quantitatively driven, concurrent mixed-methods design. A mixed-methods design was chosen to enable the collection of rich data about the facilitators and barriers that nurses experienced with the adoption of the EMR.

Quantitative data was composed of respondents' demographic characteristics, EMR use, user satisfaction, and perceptions on EMR quality (facilitators and barriers). This was supplemented by qualitative data, which described nurses' experiences with the EMR at the point of adoption in 2020. Both data were analyzed to determine whether EMR implementation has improved over time. Integrating the results helped us better appreciate the differences in their experiences from the initial implementation versus their current experiences.

Quantitative and qualitative data were also integrated to formulate recommendations for improving user satisfaction. Part of the recommendations were derived from the factors found to be associated with satisfaction in the quantitative component of the study. The qualitative component, on the other hand, was considered as user-provided recommenda-

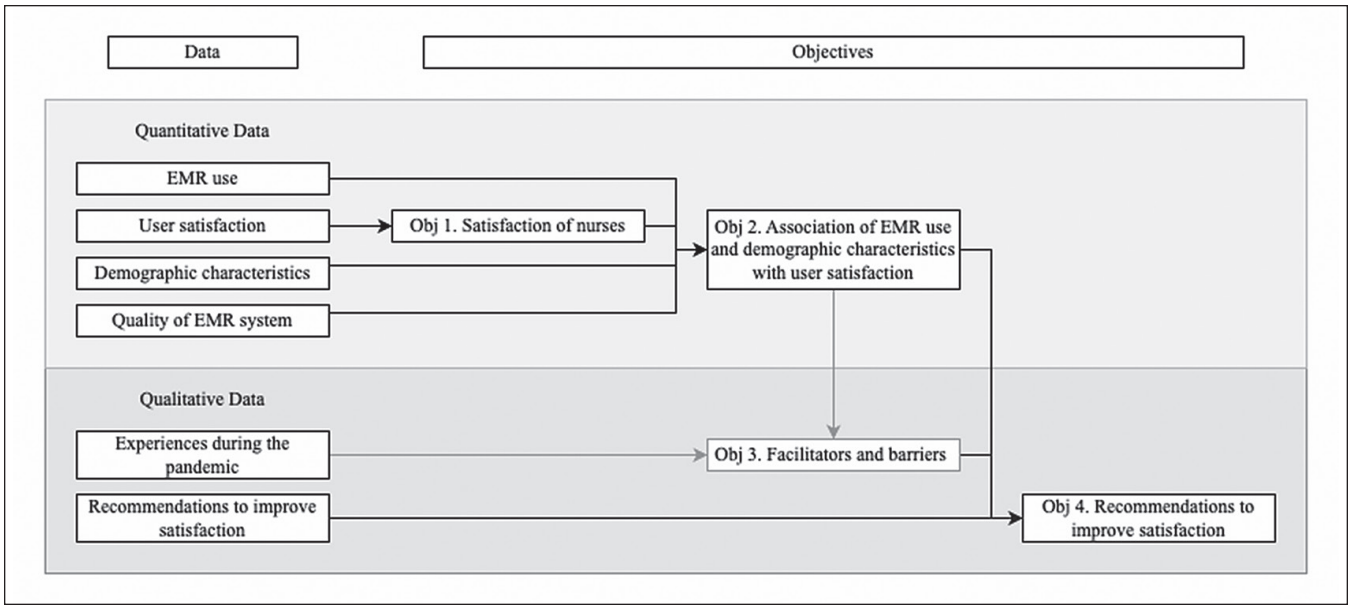

Figure 3. Integration of quantitative and qualitative data for each objective.

tions, which is important in promoting user-involvement in EMR adoption.

Following these descriptions and using Johnson and Christensen's typology of mixed methods designs, this study used a quantitatively driven concurrent design (QUAN + qual) where the core component of data is quantitative and the supplemental component is qualitative.[20] Figure 3 shows how the qualitative and quantitative data were used to achieve the objectives of the study.

Instruments

A self-administered questionnaire was used to elicit the demographic characteristics of the participants. Following this is a 34-item questionnaire developed from a similar study.[10] Approval from the author was sought and given via email. This questionnaire elicited nurses' views on EMR based on the D&M IS Success Model, with use, quality, and satisfaction as subscales. The tool was reported to have acceptable Cronbach's alphas for the subscales of use (α = 0.92), quality (α = 0.94), and satisfaction (α = 0.78). The overall scale's alpha value was 0.93.[15] Ten nurses were asked to participate in the pre-testing of the questionnaire to elicit comments on the relevance of the questions, the duration of administration, the face validity of the questionnaire, and other issues. No issues were found and the chosen nurses were no longer included in the final sample population, while their answers were not included in data processing and analysis.

The FGD included open-ended questions that elicited factors that helped them adopt RADISH successfully in 2020, the barriers that they encountered, and ways to further improve their satisfaction with the EMR. Additional questions were asked to probe for more information based on the answers of the respondents. The interview guide was modified further after each FGD to ensure that emerging themes are included and that vague questions are revised.

Data Collection Procedures

Approval from the University of the Philippines Manila - Research Ethics Board (UPM-REB) was acquired before data collection.

Survey

The investigator sent each unit an envelope containing the informed consent forms, survey forms, and the names of the randomly selected nurses. To guarantee that the questionnaires had been answered, the investigator personally followed up on the questionnaires weekly with the respondents. No identifying information was encoded and stored digitally. Contact details for the investigator were provided in the survey forms to allow participants to ask questions and raise concerns about the research.

Focus Group Discussion

The investigator approached the prospective participants personally to invite them to the FGD sessions. They were given ample time to think about the invitation to ensure that they were not being pressured or influenced to participate. Once recruited, coordination for a common time to conduct the FGD was facilitated. Reminders were given one day and an hour prior to the schedule through the contact details that they provided.

FGDs were conducted via Zoom. Permissions to audio-record the proceedings of the sessions were given prior to their commencement. Participants were assured that no identifying information will be included and published in the final manuscript. The sessions lasted for 30 to 50 minutes and were

conducted five times. The third session was already reaching data saturation when it was conducted. In the fourth session, some unique answers were still elicited but were markedly repetitive in most parts. An additional session was conducted to ensure that no additional information would be elicited. The moderator and the investigator decided to stop after the fifth session, when redundancy was obtained and there were no more emerging insights.

During each session, the investigator served as the notetaker while the moderator facilitated the discussion. The moderator was skilled in conducting the FGDs for research and health policy analyses. The moderator ensured that each participant had an equal number of chances to contribute to the discussion. Each FGD consisted of a different set of participants, meaning no participants were recruited again after they had already participated in the previous session. No issues arose when the sessions were conducted.

Data Processing and Analysis

The procedures below were done to process and analyze the data.

Survey

Descriptive statistics were used to summarize the demographic profile of the participants. The numerical variables were described as median and interquartile range, while the categorical variables were described as frequencies and percentages. Responses on EMR use, EMR quality, and user satisfaction were described as frequency and percentages of the responses on the 5-point Likert scale. Scores of EMR use, EMR quality, and user satisfaction were determined by averaging the scores of all items in each subscale. A higher median entailed a more positive outcome.[16]

The association between the independent variable and covariates of interest and the dependent variable was determined by multiple linear regression while adjusting for the confounding variable. The variable selection of significant factors was determined by backwards elimination, with an LR test of $p<0.05$ as the criteria for retention in the model.

Data analysis was performed using Stata version 17. Missing values were neither replaced nor imputed. The normality of the distribution of numerical variables was assessed by the Shapiro-Wilk test. Tests of hypotheses were evaluated with the level of significance set at $\alpha = 0.05$. Assistance from the statistician who was consulted for the formulation of the data analysis plan was sought again for the actual analysis of the gathered data.

Focus Group Discussion

The audio recordings of the FGDs were transcribed via intelligent verbatim transcription and were analyzed through thematic analysis. No translation was done to prevent the misinterpretation of responses. A priori codes from a similar qualitative study that assessed the perceptions of nurses on the enablers and barriers in EMR adoption were used as initial guides in coding the answers.[21] According to this study, it used the Theoretical Domains Framework (TDF) as a guide for coding their data since it offers a wide range of factors that might influence nurses' perceptions of EMR adoption, and it was also previously used for studies about technology in healthcare.[22]

Tables were used in organizing the qualitative data. The first round of coding used TDF as a guide. Then, new codes were formed and added to this set to represent the answers that do not fit into these a priori codes. Codes were developed by breaking down the data and observing for their similarities and differences. The author then examined the relationships among the codes, grouped them into broader categories, and identified emergent themes that run across the data sets. Member checking or respondent validation through an email was done to resolve researcher bias that could result from having a single perspective during the thematic analysis. This improves the credibility and validity of the resulting data.

Ethical Considerations

The National Ethical Guidelines for Health and Health-Related Research published by the Philippine Research Ethics Board (PHREB) were followed in conducting this study. Ethics approval for the conduct of the study was provided by the UPM-REB.

RESULTS

Survey

During the data collection, the number of eligible participants decreased from 692 to 616 since some were promoted and some resigned from the institution. A total of 353 out of 450 questionnaires were received back from the selected participants. This is short by five participants in relation to the initial computed minimum sample size. This shortage, however, had no or negligible effect on our analysis since a significant association was still elicited between use and user satisfaction. In computing the response rate, we obtained 78.4%, which is beyond the suggested cutoff for a sufficient response based on Polit and Beck.[23] Table 1 shows the demographic characteristics of the surveyed participants. Unanswered items were marked with x and were not included in the analysis. Median was chosen over mean since it is a better measure of the central tendency of the group as it is not skewed by exceptionally high or low characteristic values.

The majority of the participants were female (75.57%), had a Bachelor's degree (96.03%), and were Nurse II (81.25%). Almost half of them work in special units (45.04%). More than half were comfortable with using computers (55.52%) and received on-the-job training (55.81%). Only 17% had previous experience with the use of EMR. The median age was 38 with an interquartile range (IQR) of 15, the median length of service is 12 (IQR 11), and the median number of patients handled in a shift was 12 patients (IQR 12). For each measure, the IQR indicates the range for the middle

Table 1. Demographic Characteristics of Study Participants (n=353)

Characteristics	Median (IQR)
Age, years (n=340)	38 (15)
Length of service in PGH as a nurse, years (n=342)	12 (11)
Average number of patients handled in a shift, count (n=337)	12 (12)
	Frequency (%)
Sex (n=352)	
Male	86 (24.43)
Female	266 (75.57)
Designation (n=352)	
Nurse I	1 (0.28)
Nurse II	286 (81.25)
Nurse III	65 (18.47)
Area of assignment	
Charity wards	121 (34.28)
Pay wards	73 (20.68)
Special units	159 (45.04)
Highest educational attainment	
Bachelor's degree	339 (96.03)
Master's degree	13 (3.68)
Doctorate degree	1 (0.28)
Comfort level of using computers	
Very comfortable	140 (39.66)
Comfortable	196 (55.52)
Not comfortable to some extent	17 (4.82)
Not comfortable at all	0
Prior EMR experience	60 (17.00)
Training received for the use of RADISH	
No training	123 (34.84)
On-the-job training	197 (55.81)
In-service training	33 (9.35)

50% of respondents. Figure 4 shows the distribution of respondents per characteristic.

The median EMR use score was 4.33 (IQR 1.08). This score means there is a high EMR use among the respondents. Table 2 shows that the majority of the respondents always use the EMR when performing the listed tasks. Almost half (49.15%) reported using the EMR to "write nurse care worksheets (Kardex)" always, but this task also had the highest score on the "never" option compared to other tasks.

The median score of facilitators/barriers is 4.00 (IQR 0.65). This score means that the quality of the EMR is satisfactory to the respondents. Table 3 summarizes the responses of nurses in the survey about the quality of EMR. The survey showed that the pieces of information received by the respondents from the EMR were precise (52.97%), sufficient (55.24%), clear (54.96%), up-to-date (53.26%), accurate (60.06%), provided on time (54.11%), and met their needs (53.82%) most of the time. The survey also revealed that the system is up and available (52.69%), user friendly (48.73%), provides reports that they need (55.24%), and presents output in useful format (52.97%) most of the time.

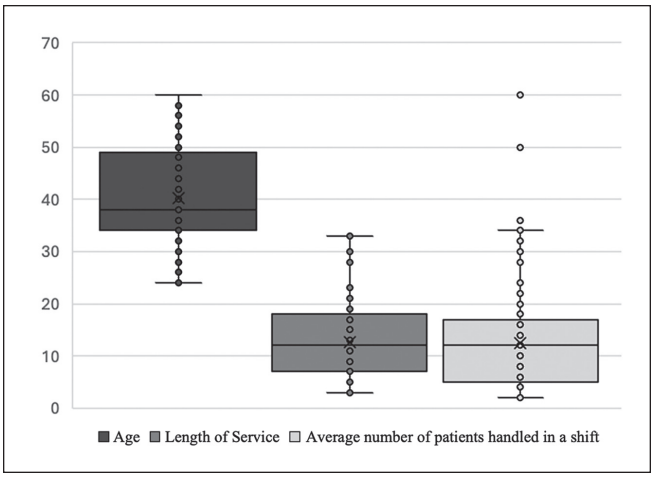

Figure 4. Box plot of numerical variables showing the distribution of respondents per characteristic.

Respondents, however, reported that the system is subject to frequent problems and crashes (34.84%) most of the time.

The median user satisfaction score is 4.22 (IQR 1.11). Overall, nurses are currently satisfied with the EMR most of the time (42.49%). The majority reported that EMR is always useful (57.51%), which is consistent with our EMR use subscale. They also reported that the EMR is always worth the time and effort to use (43.91%) and important to the hospital (50.57%). The EMR was perceived as successful (47.04%) most of the time. They reported that the EMR has always improved their performance (44.76%) and the quality of their work (42.21%). It also improved the safety of patients (44.19%) and the quality of information (41.76%) most of the time. The breakdown of scores for the user satisfaction subscale is shown in Table 4.

In determining the factors associated with user satisfaction, some were adjusted before conducting multiple linear regression. Designation was recategorized into Nurse I/II vs Nurse III because there is only one Nurse I participant. For the purpose of the discussion, Nurse I and II will be referred to as staff nurses, while Nurse III will be charge nurses. Education was also recategorized into Bachelor's vs Post-baccalaureate (Master's and Doctorate) because there is only one Doctorate participant. The level of comfort was recategorized into Comfortable (comfortable + very comfortable) vs Not comfortable (not comfortable to some extent + not comfortable at all) due to collinearity. The results of the multiple linear regression are shown in Table 5.

Controlling for the confounder (facilitators and barriers), the use of EMR was found to be significantly associated with user satisfaction. A unit increase in the use score increases the user satisfaction score by 0.08 units. "Facilitators and barriers" was a significant confounder in the relationship between EMR use and user satisfaction. This means that the EMR quality has a substantial impact on this relationship and has to be accounted for to prevent biased or misleading results.

Table 2. Nurses' Evaluation on EMR Use (n=353)

Items	Responses, n (%)				
	N	S	HT	MT	A
Nursing care management					
Review the patient's problems	5 (1.42)	15 (4.25)	37 (10.48)	105 (29.75)	191 (54.11)
Enter daily nursing care notes	6 (1.70)	18 (5.10)	22 (6.23)	55 (15.58)	252 (71.39)
Capturing patient observations at the bedside	16 (4.53)	12 (3.40)	28 (7.93)	94 (26.63)	203 (57.51)
Write nursing care plan (n=352)	32 (9.09)	37 (10.51)	36 (10.23)	84 (23.86)	163 (46.31)
Write nurse care worksheets (Kardex) (n=352)	73 (20.74)	27 (7.67)	23 (6.53)	56 (15.91)	173 (49.15)
Collect patient's info for discharge reports	38 (10.76)	26 (7.37)	32 (9.07)	81 (22.95)	176 (49.86)
Document physical assessment of patients	11 (3.12)	18 (5.10)	23 (6.52)	66 (18.70)	235 (66.57)
Frequency of use of order entry					
Obtain information on investigations or treatment procedures (n=352)	4 (1.14)	19 (5.40)	34 (9.66)	96 (27.27)	199 (56.53)
Obtain the results from new tests or investigations (n=352)	8 (2.27)	30 (8.52)	58 (16.48)	102 (28.98)	154 (43.75)
Answer questions concerning general medical knowledge (concerning treatment, symptoms, complications, etc.) (n=352)	9 (2.56)	20 (5.68)	42 (11.93)	118 (33.52)	163 (46.31)
Obtain results of tests and investigations (n=352)	6 (1.70)	34 (9.66)	60 (17.05)	109 (30.97)	143 (40.62)
To check drug information (such as allergy and interactions) (n=352)	15 (4.26)	33 (9.38)	42 (11.93)	109 (30.97)	153 (43.47)

N – Never, S – Seldom, HT – About half the time, MT – Most of the time, A – Always

Table 3. Nurses' Evaluation of the Quality of the EMR (n=353)

Items	Responses, n (%)				
	N	S	HT	MT	A
Information quality					
How often does the system provide the precise information you need?	2 (0.57)	11 (3.12)	37 (10.48)	187 (52.97)	116 (32.86)
How often does the information content meet your needs?	4 (1.13)	7 (1.98)	41 (11.61)	190 (53.82)	111 (31.44)
How often does the system provide reports that seem to be just exactly what you need?	4 (1.13)	10 (2.83)	41 (11.61)	195 (55.24)	103 (29.18)
How often does the system provide sufficient information?	4 (1.13)	8 (2.27)	41 (11.61)	195 (55.24)	105 (29.75)
How often is the system accurate?	3 (0.85)	4 (1.13)	42 (11.90)	212 (60.06)	92 (26.06)
How often are you satisfied with the accuracy of the system? (n=352)	3 (0.85)	9 (2.56)	58 (16.48)	191 (54.26)	91 (25.85)
How often do you think the output is presented in a useful format?	3 (0.85)	13 (3.68)	58 (16.43)	187 (52.97)	92 (26.06)
How often is the information clear?	4 (0.85)	6 (1.70)	43 (12.18)	194 (54.96)	107 (30.31)
How often is the system user-friendly?	5 (1.42)	17 (4.82)	58 (16.43)	172 (48.73)	101 (28.61)
How often do you get the information you need in time?	3 (0.85)	8 (2.27)	54 (15.30)	191 (54.11)	97 (27.48)
How often does the system provide up-to-date information?	3 (0.85)	8 (2.27)	58 (16.43)	188 (53.26)	96 (27.20)
Service quality					
How often can you count on the system to be up and available?	4 (1.13)	6 (1.70)	70 (19.83)	186 (52.69)	87 (24.65)
How often is the system subject to frequent system problems and crashes?	7 (1.98)	78 (22.10)	95 (26.91)	123 (34.84)	50 (14.16)

N – Never, S – Seldom, HT – About half the time, MT – Most of the time, A – Always

Table 4. Satisfaction of Nurses with the EMR Table (n=353)

Items	Responses, n (%)				
	N	S	HT	MT	A
Do you feel EMR is useful?	3 (0.85)	5 (1.42)	21 (5.95)	121 (34.28)	203 (57.51)
Do you feel your performance has improved due to EMR?	4 (1.13)	8 (2.27)	45 (12.75)	138 (39.09)	158 (44.76)
Do you feel the quality of your work has improved?	5 (1.42)	7 (1.98)	51 (14.45)	141 (39.94)	149 (42.21)
Do you feel EMR is worth the time and effort required to use it?	4 (1.13)	9 (2.55)	50 (14.16)	135 (38.24)	155 (43.91)
Do you feel the quality of information has improved due to EMR? (n=352)	4 (1.14)	7 (1.99)	49 (13.92)	147 (41.76)	145 (41.19)
Do you feel EMR has been successful in your hospital?	3 (0.85)	5 (1.42)	36 (10.20)	166 (47.04)	143 (40.51)
Do you feel EMR is an important system for your hospital? (n=352)	3 (0.85)	3 (0.85)	26 (7.39)	142 (40.34)	178 (50.57)
Do you feel that the safety of patients has improved due to EMR?	7 (1.98)	14 (3.97)	59 (16.71)	156 (44.19)	117 (33.14)
Overall, are you satisfied with the EMR system?	5 (1.42)	3 (0.85)	50 (14.16)	150 (42.49)	145 (41.08)

N – Never, S – Seldom, HT – About half the time, MT – Most of the time, A – Always

Table 5. Factors Associated with User Satisfaction

Factors	Full Model			Reduced Model		
	Beta Coefficient	95% CI	*p*-value	Beta Coefficient	95% CI	*p*-value
Use	0.09	0.01, 0.17	0.029	0.08	0.004, 0.16	0.039
Age	0.01	-0.003, 0.02	0.148			
Length of service	-0.02	-0.03, -0.01	0.005	-0.01	-0.02, -0.005	0.001
Patients per shift	-0.01	-0.01, 0.001	0.067	-0.01	-0.01, 0.003	0.063
Female	-0.06	-0.18, 0.06	0.311			
Charge nurse (Nurse III)	0.17	0.03, 0.31	0.015	0.14	0.01, 0.28	0.040
Area of assignment						
Charity wards	Reference			Reference		
Pay wards	0.09	-0.05, 0.23	0.195	0.06	-0.07, 0.20	0.351
Special units	-0.11	-0.23, 0.01	0.061	-0.10	-0.22, 0.02	0.093
Post-baccalaureate degree	0.19	-0.71, 1.09	0.676			
Comfortable using computers	0.26	0.03, 0.50	0.027			
Prior EMR experience	-0.09	-0.22, 0.04	0.169			
Training received for the use of RADISH						
No training	Reference					
On-the-job training	0.10	-0.01, 0.21	0.072			
In-service training	0.11	-0.07, 0.30	0.231			
Facilitators and barriers*	0.78	0.68, 0.88	<0.001	0.80	0.70, 0.90	<0.001

** Confounding variable*

Since we have a main variable of interest, variable selection has been performed. This looks at which of the covariates significantly affects the relationship of the main variable of interest (EMR use) with the outcome of interest (EMR satisfaction). All of the retained variables in the reduced model shown in Table 5 are the ones significantly affecting this relationship, regardless of the shown p-values. These variables have p-values less than 0.05 in the LR test (the ratio of the model with and without the covariate being tested), which means that if we remove them, the model will change significantly. This was performed through variable selection using backward elimination method.

The significant covariates are length of service, number of patients handled, designation, and area of assignment. For every one year increase in length of service, there is a 0.01 unit decrease in user satisfaction score. In terms of handled patients, every one patient increase in a shift leads to a 0.01 unit decrease in user satisfaction score. Those who are charge nurses have a higher user satisfaction score by 0.14 units than staff nurses. Those in pay wards have a higher user satisfaction score by 0.06 units than those in charity wards. Those in the special units have a lower user satisfaction score by 0.10 units than those in charity wards.

Focus Group Discussion

Only 26 survey respondents manifested their willingness to participate in the FGDs. This limited number of prospective participants posed a challenge to completing the initial count of five nurses in each FGD session. It also became a challenge to ensure proper representation in each session.

Moreover, even with a very small number of participants, difficulty in finding a common time for the sessions was also a challenge. This is why sessions only included two to four nurses instead of five. Some nurses were not able to attend the session, even if reminders were sent a day and an hour prior to the session. A total of 14 participants were recruited for FGD and were distributed into five sessions, which are shown in Table 6.

The thematic analysis rendered four major themes with several sub-themes and categories. The first theme is facilitating and hindering factors, describing the factors that influenced the ease or difficulty of EMR adoption. The second theme is environmental context, which describes the circumstances surrounding the adoption. Outcomes is another theme that describes the consequences of using the EMR. The last theme is recommendations, which describe the preferences of nurses for improving their satisfaction and experience further. These are further broken down into subthemes and categories in Table 7.

Theme 1: Facilitating and Hindering Factors

Our first subtheme is user competence and experience, which comprises the knowledge, skills, and desires of users on the use of computers and EMRs. Half of the interviewees said that their computer literacy assisted them in adoption. This facilitated their acceptance and ease of transitioning into the new system. They mentioned, however, that senior nurses who are not accustomed to using computers had more difficulty and hesitancy in accepting the system, especially with the lack of formal training.

Table 6. Characteristics of Interviewed Participants

Session no.	Nurse	Age	Sex	Designation	Type of Area	Education
Session 1 (47 minutes)	Nurse A	52	Female	Nurse II	Pay wards (Adult)	College graduate
	Nurse B	27	Female	Nurse II	Charity wards (Adult)	College graduate
	Nurse C	29	Male	Nurse II	Special units (Adult)	College graduate
Session 2 (29 minutes)	Nurse D	30	Female	Nurse II	Pay wards (Adult)	College graduate
	Nurse E	36	Male	Nurse III	Special units (Adult and Pedia)	Master's graduate
Session 3 (39 minutes)	Nurse F	32	Female	Nurse II	Special units (Pedia)	College graduate
	Nurse G	30	Female	Nurse II	Special units (Adult)	College graduate
	Nurse H	33	Female	Nurse II	Charity wards (Adult)	College graduate
Session 4 (37 minutes)	Nurse I	32	Male	Nurse III	Special units (Adult and Pedia)	Master's graduate
	Nurse J	37	Male	Nurse II	Special units (Adult and Pedia)	College graduate
Session 5 (50 minutes)	Nurse K	37	Female	Nurse III	Charity wards (Adult)	College graduate
	Nurse L	30	Male	Nurse III	Special units (Adult and Pedia)	College graduate
	Nurse M	35	Female	Nurse II	Pay wards (Adult)	College graduate
	Nurse N	53	Female	Nurse II	Special units (Pedia)	College graduate

Prior experience with other documentation systems was seen as an influencing factor in adoption. This category has varying contexts. Being accustomed to the previous paper-based system made it difficult for the nurses to adopt the new system. For the newly hired nurses, having no comparison with the previous paper-based system facilitated easier adoption. One interviewee (Nurse I, charge nurse, special unit) mentioned that being exposed to other electronic medical records allowed him to adopt the system easier.

Another subtheme is training and learning methods, which describes how nurses learned the system during its introduction. Peer teaching was one of the most notable teaching strategies. Supervisor-assisted training and team-to-team endorsements and demonstrations were some of the strategies used by the staff in teaching their own colleagues about the use of the EMR. Interviewees also mentioned that they learned better through hands-on experience and repetitive use in their respective areas.

The third subtheme is about the structural barriers, which describe the physical and infrastructural limitations hindering successful implementation. There were some contrasting statements elicited about the availability of equipment. Nurse C (staff nurse, special unit) and Nurse E (charge nurse, special unit) stated that they had enough equipment when RADISH was introduced. Nine of them, however, verbalized their disappointment in the insufficiency of computers during the adoption, stating that it added more to the stress of adopting the new system. They mentioned further that computers were given and became sufficient at the later stage of implementation.

Organizational support is the fourth subtheme and describes the expectations of nurses from some administrative unit of the hospital for providing the support, guidance, and engagement needed in the adoption.

Theme 2: Environmental Context

The first subtheme under the environmental context is work climate, which describes the situation that nurses have to endure during the adoption. The introduction of EMR brought more anxiety and frustration to the nurses, especially during the time when they also had to deal with the pandemic. Wearing personal protective equipment made it difficult for the nurses to use computers, especially since they were not accustomed to them prior to the pandemic. The anxiety about taking care of patients needing intensive care compounded when they were challenged to adopt a new documentation system. Having no power but to follow the hospital's mandate to adopt the system in a limited time made the experience even more difficult.

Professional burden is the second subtheme. Being true to their profession, nurses were burdened with the need to adopt the system to continue the delivery of care. The interviewees mentioned that they were given no choice and that they needed to resort to self-learning to be able to adopt the system. They also needed to bring their own devices to augment the lack of equipment in their respective areas during the EMR's introduction. Some also mentioned that they were overwhelmed with the frequent system updates during its development.

Person-system interaction was commended by some of the interviewees. It is our third subtheme and includes characteristics that allow users to interact with the system in a satisfactory manner. Five interviewees mentioned that the initial version of RADISH was very simple and easy to learn, facilitating their fast adoption. They also appreciated the readable chart entries from RADISH, which were considered an improvement compared to some illegible ones in the paper-based system.

Table 7. Results of the Thematic Analysis

Subthemes	Categories	Illustrative quotes
Theme 1: Facilitating and hindering factors		
1.1 User competence and experience	1.1.1. Computer literacy	*It was easy for me to adopt [the new system] since I am more computer literate than my senior nurses.* – Nurse H, Staff nurse, Adult Charity Ward
	1.1.2. Prior experience with other documentation systems	*When RADISH was first implemented, it was unusual since we have been paper-based for so long, then all of a sudden we transitioned to computers.* – Nurse M, Staff nurse, Adult Pay Ward *When I entered [the institution], it was in the middle of the pandemic. I was a new nurse. I was not familiar with the previous charting…I did not need to adjust…I could not compare it with the previous process. It was maybe why I was more open to adopt updates of RADISH.* – Nurse C, Staff nurse, Special Unit *I think one of the things that helped me that time was my knowledge. I am familiar and have utilized some forms of EMR before.* – Nurse I, Charge nurse, Special Unit
	1.1.3. Desire to use technology	*We have not encountered barriers in the implementation of RADISH since prior to that, our department had a goal to transition to paperless transactions. We removed our logbooks bit by bit and we started using Google Drive and Google Sheets, among others.* – Nurse E, Charge nurse, Special Unit
	1.1.4. Technological capacity of senior nurses	*I was concerned for our senior nurses. Some, especially those who are slow in typing, raised their brows when they heard that computers will be used. They did not know if the connection was secure. They did not know what to click or even how to control the mouse properly.* – Nurse F, Staff nurse, Pedia Special Unit
1.2. Training and learning methods	1.2.1. In-service training	*DNET had an initiative to teach the staff by batch. It was beneficial because those we were unable to teach attended the training offered by DNET.* – Nurse L, Charge nurse, Special Unit
	1.2.2. Peer teaching	*As an acting OIC [officer-in-charge] and the charge [nurse] of OR, I was the one who facilitated the learning of our staff, even if they are older than me. I made sure that they have learned. I demonstrated the RADISH tasks and they do return demonstrations.* – Nurse E, Charge nurse, Special Unit *When other staff attend trainings, they pass the learnings through word of mouth, endorsements, and demonstrations. Then, we endorse this again to the next shift. That's how we trained each other.* – Nurse F, Staff nurse, Pedia Special Unit
	1.2.3. Use of audio-visual materials	*We learned better through visualization. When our head nurse was given training, he/she video-recorded it and sent them to us to relay the information that was given to her. The videos made the transition easier.* – Nurse A, Staff nurse, Adult Pay Ward
	1.2.4. Hands-on experience	*I am actually satisfied with the way RADISH was taught, even if we were taught with the basics only. We learned better through hands-on experiences in our respective areas.* – Nurse C, Staff nurse, Special Unit
	1.2.5. Sensitization	*Later on, we learned [the system] through everyday use.* – Nurse M, Staff nurse, Adult Pay Ward
1.3. Structural barriers	1.3.1. Varying availability of equipment	*We had a problem when there were not enough computers for the number of staff on duty. We were not able to check the doctors' orders immediately. During that time, there were eight of us on duty, and there were only three computers.* – Nurse N, Staff nurse, Pedia Special Unit *There was an abundance of computers, so we did not need to share with the doctors. It was well-fitted for our unit.* – Nurse E, Charge nurse, Special Unit
	1.3.2. Unstable internet connection	*As for the internet, our connection was bad for the whole shift. There were days when RADISH was down or there was poor internet connection. It added more to the workload of the staff.* – Nurse F, Staff nurse, Pedia Special Unit
	1.3.3. Limited space for equipment	*One of the challenges is space. Our stations were not made for bulky monitors and desktops. Sometimes, instead of seeing the patient while doing our charting, we had to go to the isolated area where the computers could only be stationed.* – Nurse L, Charge nurse, Special Unit
1.4. Organizational support	1.4.1. Administration's responsiveness	*They will mention to our chairman the lack of equipment since we shifted to online. They then gave us additional units. We now have six computers.* – Nurse J, Staff nurse, Special Unit
	1.4.2. Inadequate support from IT	*There was no support system before on troubleshooting system, hardware, and software issues. Instead of enhancing the work, it resulted in added workload since you also need to troubleshoot the system.* – Nurse I, Charge nurse, Special Unit
	1.4.3. System unfamiliarity of nurse administrators	*One of the barriers was when our head nurse did not know how to use the system even if the staff nurse were required to use it. It made the followers or staff hesitant to use the system.* – Nurse L, Charge nurse, Special unit
	1.4.4. Inconsistent user consultation	*We had an initial meeting with our chief resident and Dr. Homer Co. At the wards, they click a lot of buttons. For us, we use only a few buttons since our goal is to write nurses' notes and access doctors' orders. We seldom carry out orders in RADISH. When we attained our goals with Dr. Co, the transition became fast.* – Nurse E, Charge nurse, Special Unit *I noticed that it was very physician-centered when it was developed. Nursing had no input that time. Nursing has facets that are not applicable to the medical field. Similarly, there are aspects on the medical side that are not seen in nursing. This is not particular to the profession but to the work processes. Lack of input from nursing made it difficult.* – Nurse I, Charge nurse, Special unit
	1.4.5. Unsatisfactory dissemination of information	*Sometimes, there were updates in RADISH that were sudden. You would just discover that there was something new on your own. They will then inform us [of these updates] after we have discovered them already.* – Nurse N, Staff nurse, Special Unit

Table 7. Results of the Thematic Analysis *(continued)*

Subthemes	Categories	Illustrative quotes
Theme 2: Environmental context		
2.1. Work climate	2.1.1. Hospital's mandate	*As mandated by our supervisor. We did not have a choice since it was already mandated.* – Nurse I, Charge nurse, Special Unit
	2.1.2. Simultaneous burden of the pandemic	*Since we were wearing PPEs [Personal Protective Equipment], it was difficult to use computers, especially if the PPE was small. It was difficult to use the mouse. It was like our bodies were not accustomed to using these devices, more so since we were wearing PPEs.* – Nurse H, Staff nurse, Charity Ward *It added to the frustration of the nurse since there was already a COVID situation. There was anxiety in carrying out orders and in documenting everything, especially since almost all patients need intensive care.* – Nurse D, Staff nurse, Pay Ward
	2.1.3. Limited time to adopt	*We needed to adopt abruptly that time. I wish they could have implemented it by batches, prioritizing those who were already trained. However, they mandated that 100% of the employees should use the system in a span of overnight.* – Nurse I, Charge nurse, Special Unit
2.2. Professional burden	2.2.1. Lack of autonomy in adoption	*We really just practiced on our own, that's why we were able to adopt because we did not have any other choice.* – Nurse B, Staff nurse, Charity Ward
	2.2.2. Resorting to self-learning	*Although at that time, even without training, we had a mandate to use the system. So, we decided to learn the system on our own.* – Nurse L, Charge nurse, Special Unit
	2.2.3. Use of own equipment	*What I did was I bought my own tablet so that every time I go to the patients, I would just check my tablet right there and then look for orders, discontinued medications, or any updates.* – Nurse N, Staff nurse, Special Unit
	2.2.4. Overwhelming system updates	*We did research on how to lighten our workload while using RADISH. Consequently, they implement updates very frequently until it became the version that it is today. However, in terms of adaptation, the challenge was continuous with every update that was implemented.* – Nurse A, Staff nurse, Pay Ward
2.3. Person-System Interaction	2.3.1. Simplicity of the system	*RADISH was easy to navigate at first. It was very simple and very basic at that time. There were only a few options and few buttons and links to toggle so it was easy to navigate.* – Nurse D, Staff nurse, Pay Ward
	2.3.2. Readable chart entries	*I prefer computers instead of papers. Orders were easy to see unlike before when we had to use physical [paper] charts.* – Nurse K, Charge nurse, Charity Ward
Theme 3: Outcomes		
3.1. Benefits	3.1.1. Better access to charts	*Even if the patient was still not in the area, we were able to review their charts so we were able to anticipate their needs.* – Nurse E, Charge nurse, Special Unit *It was easier to communicate outside. They [doctors] were able to encode their orders, hence, we can easily access right away what they wanted us to do in the isolation.* – Nurse A, Staff nurse, Pay ward *Since it was previously allowed to connect to RADISH outside the hospital, some of our senior nurses, who were not yet done with encoding because of the heavy workload, accomplished them in their homes because the doctors were looking for them.* – Nurse G, Staff nurse, Special Unit
	3.1.2. Prevention of documentation errors	*I prefer RADISH because you can avoid errors in carrying out doctor's orders.* – Nurse N, Staff Nurse, Special Unit
	3.1.3. Efficiency at work	*When I found out that we will be using computers for charting, I thought, This will be fast. Our charting will be quicker since we will not be fighting over the charts with the doctors anymore.* – Nurse F, Staff nurse, Special Unit
3.2. Challenges	3.2.1. Added workload to educate others	*I don't mind teaching how to use it, especially to other staff. However, sometimes it affects your workflow. For example, you're doing bedside care, documentation, and carrying out orders. Then, sometimes, a co-staff will bother you to ask something. Bottomline, you became the unofficial troubleshooter of the unit. So, it added more to their original workload.* – Nurse I, Charge nurse, Special Unit
	3.2.2. Inefficiencies from technologically challenged nurses	*Those who are not yet used to computers have more lapses or backlogs like failing to transcribe medications into the MSTAR (therapeutic sheet).* – Nurse K, Charge nurse, Pay Ward
	3.2.3. Time-consuming documentation	*When [the system] updated, it required us to type our assessment. It was the time when our nurses thought that it became more of a hassle since it was overwhelmingly busy inside the area, and we still needed to allot time for our charting.* – Nurse B, Staff nurse, Charity Ward
	3.2.4. Unintended consequences of improved access	*It caused conflict among many units that time. Checking others' workflow or job became possible. The system was not ready for data privacy at that time.* – Nurse I, Charge nurse, Special Unit
	3.2.5. Inconsistent chart entries	*They [doctors] write orders even if they have not seen the patient. Like when the patient is at the OR and the doctor charted that he or she has seen the patient at bedside. We were thinking he or she has not seen the patient before writing an order.* – Nurse K, Charge nurse, Charity Ward

Table 7. Results of the Thematic Analysis *(continued)*

Subthemes	Categories	Illustrative quotes
Theme 4: Recommendations		
4.1. Efficiency enhancement	4.1.1. Easier and faster documentation	*[I suggest] to update the assessment so that it would be easier to document. I think it would be better to use checkboxes that we could just click instead of typing them. It's not just for us but also for those who handle a lot of patients so that they can focus on the bedside. Our time will not be consumed too much with our computer use.* – Nurse C, Staff nurse, Special Unit *The removal of copy-paste is frustrating. In our unit, surgeries were fast-paced. For instance, I handle 20-30 patients a day. If I would type my notes one by one, it would really be difficult even if my interventions were all the same.* – Nurse E, Charge nurse, Special Unit
	4.1.2. Reliable infrastructures	*Ensure that there is enough equipment per area that the nurses could use so that we do not need to rush doing bedside care to finish early and sit for charting. In addition, [I also recommend] a stable internet connection.* – Nurse F, Staff nurse, Special Unit
	4.1.3. Systems integration	*They added another system outside RADISH. Since not all that we need is in RADISH, we need to go outside the system. I feel that it's a factor that it's not okay. If the labs were there, even the ERP (system for requesting medications and supplies), if it's there too, I think it would be better since it's just one sign-in for everything.* – Nurse L, Charge nurse, Special Unit
4.2. Communication and collaboration	4.2.1. Information dissemination	*Update us if there are any changes so that we will be informed ahead of time and we can keep up.* – Nurse G, Staff nurse, Special Unit
	4.2.2. Better training	*I feel that it would really help, especially for the new hires, if they would be given intensive teaching sessions on how to navigate RADISH. It would be better if there were intensive sessions followed by a guided return demonstration with a person skilled in its use.* – Nurse H, Staff nurse, Charity Ward
	4.2.3. Nurse involvement	*I appreciate that they are now open to suggestions about updates. As a user, you will know which areas in RADISH could still be improved. They are willing to apply those changes into the system. It would be better if they will ask nurses or users every half-year on how to improve the system further. It would be better if it were done on a regular basis.* – Nurse H, Staff nurse, Charity Ward

Theme 3: Outcomes

The first subtheme under outcomes is about benefits, which include factors that made the EMR advantageous to its users. The use of RADISH granted users access to patients' charts whenever and wherever they were. It allowed doctors to write their orders outside the isolation areas, consequently allowing nurses to view the most recent orders without going out of the isolation areas. It also allowed nurses to review charts of patients that were about to be transferred to their unit to anticipate their needs once they were received. Although not ideal, some nurses used this enhanced access to continue their documentation in their homes if they were not able to accomplish it during their working hours.

Efficiency at work was also mentioned in the interviews. Simultaneous chart access, elimination of paper refills, and capability to use the copy-paste function contributed to their work efficiency. The prevention of errors due to readable chart entries was also mentioned as one of the benefits resulting from EMR use.

Another subtheme is challenges, which describes the issues encountered by nurses in using the EMR. Educating others, both doctors and nurses, was considered an added workload during the adoption. Some nurses also experienced inefficiencies at work from the backlogs of their fellow staff who were not yet familiar or comfortable with EMR use. Aside from these, nurses also considered narrative documentation time-consuming, which may be an adjustment since they utilized a checklist type of documentation prior to adoption.

Some nurses mentioned that the improved access to charts resulted in a number of unintended consequences. These consequences include duplication of entries, increased volume of orders, and issues with data privacy. The writing of inconsistent and outdated chart entries also became possible since doctors could write their orders without the need to visit patients in the units.

Theme 4: Recommendations

Efficiency enhancement is the first subtheme under recommendations. It encompasses strategies that the nurses think would help them be more efficient at work while using the EMR. Easier and faster documentation were frequently mentioned in the interviews when nurses were asked about their recommendations to improve their satisfaction. Ways to improve documentation were mentioned, specifically using a checklist type of documentation. One interviewee (Nurse J, staff nurse, special unit) suggested separating the nurses' notes from doctors' orders to facilitate easier review of the health management of patients. In terms of medication administration, ways to print the entirety of the therapeutic sheet and to allow simultaneous recording of medications given at the same time were suggested. Some restrictions were also seen to affect their efficiency. The use of the copy-paste function was suggested to be continued to allow documentation of similar cases for multiple patients in a limited amount of time.

According to the interviewees, efficiency could be improved if they were given reliable infrastructure both prior to adoption and in the current implementation. System and equipment maintenance was suggested by one of the interviewees. Furthermore, they were requesting the

integration of all the information systems that the staff are using for a more streamlined process.

The second subtheme is communication and collaboration, which describes the preferences of nurses in passing information from one point to another. Nurses would like to be informed ahead of time if updates are going to be implemented in the system. Regular user consultation and improved nurse involvement were deemed essential to improving their satisfaction with the system. In terms of training, one statement that stood out was the suggestion to share best practices or techniques for EMR use.

DISCUSSION

While the survey shows that nurses are currently satisfied with the EMR, the FGD revealed that this was not the case when it was first introduced in 2020 since the thematic analysis shows several issues that were endured by nurses in its initial implementation. The FGD served as an avenue for exploring the differences in their experiences over the years, from the initial implementation to their current experiences. Integrating the results, it implied that some issues that were encountered in 2020 have been addressed over the years, hence the current high satisfaction score in the survey.

Use and Satisfaction of Nurses with the EMR

As expected, there is a high EMR use score, especially since RADISH was mandated to be the hospital's official electronic medical record. This means that nurses must use the EMR to carry out their daily tasks until such a time when the system fits their workflow. The score, however, was not a perfect five since there are tasks that nurses need to do daily but are not yet available in the EMR, like writing nurse care worksheets or KARDEX.

The task "write nurse care worksheets (KARDEX)" has a relatively high score on the "never" option compared to other tasks since these forms are still filled out by hand, except in some cases when a unit creates a digital version of the form on a separate word processing software or application such as MS Word and Google Docs. Nurses then get the information from the patient's chart at the EMR to accomplish this task, which may explain why the majority of the respondents still consider high EMR use in relation to this task. This, however, does not mean that the functionality is available at the EMR.

Nurses most frequently use the EMR to "enter daily nursing care notes" and "document physical assessment of patients." This may be explained by the characteristics of our respondents, who are mostly staff nurses that are expected to document their patient care. Both of the said tasks pertain to documentation, which the FGD participants suggested improving to allow easier and faster accomplishment.

Currently, the use of EMR is primarily for patient care and documentation. By patient care, it means that nurses use the EMR to review patient problems, obtain information on tests and treatment procedures, and create nursing care plans based on the data from EMR. Other use of data beyond this, such as for research and program development, was not mentioned in the FGDs. This is an untapped potential of the EMR, which the nurses have yet to discover.

One of the changes in nurses' workflow that might have occurred after the adoption is the elimination of deciphering illegible entries during chart reviews. Chart entries became readable, as revealed in the thematic analysis. Nurses also no longer need to sift through the orders to look for certain information since a search engine is already available. Elimination of these tasks may have contributed to their satisfaction.

Nurses are currently satisfied with the use of their homegrown EMR, as evidenced by a high score on the user satisfaction subscale. They perceived it as a valuable tool for improving their work performance, the quality of their care, and the safety of their patients. Ultimately, they perceived its implementation to be successful in the hospital.

Overall, nurses have high EMR use even if some functionalities are not yet available in the EMR. They are also currently satisfied with the EMR. This may imply that no revisions or updates are needed in the system at the moment. In the FGDs, however, nurses mentioned several recommendations on how to improve their satisfaction further.

Association of Nurses' EMR Use and Demographic Characteristics with User Satisfaction

This study found that EMR use is significantly associated with user satisfaction. Analysis has shown that as nurses use the EMR in accomplishing their tasks, it results in an increase in their user satisfaction. Given the timing when satisfaction was assessed, years of use have already passed, which was a long time for developing their satisfaction further. This finding supports the D&M IS Success Model and, consequently, this study's conceptual framework. Our thematic analysis has further provided support to this by showing that learning through sensitization eventually facilitates successful adoption and, hence, satisfaction.

Several work characteristics were seen to significantly affect the relationship between EMR use and satisfaction. In some studies, length of service was found to affect user satisfaction.[12,14,16,24,25] This study has found that nurses' user satisfaction tends to decrease as they continue to serve longer. We may relate this to the result of our thematic analysis, which has shown that prior experience with other documentation systems affects how users accept the EMR. Those who were relatively new to the institution tend to be more accepting of the EMR compared to those who have been accustomed for so many years to the previous paper-based documentation system. In the regression analysis, it was found that prior experience with other EMRs was not a significant covariate of the relationship between EMR use and satisfaction, contrary to other study findings.[11,16,26,27]

This may be because it focused solely on prior EMR experiences and did not consider the previous paper-based system.

The thematic analysis has also shown that senior nurses had more difficulty adopting the EMR. The regression analysis, however, did not identify age as a significant covariate, consistent with other study findings.[16] This means that when the interviewees refer to senior nurses, they might be referring to those who have been in the service longer rather than those who are older by age.

Charge nurses tend to have high user satisfaction compared to staff nurses. This is in contrast with the association of length of service with user satisfaction, which may be because not all senior nurses are promoted to a Nurse III position. This is also in contrast with another study finding, which showed that nursing rank does not have an effect on satisfaction.[16] Few of the differences in their functions are direct patient care and accomplishing nurses' notes, which the charge nurses are sometimes not obliged to do. Since this is the case, their burden of documentation is not as heavy compared to staff nurses. In most cases, charge nurses are in charge of reading or carrying out orders for the staff nurses. Our thematic analysis says that reading chart entries was made easier through the EMR, hence their satisfaction. Charge nurses are also expected to assume a managerial role in the absence of a head nurse to oversee the operations of the unit, while staff nurses are focused mainly on the provision of direct patient care.

It was mentioned earlier that documentation was the primary use of EMR among nurses. Our thematic analysis says that writing notes was considered time-consuming early in the pandemic. This struggle could increase exponentially with every added patient being handled, as it was found to also affect user satisfaction. Being an end-referral hospital, UP-PGH frequently serves a high volume of patients, sometimes more than it can accommodate. Ways to improve efficiency in EMR use despite handling a high volume of patients while also accounting for its safe use must be explored to ensure optimal user satisfaction.

User satisfaction differs per type of unit to which the nurse is assigned. Those in pay wards are more satisfied with the EMR compared to those in charity wards. This might be influenced by the number of patients handled in a shift, as nurses in pay wards relatively handle fewer patients. They also have a designated charge nurse who carries out doctors' orders, allowing staff nurses to allot more time to patient care and documentation.

Meanwhile, those in special units are less satisfied with the EMR compared to those in the charity wards. They, however, often handle fewer patients as they generally need intensive care. Hence, their EMR satisfaction may be related to the intensity of care that they need to provide rather than the number of patients handled.

The majority of the survey respondents reported that they are currently comfortable with the use of computers. Comfort level in using computers was not found to be a significant covariate, which was inconsistent with some studies.[16,21,28] Unfortunately, we do not have available data on how comfortable they were with computers prior to the pandemic, limiting our ability to say if this has improved over time.

To sum up, EMR use, length of service, designation, number of patients handled, and unit of assignment were found to be associated with satisfaction. While satisfaction is high at the moment, it is important to keep these variables in mind when system updates and modifications are to be done in the future to optimally maintain their satisfaction scores.

Facilitators and Barriers Encountered by Users in EMR Adoption

The EMR quality was reported to be satisfactory at the moment, as evidenced by a high score yielded through the survey. This was considered a portion of the overall facilitators and barriers to EMR adoption. The analysis has demonstrated that these could affect both EMR use and user satisfaction, further supporting the D&M IS Success Model and this study's conceptual framework.

As mentioned previously, the survey reflects the current status of nurses' EMR use, satisfaction, and perception with EMR quality. The thematic analysis, however, explored the previous experiences of nurses with adoption, exposing several facilitators and barriers that were encountered in the past but were not reported through the survey. This allowed for comparison between their current and past experiences with EMR implementation.

Our thematic analysis revealed that during the adoption, there were instances of inconsistent chart entries due to the reckless use of the copy-and-paste function. We can say that the precision, clarity, and accuracy of information have improved over time since there is good feedback about them in the survey. These factors were found to have a positive impact on the workflow of nurses, according to some studies.[13,16,26,28]

Given that the system was introduced in response to a need during the pandemic, adoption was really sudden, causing some adoption prerequisites to not be provided immediately and adequately. These include assessment of user competence and experience and the provision of training, structural necessities, and organizational support.

One-third (34.84%) of the survey respondents mentioned that they had not received any training during the adoption, while more than half (55.81%) learned the system through their fellow nurses. These are supported by the results of the thematic analysis, but in-service training was mentioned to have been implemented at a later stage of adoption. Computer literacy and the desire to use the technology were considered factors that allowed nurses to adopt the EMR with ease, similar to another study.[12]

Nurses felt the burden to comply with the environmental pressures of the pandemic, the hospital, and their profession. Having to respond to the mandate of the hospital, nurses were forced to resort to self-learning at the point of adoption

but had limited time to learn the system. Nurses also had to bring and use their own equipment to augment its inadequacy in the units. This reflects the dedication and resourcefulness of nurses in performing their duties during a time of need.

Some nurses were also burdened with educating their fellow nurses, especially those who are not technologically inclined. Through frequent use, they eventually became satisfied with the EMR, resembling other study findings.[16] Luckily, the system was easy to learn because of its simplicity at the time it was introduced. One of the key factors in user satisfaction was ease of use.[11,26,29]

The hospital was not ready for EMR adoption in terms of infrastructure and physical setup. Equipment was lacking, the internet connection was unreliable, and the space was not enough to accommodate the computers during the adoption. In other studies, these were deemed essential to implementation success.[3,8,11,16,21,26,27,30] Expecting the staff to use the system without providing these led to frustration, hesitance, and powerlessness in accepting the system, consistent with other study findings.[11,21,26,27] A decrease in perceived autonomy was consistent with another pandemic-related study on EMR adoption.[12]

Organizational support was deemed important by the interviewees, especially at the point of adoption. This is consistent with other study findings.[8,11,16,29,31] The ability of the administration to respond to the needs of the users in terms of EMR implementation was preferred. Moreover, collaborative work with IT and nurses was also lacking and was recommended to this point.

In the event of confusion, nurses would have wanted to seek assistance from their nurse supervisors. They, however, were unfamiliar with the system, which made it more difficult for the nurses to follow the mandate. It was expected that they should also be familiar with how the system works in spite of their administrative functions so that they could well represent the staff in EMR planning, development, and rollout. Our literature review indicates that nurse managers need to understand that it is important to provide nurses with timely and appropriate technical support when issues arise at work.[16] It also sends a message that they are facing the adoption challenges alongside their staff, fostering trust and dependability.

Information dissemination, especially about system updates, needs to be improved up to this moment. During the pandemic, one of the frustrations of the nurses was the overwhelming system updates, of which they were not informed and were not prepared. Cognitive overload was apparent among nurses due to these frequent updates, as well as remembering hospital protocols in the management of COVID-19 cases. Right now, our thematic analysis has shown that this is still an unfulfilled appeal among nurses.

Nurses later realized its benefits since chart entries became readable and accessible, consequently improving efficiency and preventing errors. Prevention of errors was one of the benefits, consistent with other similar studies.[11] Better access and efficiency in documentation were reported in another study.[25]

Some changes in nurses' workflow that might have occurred after the adoption is the elimination of deciphering illegible entries during chart reviews. Nurses also no longer need to sift through the orders to look for a certain information since a search engine is already available. Elimination of these tasks may have contributed to their satisfaction.

To conclude, the FGD revealed that nurses were not initially pleased with the EMR in 2020 as their satisfaction was hindered by the inadequacy of user competency assessment, training, structural necessities, and organizational support. These variables were not included in the survey but were elicited during the discussions. The EMR quality, however, was a variable that was considered to have improved over time, contributing to their current high user satisfaction score.

Recommendations to Improve Nurses' Satisfaction with EMR Use

Although satisfaction is high at this point, recommendations to improve efficiency, communication, and collaboration were elicited through the FGDs. The discussions overwhelmingly highlighted the need to improve nursing documentation, aiming to make it easier and faster for nurses to manage, given the high volume of patients and the intensity of care they provide. Some recommendations on improving efficiency in documentation that emerged during the FGDs were the use of checkboxes instead of narrative documentation, enabling the copy-and-paste function, enabling bulk recording of administered medications, improving the user interface, and improving the user friendliness of the system. In the introduction of digital health solutions such as an EMR, they would have wanted to have reliable infrastructures first to allow them to explore and learn the system thoroughly.

Nurses have voiced their request to integrate the different systems they use in their daily work. One of the systems that was mentioned is OpenERP where nurses request needs and medications for their patients. Another is HCLabs and OpenMRS where nurses and doctors check the laboratory findings of their patients. Nurses mentioned that it would be better if these systems were integrated to streamline their workflow.

The provision of better training was recommended even up to this point, especially since it was perceived to affect how users accepted the system. In the introduction of a new system, special attention must be given to those who are not computer literate and have been in the service for a longer period of time. There might be a need to follow the suggestions of other studies for individualized or customized training strategies for specific nursing groups or roles to help prevent cognitive overload.[11,27] Otherwise, inefficiencies may result from the unfamiliarity with the system. A combination of training and learning methods, including intensive teaching and return demonstrations was suggested.

One of the few notable answers from the interviewees was the recommendation to gather feedback regularly. The process to gather feedback from nurses is still not clear up to this moment. A way to consolidate these is vital to ensure that requests are aligned with the established documentation standards and will not contradict one another. Nurse managers may serve as point persons to do this, but careful deliberation must be made since senior nurses were reported to not be as technologically skilled as expected. A similar study suggested the formulation of focus groups to address time-related issues in EHR implementation.[14]

CONCLUSIONS

This study assessed nurses' satisfaction with the use of a public tertiary hospital EMR and explored the pandemic-related experiences of EMR adoption. A novel aspect that this study offers is its perspective on EMR adoption through the lens of users who had to simultaneously deal with the pandemic. This has not been widely explored in the past as this happens rarely. Furthermore, results show congruence with the DeLone and McLean Informations System Success Model, which was used as this study's theoretical framework.

There are a lot of informatics-related studies recommending strategies that could contribute to a successful EMR adoption. Since the institution was not able to follow these recommendations at the point of adoption, one might assume that the system would eventually fail. However, this study showed that the implementation succeeded despite the circumstances, but not without issues. Having users that are resourceful in generating ways to address the deficiencies were essential to fulfill this pressing need. Moreover, developing the EMR from scratch allowed it to adjust to the needs of the users as they try to use the system bit by bit.

Nurses have high EMR use in spite of having some functionalities not available in the EMR at the moment. They were expected to incorporate the EMR into their daily tasks, ultimately integrating it into their workflow over time. It was found that as they use the EMR further, it leads to higher levels of satisfaction.

Nurses report being satisfied with the EMR at the present, implying that no revisions or updates in the system are required for now. This is in spite of encountering a number of issues in the past, which may have been addressed eventually over the years. Given that it has been four years since the adoption, high satisfaction scores would be expected following the extent of EMR use.

Satisfaction was affected by some work characteristics, including length of service, designation, number of patients handled, and area of assignment. Length of service appears to correlate with decreased satisfaction, potentially due to prior experience with other documentation systems. Charge nurses have higher satisfaction scores compared to staff nurses, possibly due to differences in responsibilities and workload. Challenges persist, particularly in managing the documentation workload in terms of patient volume. Satisfaction with the EMR also varies across different units, influenced by patient load and intensity of care. Although satisfaction is currently high, it's important to consider these variables for future system updates and modifications to maintain optimal satisfaction levels.

The EMR quality was also found to be satisfactory and has improved over the years. It was found to contribute significantly to the association between EMR use and user satisfaction. The FGD, on the other hand, revealed that the adoption was not satisfactory at the beginning and had some facilitating and hindering factors that were considered to have influenced adoption. These factors include user competencies, training, structural necessities, and organizational support.

Recommendations

Based on the findings of this study, EMR use should be maintained at an optimal level in order to ensure user satisfaction. Healthcare institutions must seek strategies to integrate the use of EMR into the workflow of users to ensure successful EMR implementation.

It is also recommended to give staff nurses ample opportunity to provide feedback on how to improve their satisfaction, as they comprise most of the population and use the system more often for documentation. Healthcare institutions are encouraged to engage with the users of their EMR to gather insights on how to address challenges in implementation.

Several recommendations to improve satisfaction were elicited from the FGDs. These recommendations focused on efficiency enhancement, communication, and collaboration. Addressing gaps in feedback gathering, improving information dissemination, and integrating various systems used in daily workflow emerged as priorities for implementation. Regular feedback mechanisms and collaboration between stakeholders, including nurse managers and IT personnel, are vital for optimizing EMR use and satisfaction. By implementing these recommendations, the hospital can enhance efficiency among nurses, ultimately improving patient care and workflow.

In adopting an EMR during a pandemic, the minimum requirement was the provision of equipment. It is recommended that this be addressed first to assist nurses in learning the system, even on their own with the limited time they are given. Other institutions could use this as a guide when they need to introduce digital health solutions abruptly in response to a need besides a pandemic. Strategies to promote a culture of change readiness and innovation is also recommended to improve acceptance of the systems, even with limited resources.

Another study could be done to evaluate the satisfaction of other user types, such as doctors and pharmacists, among others. This is essential to provide a holistic view of EMR use and satisfaction.

Strengths and Limitations

This study is most likely one of the first to explore EMR adoption during a pandemic since there was only published article about this as of writing. It is also possibly the first to use the Delone and McLean Information System Success Model in the Philippines, which the results of this study supported. The use of a mixed method approach allowed for an extensive exploration of the experiences of nurses in EMR adoption.

This study only assessed the satisfaction and use of nurses on UP-PGH's RADISH. This study recognized that user satisfaction varies from one user type to another and that it should only be evaluated one at a time.[9] Hence, nurses' satisfaction could not be simultaneously evaluated with other users' satisfaction, especially if our aim is to address the identified nurse-related issues.

The evaluation of nurses' satisfaction was given priority because of the scope of their involvement in RADISH implementation. They are in charge of entering data into almost all of the EMR features of RADISH. During their shift, aside from reading and carrying out doctors' notes and viewing patients' laboratories and diagnostics, they are also required to document their care, create laboratory and diagnostic requests as ordered, encode their assessments and observations, log the patients' intravenous (IV) fluids, and log their administered medications. Some members of the healthcare team, such as doctors and pharmacists, depend on these pieces of data for monitoring the patients' status and adherence to the treatment plan. Hence, nurses' role in providing this information is crucial to patients' health management. It is imperative to keep their EMR satisfaction at an optimal level to help them improve their experience and confidence in EMR use, which could later on improve data quality and accuracy. Additionally, it was previously mentioned that their satisfaction with EMR could have an effect on the quality of care, which in turn might translate to better patient outcomes.[11] Putting these in mind, the investigator opted to evaluate their satisfaction before any other services or departments in the institution.

RADISH is a homegrown EMR. This provided an opportunity for the study to capture the unique experiences of users who witnessed the transformation of their paper charts and forms into their digital versions. Hence, this study took place at only one institution (UP-PGH) and evaluated user satisfaction on only one EMR (RADISH). Consequently, the results of this study may not be generalized to the public, especially considering some factors that may vary between institutions, including work culture, available resources, and governance, among others. However, this still provides insights into program development and implementation with the same setup and context.

This study used self-administered surveys for data collection, which do not provide an accurate measurement of the actual use and quality of EMR. These were measured through the self-reports of the study participants. The use of this method limited the participants' ability to expound on their answers on the survey. Utilizing a focus group discussion allowed some of them to share more about their experiences with EMR adoption. Research assistants were not hired because of limited funding. Funding for this research was solely provided by the investigator.

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REFERENCES

1. Anaikatti P, Sheth S, Canlas A, Shanbhag N, Goh M, Lim H. Electronic medical record platform enhancements during COVID-19 to support identify-isolate-inform strategy for initial detection and management of patients. Emerg med Australas. 2021 Feb;33(1): 164–7. doi: 10.1111/1742-6723.13684. PMID: 33140528.
2. Baumgart D. Digital advantage in the COVID-19 response: perspective from Canada's largest integrated digitalized healthcare system. NPJ Digit Med. 2020 Aug;3:114. doi: 10.1038/s41746-020-00326-y. PMID: 32923691; PMCID: PMC7459297.
3. Bhyat R, Hagens S, Bryski K, Kohlmaier J. Digital health value realization through active change efforts. Front Public health. 2021 Oct 12;9:741424. doi: 10.3389/fpubh.2021.741424. PMID: 34712641; PMCID: PMC8547540.
4. Cheng D, Coote A, South M. A digital approach in the rapid response to COVID-19 - Experience of a paediatric institution. Int J Med inform. 2021 May; 149:104407. doi: 10.1016/j.ijmedinf.2021.104407. PMID: 33588302; PMCID: PMC7866849.
5. De Biase G, Freeman W, Bydon M, Smith N, Jerreld D, Pascual J, et al. Telemedicine utilization in neurosurgery during the

COVID-19 pandemic: a glimpse into the future? Mayo Clin Proc Innov Qual Outcomes. 2020 Dec;4(6):736–44. doi: 10.1016/j.mayocpiqo.2020.07.013. PMID: 33324948; PMCID: PMC7728424.
6. Liu Y, Wang Z, Ren J, Tian Y, Zhou M, Zhou T, et al. A COVID-19 risk assessment decision support system for general practitioners: design and development study. J Med Internet Res. 2020 Jun; 22(6):e19786. doi: 10.2196/19786. PMID: 32540845; PMCID: PMC7332157.
7. Grossman S, Han S, Balcer L, Kurzweil A, Weinberg H, Galetta S, et al. Rapid implementation of virtual neurology in response to the COVID-19 pandemic. Neurology. 2020 Jun 16;94(24):1077–87. doi: 10.1212/WNL.0000000000009677. PMID: 32358217.
8. Smith W, Atala A, Terlecki R, Kelly E, Matthews, C. Implementation guide for rapid integration of an outpatient telemedicine program during the COVID-19 pandemic. J Am Coll Surg. 2020 Aug;231(2): 216–22.e2. doi: 10.1016/j.jamcollsurg.2020.04.030. PMID: 32360960; PMCID: PMC7192116.
9. DeLone W, McLean E. The DeLone and McLean model of information systems success: a ten-year update. Journal of Information Management System. 2003 April; 19(4): 9-30. doi: 10.1080/07421222.2003.11045748.
10. Otieno O, Toyama H, Asonuma H, Asonuma M, Kanai M, Kanai-Pak M, et al. Nurses' views on the use, quality and user satisfaction with electronic medical records: questionnaire development. J Adv Nurs. 2007 Oct;60(2):209–19. doi: 10.1111/j.1365-2648.2007.04384.x. PMID: 17877568.
11. Parthasarathy R, Steinbach T, Knight J, Knight L. Framework to enhance nurses' use of EMR. Hosp Top. 2018 Jul-Sep;96(3):85–93. doi: 10.1080/00185868.2018.1488545. PMID: 30277450.
12. Jedwab R, Hutchinson A, Manias E, Calvo R, Dobroff N, Redley B. Change in nurses' psychosocial characteristics pre- and post-electronic medical record system implementation coinciding with the SARS-CoV-2 pandemic: pre- and post-cross-sectional surveys. Int J Med Inform. 2022 Jul;163:104783. doi: 10.1016/j.ijmedinf.2022.104783. PMID: 35512624; PMCID: PMC9052633.
13. Kutney-Lee A, Sloane D, Bowles K, Burns L, Aiken L. Electronic health record adoption and nurse reports of usability and quality of care: the role of work environment. Appl Clin Inform. 2019 Jan;10(1):129–39. doi: 10.1055/s-0039-1678551. PMID: 30786302; PMCID: PMC6382496.
14. McBride S, Tietze M, Hanley M, Thomas L. Statewide study to assess nurses' experiences with meaningful use-based electronic health records. Comput Inform Nurs. 2017 Jan;35(1):18-28. doi: 10.1097/CIN.0000000000000290. PMID: 27655332.
15. Top M, Yilmaz A, Karabulut E, Otieno O, Saylam M, Bakır S, et al. Validation of a nurses' views on electronic medical record systems (EMR) questionnaire in Turkish health system. J Med Syst. 2015 Jun;39(6):67. doi: 10.1007/s10916-015-0250-2. PMID: 25957164.
16. Tubaishat A. Evaluation of electronic health record implementation in hospitals. Comput Inform Nurs. 2017 Jul;35(7):346-72. doi: 10.1097/CIN.0000000000000328. PMID: 28221186.
17. Johnson W, Gee P, Kelly L, Butler R. The effect of electronic medical records on nurses' job satisfaction: a multi-year analysis. Urban Studies and Public Administration. 2021 Jun;4(3). doi:10.22158/USPA.V4N3P.
18. Farman A, Kousar R, Hussain M, Waqas A, Gillani D. Impact of job satisfaction on quality of care among nurses on the public hospital of Lahore, Pakistan. Saudi Journal of Medical and Pharmaceutical Sciences. 2017 Jun. doi: 10.21276/sjmps.
19. Al-Qahtani A, Stirling B, Forgrave D. The impact of job satisfaction on nurses' work lives: a literature review. QScience Connect. 2020 Feb;2020(1). doi: 10.5339/connect.2020.1.
20. Johnson B, Christensen L. Educational research: Quantitative, qualitative, and mixed approaches, 5th ed. Washington DC: SAGE; 2014. p. 496.
21. Jedwab R, Manias E, Hutchinson A, Dobroff N, Redley B. Understanding nurses' perceptions of barriers and enablers to use of a new electronic medical record system in Australia: a qualitative study. Int J Med Inform. 2021 Nov 29;158:104654. doi: 10.1016/j.ijmedinf.2021.104654. PMID: 34883386.
22. Atkins L, Francis J, Islam R, O'Conner D, Patey A, Ivers N, et al. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. Implement Sci. 2017 Jun 21;12(1):77. doi: 10.1186/s13012-017-0605-9. PMID: 28637486; PMCID: PMC5480145.
23. Polit D, Beck C. Nursing Research Principles and Methods, 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2004. p. 366.
24. Franco M, Baird J, Brown L, Overly F. Electronic medical record in the ED: a cross-sectional survey of resuscitation documentation practices and perceptions among emergency department clinicians. Pediatr Emerg Care. 2018 May;34(5):303–9. doi: 10.1097/PEC.0000000000001441. PMID: 29596279.
25. Misto K, Padula C, Bryand E, Nadeau K. Nurses' perception of the impact of electronic documentation on the nurse-patient relationship. J Nurs Care Qual. 2019 Apr/Jun;34(2):163–8. doi: 10.1097/NCQ.0000000000000339. PMID: 29975218.
26. Jacob C, Sanchez-Vazquez A, Ivory C. Clinicians' role in the adoption of an oncology decision support app in europe and its implications for organizational practices: qualitative case study. JMIR Mhealth Uhealth. 2019 May;7(5):e13555. doi: 10.2196/13555. PMID: 31066710; PMCID: PMC6524456.
27. Njane A, Jedwab R, Calvo R, Dobroff N, Glozier N, Hutchinson A, et al. Perioperative nurses' perceptions pre-implementation of an electronic medical record system. Stud Health Technol Inform. 2021 Dec 15;284:522–7. doi: 10.3233/SHTI210787. PMID: 34920585.
28. Raghunathan K, McKenna L, Peddle M. Use of academic electronic medical records in nurse education: A scoping review. Nurse Educ today. 2021 Jun;101:104889. doi: 10.1016/j.nedt.2021.104889. PMID: 33865191.
29. Lambooij M, Drewes H, Koster F. Use of electronic medical records and quality of patient data: different reaction patterns of doctors and nurses to the hospital organization. BMC Med Inform Decis Mak. 2017 Feb 10;17(1):17. doi: 10.1186/s12911-017-0412-x. PMID: 28187729; PMCID: PMC5303309.
30. Mollart L, Newell R, Geale S, Noble D, Norton C, O'Brien A. Introduction of patient electronic medical records (EMR) into undergraduate nursing education: An integrated literature review. Nurse Educ Today. 2020 Nov;94:104517. doi: 10.1016/j.nedt.2020.104517. PMID: 32853983.
31. Curtis C, Nguyen M, Rathnasekara G, Manderson R, Chong M, Malawaraarachchi J, et al. Impact of electronic medical records and COVID-19 on adult Goals-of-Care document completion and revision in hospitalised general medicine patients. Intern Med J. 2021 May;52(5):755-62. doi: 10.1111/imj.15543. PMID: 34580964; PMCID: PMC8653102.