

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

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Abstract

Background Technology is increasing the complexity in the role of today's nurse. Healthcare organizations are integrating more health information technologies and relying on the Electronic Health Record (EHR) for data collection, communication, and decision-making. Nursing faculty need to prepare graduates for this environment and incorporate an EHR into a nursing curriculum. **Aim of study:** Was for designing and implementing EHRs software for intern-nurses by using advanced mobile devices. **Design:** A quasi-experimental design was utilized. **Setting:** This study was conducted in different units in medical and surgical clinical departments at Benha University Hospital. **Subjects:** Representative simple random sample consisted of 25% of intern-nurses (60 intern-nurses) of Benha Faculty of Nursing. **Tools:** Data of the present study was collected by using three tools; First tool: Intern-Nurses' Knowledge Questionnaire, Second tool: Intern-Nurses' Technological Skills (Observational checklist) and Third tool: Intern-Nurses' Attitude Questionnaire. **Result:** The highest percent of intern-nurses (90%) had adequate knowledge scores about EHRs at immediately post-program implementation phase, the majority of them had high technological skills level required for using EHRs, and positive attitude toward EHRs at follow up and immediately post-program from the preprogram implementation phases (83.3%, 76.6%, 86.7% & 85.0%) respectively. **Conclusion:** There was highly statistically significant positive correlation among intern-nurses knowledge regarding EHRs software with their technological skills and attitude toward EHRs software at pre-program, immediate post and follow up program implementation phases. **Recommendation:** The hospital administration should take the necessary steps to develop proper information communication technology infrastructure required for EHRs records utilization with AMDs in clinical practice and gradual introduction of an EHR software system in the general hospital.

Key words: Advanced Mobile Devices (AMDs) - Electronic Health Records (EHRs)- Intern-nurses performance.

Introduction

Technology has continued to change health care since the stethoscope was invented in 1816. As with contemporary technology, the device did not replace the work of clinicians, but rather enhanced and expanded their capabilities. Digital thermometers, advanced wound care supplies, ECGs, and electric patient lifts are just a few of the

technologies that have enhanced and expanded clinical practice. As the healthcare industry faces the challenges of skyrocketing costs, decreasing reimbursement, nursing shortages, and increased patient acuity. So the technology may help to meet patients' needs and optimize the work (**Rashed, 2018**).

Healthcare delivery largely depends on information for effective decision making. Every nursing action relies on knowledge

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

based on information. As the nursing process begins with obtaining the information and communicating it in the initial and ongoing assessment. So Nursing Informatics (NI) is the man-augment of data, information, knowledge and wisdom relevant to nursing. As we enter the era of EHR, NI has become indispensable element in the nursing practice (Cathy, 2014).

Documentation is one of the most crucial aspects of nursing care, as reflected in the old nursing adage, "If it wasn't charted, it wasn't done". Nurses in an acute care medical surgical unit spend approximately 147 minutes charting in a typical 10-hour shift. The EHR is where this important collection of data, information, knowledge and eventually wisdom resides. Nursing education, however, has not kept pace with the need for nursing students to learn how to use this valuable tool. Nursing students have limited access to EHRs in prelicensure programs. Nurse faculty and nursing students' attitudes and perception toward health information technology in nursing education have been studied, yet concrete descriptions and procedures for implementing technology are lacking (Jenkins et al., 2018).

The concept of mobile electronic medical record systems is expected to be one of the superior approaches for improving nurses' bedside and point of care services. EHR: health record of an individual that is accessible online from many separate, interoperable automated systems within an electronic network. EHR: an electronic method of storing, manipulating and communicating medical information of all kinds including text, images, sound, video and tactile senses, which are more flexible than paper-based systems. Often referred to as a medical record, it contains a client's (patient) entire medical history and information crucial

to future care. Electronic documentation: a document existing in an electronic form to be accessed by computer and any type of mobile information technology ((Elliott et al., 2018; De Groot et al., 2020).

The EMR is a longitudinal and real-time electronic record of patient medical information generated, gathered, managed and consulted by authorized clinicians and staff within any care delivery setting. A number of terms are associated with these records including EHR, EP, and CMR, among others. These terms are often used interchangeably. National Alliance for Health Information Technology adopted the definition of an EMR: "an electronic record of health related information on an individual that can be created, gathered, managed and consulted by authorized clinicians and staff within one health care organization" , even if it was used interchangeably with term 'EHR' (Ring, & Tierney, 2017).

Mobile technology are portable and are updated frequently, as compared to textbooks which become obsolete quickly has the potential to enhance nursing practice through nurses being able to find or check information about illness, disease or injury, view or revise procedures or care to be undertaken, or ensure correct medications are administered to patients without needing to go to the nurses' station, treatment room or locate a computer terminal to retrieve information (O'Connor, et al., 2020).

In some nursing programs, students are not exposed to electronic documentation until they participate in clinical rotations in local hospitals. Unfortunately, during clinical rotations, it is not easy for students to learn about best practices in electronic documentation. However, students can learn to navigate EHRs in simulation labs. It has reported partnering with a medical center to

provide students access to training with EHRs before the first clinical rotation. These students felt more confident with their documentation. In addition to educating students in a transitional electronic environment is no longer optional for Nursing Faculty. It is necessary for accurate documentation, transmission, and management of data for improving patient care (**Chung & Cho, 2017**).

The wide adoption of EHR systems has led the Institute of Medicine (IOM) to emphasize the use of informatics as a core competency required of all health care professions. The 2009 Health Information Technology for Economic and Clinical Health Act (HITECH) directs all health providers to use EHRs. The National League for Nursing (NLN) recommends that Nursing Faculty should incorporate informatics into all levels of the curriculum. However, the nursing profession has been slow to incorporate information technology into formal nurse education and practice (**O'Connor & Andrews, 2018**).

Additionally, EHR also incorporates new features, help nurse's practice better nursing care, supporting standard nursing terminology, incorporating clinical documentation from various sources, supporting standard care plans, guidelines, and protocols, supporting drug interaction checking, presenting alerts for preventive services and wellness, and linking clinical tasks. These features may alter how nurses document, make decisions, and communicate with other healthcare providers (**Kim et al., 2017**).

With EHRs health care team members are able to capture patient information of different disciplines, and share the information to promote better patient care management and outcomes, eliminate unnecessary and duplicate tests, and to reduce medical errors.

Various studies have shown that using EHRs has improved patient safety, increased the quality of care, and reduced health care costs. In addition, the data in EHRs is considered a significant resource for clinical evidence that has been used for evidence based practice research in multidiscipline. However, several studies suggested that poor understanding of EHR's functionality may lead to medical errors (**Jedwab et al., 2019; Samadbeik et al., 2020**).

With EHRs, the transfer of complete records from provider to provider or facility to facility happens electronically. That also means records don't get lost or delayed when patients change providers or providers make referrals. Therefore, healthcare professionals need to be trained to be knowledgeable and have a true understanding of the use of EHRs to prevent medical errors and improve the quality of patient care (**Kowitlawakul, et al., 2015; Mollart, et al., 2020**).

Computerized medical record systems, commonly referred to as EHR or EMR, and were introduced in clinical settings in the early 1960s. Since then, the adoption rate of EMR systems has continuously increased. While EHRs have been widespread, the nursing education curriculum is faced with challenges related to EHR use in clinical practicum. One of the possible reasons is that computers are either accessible only at fixed sites or restricted due to the volume of users and there are other barriers described physical barriers, such as a lack of space and the lack of EMR workstations for students at practicum sites. Another barrier was that students have access to the EMR computer without appropriate permissions to input information because of practical and liability issue (**Whitt, et al., 2017; Choi et al., 2018**).

Moreover, various studies showed that new technologies, such as ubiquitous mobile

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

devices and health information technology systems, used at hospitals and outpatient clinics could be integrated into clinical practicum curricula. Most nurses and nursing undergraduates regarded mobile devices as useful in accessing necessary information, making notes, saving time, and increasing self-confidence, as well as in improving patient safety and quality of care (O'Connor, 2018).

Aim of the study

This study aimed for designing and implementing electronic health records software for intern-nurses by using advanced mobile devices.

Research Hypotheses

It is hypothesized that designing and implementing electronic health records software for intern-nurses by using advanced mobile devices would lead to significant improvement of intern-nurses' knowledge, technological skills, performance and attitude toward electronic health records software by using advanced mobile devices

Subject and Method

Research design

A Quasi-experimental design was used to achieve the aim of the present study.

Setting

The present study was conducted in different units in medical and surgical clinical departments at Benha University Hospital (Free services hospital) where the intern-nurses were trained.

Medical units	Surgical units
Medical emergency unit	Surgical emergency unit
Intensive care unit	Operating rooms
Coronary care unit	Urology unit
Dialysis unit	Obstetrics and gynecology unit
Pediatric units	Orthopedic units
Medicine units	
6 units	5 units

Sample

The subjects who participated in this study were composed of representative simple random sample consisted of 25% of intern-nurses of Benha Faculty of Nursing who were enrolled in the internship year 2019/ 2020 at Benha University Hospital and having advanced mobile device . The total number of intern-nurses was 240 intern-nurses at the time of the study, so the actual number of intern-nurses included in this study was (60) chosen randomly.

Sampling technique: All names of intern-nurses of each group were presented in a label then put in bowl and chosen the names of intern-nurses to be included in the study randomly.

Tools for data collection

Tools of data collection

Data of the present study was collected by using the following three tools;

Intern-Nurses' Knowledge Questionnaire:

Self-administered questionnaire was developed by the researcher based on literature review (Hassan & Mostafa, 2009; Ajibade, Oladeji, & Okunlade, 2013; Dall, 2014; Akpabio, & Ella, 2015; Pordeli, 2017 ;Rashed, 2018) to assess intern-nurses' knowledge about electronic health records software by using advanced mobile devices it used before, immediately post and follow up three months after implemented of training program. It consisted of two parts as follows:

The first part: It included intern-nurses' personal data and divided into the following 3 sections:

Section1: It consisted of 10 questions about personal characteristics of intern-nurses; (age, gender, marital status, Place of living (residence), Pre-university education, do you have a computer, how would you rate

your computer literacy skills, Have Medical Apps installed on your mobile device, do you think hospital employers should establish policy for personal communication devices use ,In general, how do you feel about advanced mobile devices (cell phone, smartphone or tablet computer)).

Section 2: It consisted of 11 questions about previous AMDs utilization in learning and academic training

Section3: It consisted of 7 questions about previous experience and utilization of any type of AMDs or desktop computer.

Table (1) The second part: Self-administered questionnaire. It consisted of (92) questions and divided into 3 sections distributed as follows

Question type	True or false	Multiple choice	Total
Section content			
Knowledge about NI	13	16	29
Knowledge about AMDs	13	9	22
Knowledge about EHRs	22	19	41
Total	48	44	92

Scoring system

The scoring system for intern-nurses' knowledge was calculated as follows; (1) score for correct answer, and (0) for incorrect. The score of the items was summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into a percent score.

The total knowledge score (92 degrees)

- Adequate knowledge if the percentage score $\geq 60\%$ (55- 92 degrees)
- Inadequate knowledge if the percentage score is $< 60\%$ (0 < 55 degrees)

II-Intern-Nurses' Technological Skills (Observational checklist):

Observational checklist was developed by the researcher based on scientific literature review (Tiger Initiative. 2009; Ghoneimy, 2015; Adeleke, Salami & Achinbee, 2015; Pordeli, 2017; Rashed, 2018). It included two parts:

The first part: Intern Nurses' Technological Skills Observational Checklist: It include different items to assess intern-nurses' technological skills for using electronic health records software by using advanced mobile devices before, immediately

post and follow up after three months implemented of training program. It consisted of "31" items that grouped under two categories:

Technological skills required for using EHRs: It covered "25" items.

Informatics literacy and management skills: It covered "6" items.

Scoring system

The scoring system for Intern nurses' technological skills was calculated according to a three-point likert scale ranges from: not done (0 point), incompletely done (1 point) and completely done (2 points). The total score was "62" degree and cut point was done at $60\% = 37$ scores. A total score was calculated by summing up the grades of items of checklist, the scores were converted into percent score. The level of practice was determined as the following:

- High level if the percentage score is $\geq 75\%$ (75% (47 - 62 degrees),
- Moderate level if the percentage score equals $60 - < 75\%$ (from 37 < 47 degrees)

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

- Low level if the percentage score if the percentage score is $< 60\%$ ($0 < 37$ degrees)

The second part: Intern-Nurses' Performance Observational Checklist (Data entry): It include different items to measure intern-nurses' actual performance before, immediately post and follow up after three months implemented of training program. It covered 14 items.

Scoring system

The scoring system for Intern-nurses' performance (Data entry) was calculated according to a three-point likert scale ranges from: not done (0 point), incompletely done (1 points) and completely done (2 points). The total score was "28" degree cut point was done at $60\% = 14$ scores. A total score was calculated by summing up the grades of items of checklist, the scores were converted into percent score. The level of performance was determined as the following:

- Highly acceptable (High level) level if the percentage score is $\geq 75\%$ (75% (18- 28 degrees),
- Acceptable (Moderate level) if the percentage score equals $60 - < 75\%$ (from $14 < 18$ degrees)
- Unacceptable (Low level) if the percentage score if the percentage score is $< 60\%$ ($0 < 14$ degrees)

III- Intern-Nurses' Attitude Questionnaire:

A structured questionnaire was developed by the researcher based on scientific literature review (Suppiah Dall, 2014; Olok, Yagos, & Wang, Ho, & Chen 2015; Ismail, 2017; Andrew, Taylorson, & Langille 2018; Choi, 2018; Gajanayake, Sahama, , & Iannella, 2013). It consisted of "86" items to determine intern-nurses' attitude toward using electronic health records software by using advanced mobile devices before, immediately

post and follow up after three months implemented of training program divided into 8 dimensions distributed as follows;

1st dimension optimism (7 items), 2nd innovation (7 items), 3rd discomfort (7 items), 4th insecurity (9 items), 5th usefulness (18 items), 6th satisfaction (20 items), 7th access to information (11 items) and 8th preference (7 items).

Scoring system

The scoring system for Intern-nurses' attitude was calculated according to a three-point likert scale ranges from: disagree (0 point), uncertain (1 points) and agree (2 points). The score was reversed for negative items. Scores of each dimension summed up and converted into percent scores.

Each intern- nurse chooses only one best answer after reading and understanding the items carefully. Finally, the answer was assigned numerical values according to the following scores that reflect intern- nurses' attitude toward using electronic health records software by using advanced mobile device

The total attitude score (172 degrees)

- positive attitude if the percentage score is $\geq 75\%$ (129 - 172 degrees),
- Negative attitude if the percentage score if the percentage score is $< 60\%$ ($1 < 103$ degrees)

Validity of tools:

The tools were tested for validity (face, content), through revising and judging the study tools by a panel of seven experts' six experts in Nursing Administration and one expert in Community Health Nursing. The experts are from different Nursing Faculties (one assistant professor from Cairo University, three assistant professors from Tanta University, one professor from Ain Shams University and one professor and assistant professor from Benha University).

Reliability of tools:

Cronbach alpha coefficient calculated to assess the reliability of tools of data collection. The 0.86 for knowledge tool, 0.90 for technological skills tool and 0.98 for attitude tool.

Ethical considerations

The study protocol was approved by the research and ethics committee at the Faculty of Nursing Benha University. Intern-nurses were informed about their rights to withdraw from the study at any time without the need for giving any reason. Also they were assured that the information will be utilized for scientific research only. A verbal consent for participating in the study was also obtained from intern-nurses. In addition, confidentiality and anonymity of the subjects were ensured through coding of all data.

Pilot study:

Pilot study was conducted in November 2019 to assess tools and the electronic health record software clarity and applicability and to detect the obstacles and problems that may encounter during data collection. It has also served for estimating the time needed for filling tools of data collection. It was conducted on 10% of the total number of the intern-nurses participated in the pilot study. "6"intern-nurses and were included in the main study subject because there no modification is required. The time needed was ranged from 20-30 minutes for Intern-nurses' Knowledge Questionnaire, 30-45 minutes for Intern-nurses' Observational checklist for both their technological skills and actual data entry and 30- 40 minutes for Intern-nurses' Attitude Questionnaire.

Fieldwork:

A- Assessment phase:

This phase started from April 2019 to January 2020 covering 10 months. It was concerned with the preparation and

construction of different data collection tools, through the following steps:-

❖ Developing three tools for data collection; Intern-nurses' Knowledge Questionnaire, Intern-nurses' Technological Skills (Observational checklist) and Intern-nurses' Attitude Questionnaire

B- Planning phase:

This phase started from March 2019 to February 2020 covering 12 months and included the following activities

⇒ **Developing electronic health records training program content in the form of handout it included the following;**

❖ Reviewing the available literature concerning the nursing informatics, advanced mobile devices utilization in clinical practice and electronic health records.

❖ Developing electronic health records training program content that include development of five sessions concerned with nursing informatics, advanced mobile devices utilization in clinical practice and electronic health records, each session consisted of a number of topics.

⇒ Revising and judging electronic health records training program content by the same panel of a seven experts mentioned above.

Preparing the electronic health records software system it included the following;

❖ Designing electronic health records software system by the researcher, Assistant of Engineering Programmers and Software Designers by using a mix of Front-end and Back-end technologies [javascript stack] For Front-end, ES6, TypeScript, RXJS, Angular, Bootstrap, HTML5, CSS3, CSS, SCSS, Material Design For Back-end , NoSQL Database (firebase) and it's RestAPI.

❖ Electronic health records software system composed of 14 sheets as follows: 1)-Patient personal history- (2)-Patient admission and

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

discharge sheet- (3)-Patient personal history- (4)-Patient physical examination sheet- (5)-Patient System review sheet- (6)-Patient numerical pain rating sheet- (7)-Physician physical restraint order and nurse follow up sheet- (8)-Patient consultation request-(9)-Discharge summary-(10)-Vital signs observational record sheet- (11)-Fluid balance observational record sheet- (12)- medication administration record-(13)-Patient requested lab investigation record sheet- (14)-Patient intra operative anesthetic record sheet.

❖ Designing electronic health records software guide illustrated by pictures extracted from the different electronic health records software sheets.

❖ Revising and evaluating the electronic health records software guide by a panel of nine experts consisted of the same panel of a seven experts mentioned above in addition to the Director of the e-Learning Center and the Dean of Faculty of Veterinary Medicine from Benha University and one Assistant Professor from Faculty of Computers and Information from Benha University.

C-Implementation phase:

❖ Data of the current study were collected from February 2020 to June 2020 covering 5months. The researcher held meetings with subject groups who accepted to participate in the study. The intent of the meeting was to clarify and explain the nature of the EHRs software system, the aim, method of teaching, media and method of evaluation and time of the training program to ensure maximum cooperation from the participants.

❖ During the meeting the participants were informed the arrangements for attendance and their rights to complete or no complete the program at any time without the need to give any clarification and reasons.

❖ At first, there was an orientation (face to face) session held by the researcher at one of

the training classes in Benha university hospital, the researcher presented an instructional video about “how to use EHRs” and intern-nurses were informed about the time schedule and the training class site where the session will be held and the time of each session to be appropriate with their time.

❖ Watts App group was made and all the intern-nurses were added to it.

❖ The Intern-nurses' Knowledge Questionnaire was completed before beginning the course in written format in order to compare it with immediate and follow up tools and then the intern nurses were observed by the researcher for their technological skills at first then they were observed for actual data entry (opening the EHRs link (able to access this URL '<http://localhost:4200>' from chrome application , enter EHRs email and password , open EHRs application, click on any title in the page side-bar to appear it's medical and nursing content), moving between EHRs different sheets , opening each sheet(as they mentioned previously) , document and select different items in each sheet " we were use patient file from the hospital by picturing it with following the ethical consideration (not written the patient name for maintaining the patient privacy) after we have a permission from the nursing staff in the department where they were trained" , and finally save and log out of EHRs different sheets ". After intern-nurses were observed they were asked to complete Intern-nurses' Attitude Questionnaire before beginning the course in written format in order to compare it with immediate and follow up tools.

❖ The intern-nurses were divided into 6 groups, each group includes (10) intern-nurses during theoretical sessions and each group of them were divided into two subgroups consisted of "5" intern-nurses during practical

sessions to be observed carefully and for the internet connection as sharing the net from one phone to another through WI-Fi- hotspot.

❖ After the tools of data collection and the observation have completed the course sessions were implemented by the researcher. The course sessions has taken 10 days "5" theoretical sessions and 5 practical sessions the duration of each session was 3 hours. It started at 9.30 Am to 12.30 Pm, in the morning shift. At the beginning of the each session an orientation to the training program. Feedback was given in the beginning of each session about the previous one and at the ending of each session about the current session.

D- Evaluation Phase:

During this phase, the impact of the training program was evaluated through the following; Immediate evaluation included, immediately post implementation of the program, knowledge questionnaire and attitude questionnaire sheets, were collected online in electronic format knowledge questionnaire link (<https://forms.gle/CKHRyXqthbia6p2DA>) attitude questionnaire link (<https://forms.gle/zkcSqt5gQmaFt5rL8>) and it's link was send to intern-nurses through the watts App group which was previously made by the researcher to fill them. Intern -nurses took about two weeks to fill the tools of data collection (knowledge questionnaire and attitude questionnaire sheets) because there was no opportunity to meet with intern-nurses to avoid overcrowding as an implementation of precautionary measures to prevent infection with Covid 19 (Corona virus).

❖ Technological Skills Observational Checklists were collected online through zoom program (through sharing the screen between the researcher and the participants to be directly observed). As the intern-nurses

were added as host by the researcher to be able to share their own screen as each group of them that were previously divided into. They were requested to make some activity such as a presentation and presented it.

❖ As regarding to EHRs software it was already still exist on <http://localhost:4200> and they completed them by the same way that was previously explained.

❖ After three months of the program implementation, they were asked to complete tools of data collection and send them again to the researcher (follow-up phase) with the same way that immediate post program tools were collected.

Statistical analysis

Data were verified prior to entry into the computer. The Statistical Package for Social Sciences (SPSS version 20) was used for that purpose, followed by data analysis and tabulation. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). The statistical tests were used as Paired (t) test was used to compare mean scores between the same sample at different study phases while Chi square was used for number and percent distribution, and Spearman correlation test (r) was used to define correlation among socio- demographic characteristics and the study sample at different study phases. A highly significant level value was considered when $p \leq 0.001$, while a significant level value was considered when $p \leq 0.05$, and insignificant when $p > 0.05$.

Limitations of the study

The researcher was confronted with a few obstacles during the implementation of the study as:

Administrative limitation:

- The time for giving the session for intern-nurses who were distributed in different units was difficult to be organized.

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

- Obtaining training classes in some time were so difficult because the student of faculty of medicine were using these training classes.
- Obtaining a patient file was difficult because the nursing staff work load add to the fact that the ticket is not organized and the patient information is unclear and incomplete.

Technical limitation:

- There were some problems with internet connections, such as the speed or the absence of a mobile signal where they were staying.
- The difficulty of downloading the application due to the speed the internet because it is an internet package and internet memory stick (Internet flash) and the cost to the researcher Net package. Which lead to distribution of the intern-nurses group into subgroups and sometime intern-nurses were requested to complete the EHRs sheet in the home as the availability of Wi-Fi connection and send them back to the researcher to complete the observation.

Results

Table (1): Shows that nearly more than half of intern-nurses (56.7 %) had age more than 22 years old with Mean \pm SD (22.33 \pm .54), the majority of intern-nurses (80.0 %) were female, more than three quarters of intern-nurses (76.7%) were single and all intern-nurses (100%) have Medical Apps installed on their mobile device. In relation to their place of living, the highest percent of inter-nurses (90%) are living at rural areas. In regarding to their thought that hospital employers should establish policy for personal communication devices use the majority of them (83.3 %) thought that hospital employers should establish policy for personal communication devices use.

Table (2): Reveals that there was improvement in mean score of intern-nurses' knowledge regarding electronic health records software at immediate post program implementation phase as compared to the pre -program phase (75.11 \pm 15.24 & 39.95 \pm 21.61) respectively. However, a slight mean decline (67.93 \pm 21.20) occurred during follow-up phase. Also, the table shows that there was a highly statistical significant difference between intern-nurses' total knowledge scores regarding electronic health records software throughout program phases ($p = 0.000^{**}$). In addition to, the table shows that there was a highly statistically significant improvement in intern-nurses' total knowledge scores in relation to electronic health records software (16.60 \pm 10.67) at pre- program phase (before intervention) and it increased to (33.31 \pm 8.45) at immediate post program implementation phase while it was decreased (30.13 \pm 10.66) at follow-up phase of the program but still more than pre-program.

Table (3): Indicates that there was improvement in mean score of intern-nurses' required technological skills for using electronic health records software and their actual performance at follow-up phase and immediate post program implementation as compared to the pre -program phase (80.70 \pm 13.12 -79.46 \pm 14.47 & 37.85 \pm 15.37) respectively. Also, the table shows that there was a highly statistically significant difference between intern-nurses' required technological skills for electronic health records software and their actual performance throughout program phases ($p = 0.000^{**}$).

In addition to, the table shows that there was a highly statistically significant improvement in intern-nurses' total scores of required technological skills for using electronic health records software and their actual performance in relation to Total

Informatics literacy & management skills (2.20 ± 2.29) at pre- program phase (before intervention) and it improved to (11.46 ± 2.01) at immediate post program implementation phase and follow-up phase of the program.

Table (4): Illustrates that there was improvement in mean score of intern-nurses' total attitude toward electronic health records software at follow-up and immediate post program implementation phases as compared to the pre -program phase (150.85 26.29 - 147.55 32.06 & 90.81 40.79) respectively. Also, the table shows that there was a highly statistically significant difference between total score of intern-nurses' attitude toward electronic health records software and their actual performance throughout program phases ($p = 0.000^{**}$).

In addition to, the table shows that there was a highly statistically significant improvement in intern-nurses' total attitude toward electronic health records software scores in relation to total discomfort and total insecurity at pre- program phase (before intervention) (3.88 ± 3.67 & 4.71 ± 3.42) respectively and it improved at immediate post program implementation phase and follow-up phase of the program to (10.21 ± 4.25 & 11.56 ± 4.08) respectively.

Table (5): Displays that there was a highly statistically significant positive correlation among intern-nurses' total knowledge, technological skills and attitude toward electronic health record software at pre-program, immediate post and follow up program implementation phases. This means that intern-nurses' knowledge regarding EHRs has been increased, then their technological skills has been improved and accordingly their attitude toward electronic health record software has been increased.

Figure (1): Illustrates that half of intern-nurses (50.0%) had positive feeling level toward AMDs utilization in clinical practice

and one third of them (30.0%) had strongly positive feeling level toward AMDs utilization in clinical practice. While fifth of them (20.0%) had negative feeling level toward AMDs utilization in clinical practice

Figure (2): Indicates that there was a highly statistical significant improvement in knowledge levels regarding electronic health records software after intervention both post and follow up phases after three months of program from the preprogram phase. The majority of intern-nurses (78.3 %) had inadequate knowledge scores about electronic health records software utilization in clinical practice at pre-program implementation phase before intervention. While the highest percent of them (90%) had adequate knowledge scores about electronic health records software utilization in clinical practice at immediate post program implementation phase

Figure (3): Shows that there was a highly statistical significant improvement in intern-nurses' total technological skills required for using electronic health records software after intervention both post and follow up phases after three months of program from the preprogram phase. Moreover, nearly two thirds of intern-nurses (58.3 %) had low technological skills level at pre-program implementation phase before intervention. While the majority of intern - nurses had high technological skills level at follow up phase and immediately post-program implementation phase (83.3% & 76.6%) respectively.

Figure (4): Illustrates that there was a highly statistical significant improvement intern-nurses' attitude toward electronic health records software level after intervention for both post and follow up phases after three months of program from the preprogram phase. More than half of intern-nurses (55.0 %) had a negative attitude toward electronic

**Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using
Advanced Mobile Devices**

health records software at pre-program implementation phase before intervention. While the highest percentage of intern - nurses had a positive attitude toward electronic health records software at follow up and immediately post-program implementation phases (86.7% & 85.0%) respectively.

Table (1): Frequency distribution of studied intern-nurses personal data regarding personal characteristics (No= 60)

Personal characteristics	No	%
Age		
Less than 22	26	43.3
More than 22	34	56.7
Mean \pm SD 22.33 \pm .54		
Gender		
Male	12	20.0
Female	48	80.0
Marital status		
Single	46	76.7
Married with children	8	13.3
Married without children	6	10.0
Place of living (residence)		
Urban	6	10.0
Rural	54	90.0
Pre-university education		
Secondary school	41	68.3
Technical nursing diploma	19	31.7
Do you have a computer		
No	17	28.3
Yes	43	71.7
Have Medical Apps installed on your mobile device?		
No	0	0.0
Yes	60	100.0
Do you think hospital employers should establish policy for personal communication devices use?		
No	10	16.7
Yes	50	83.3

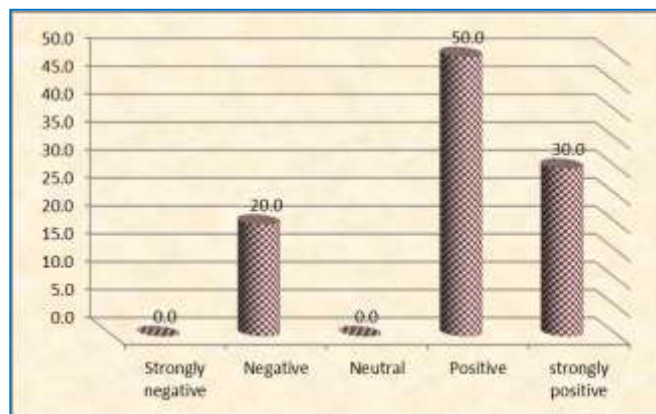


Fig1: Percentage distribution of intern-nurses' feeling levels toward AMDs utilization in clinical practice

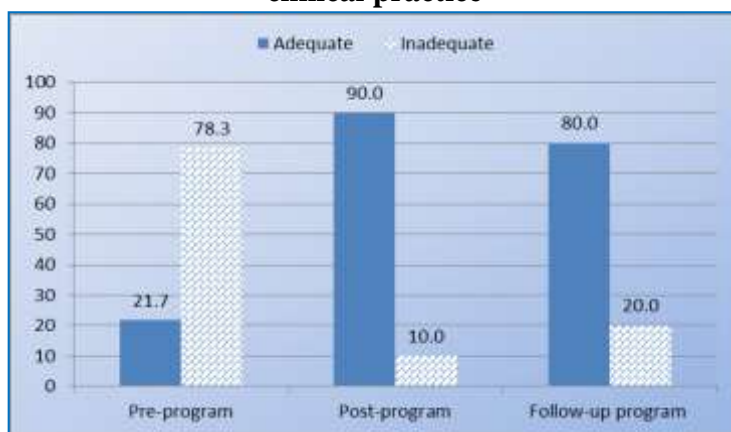


Fig2: Percentage distribution of the Studied intern-nurses' total knowledge levels regarding electronic health records software throughout the program phases

Table (2): Comparisons of studied intern-nurses' total knowledge scores about electronic health records software throughout the program phases (No= 60)

Dimensions of knowledge	Maximum score	Program phases					Mean percent	Paired t test (1)	Paired t test (2)	Paired t test (3)
		Pre program	Mean percent	Immediate post program	Mean percent	Follow up program				
No= (60)										
Nursing informatics	29	10.58±5.98	36.48	22.30±4.87	76.89	19.88±6.95	68.55	21.762*	4.913*	13.394*
Advanced mobile devices	22	12.76±6.12	58	19.50±3.39	88.63	17.91±4.88	81.40	10.647*	3.600*	9.085**
Electronic health records	41	16.60±1.067	40.48	33.31±8.45	81.24	30.13±1.066	73.48	13.905*	4.324*	10.868*
Total scores	92	39.95±2.161	43.42	75.11±15.24	81.64	67.93±2.120	73.83	17.971*	4.566*	13.325*

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

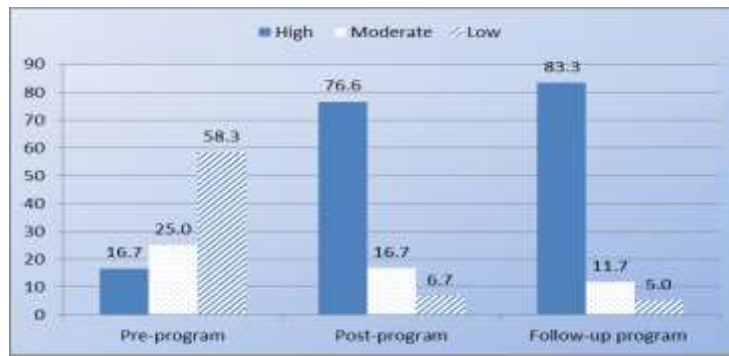


Fig3: Percentage distribution of the Studied intern-nurses' total technological skills required for using electronic health record software through the program phases

Table (3): Comparisons of studied intern-nurses' total required technological skills scores for using electronic health records software through the program phases (No= 60)

Technological skills dimensions	Maximum score	Program phases						Paired t test (1)	Paired t test (2)	Paired t test (3)
		Pre program	Mean percent	Immediate post program	Mean percent	Follow up program	Mean percent			
No= (60)										
Technological skills required for using EHRs	50	18.91±9.53	37.82	42.23±8.82	84.46	43.10±8.22	86.2	21.070**	2.963*	16.119*
Informatics literacy & management skills	12	2.20±2.29	18.33	11.46±2.01	95.5	11.46±2.01	95.5	27.305**	-/-	21.262*
Total Technological skills	62	21.11±11.40	34.04	53.70±10.37	86.61	54.56±9.79	88.0	23.989**	2.963*	18.280*
Actual performance(data entry)	28	16.73±4.83	59.75	25.76±4.64	91.92	26.13±4.04	93.32	15.166**	2.120*	12.788*
Total scores	90	37.85±15.37	42.05	79.46±14.47	88.28	80.70±13.12	89.66	23.855**	2.999*	24.583*

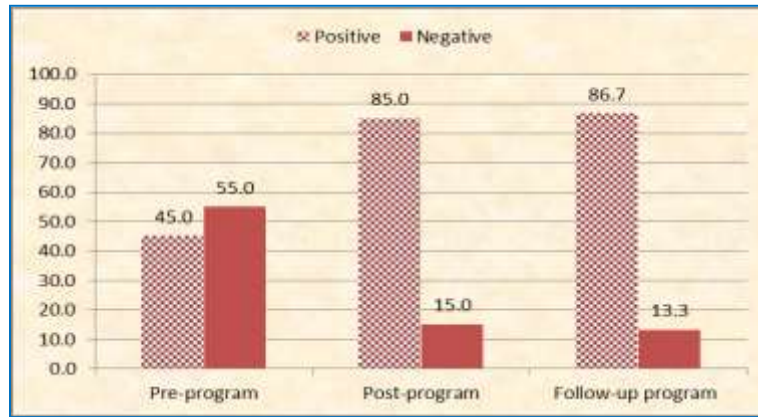


Fig 4: Percentage distribution of the Studied intern-nurses' total attitude toward electronic health records software through the program phases

Table (4): Comparisons of studied intern-nurses' total attitude scores toward electronic health records software through the program phases (No= 60)

Dimensions of attitude	Maximum score	Program phases						Paired t test (1)	Paired t test (2)	Paired t test (3)
		Pre program	Mean percent	Immediate post program	Mean percent	Follow up program	Mean percent			
				No= (60)						
Total optimism	14	6.43±4.57	45.92	11.36±3.1 6	81.14	11.70±2.8 6	83.57	10.749*	2.824*	11.053**
Total innovation	14	7.90±3.19	56.42	13.03±1.8 3	93.07	13.31±1.4 6	95.07	14.645*	2.481*	14.521**
Total discomfort	14	3.88±3.67	27.71	10.21±4.2 5	72.92	10.21±4.2 5	72.92	12.693**/	-/-	12.693*
Total insecurity	18	4.71±3.42	26.16	11.56±4.0 8	64.22	11.56±4.0 8	64.22	20.286**	-/-	20.286*
Total usefulness	36	23.58±8.7 2	65.5	33.76±4.4 7	93.77	34.21±3.5 8	95.02	12.010*	2.025*	11.868**
Total satisfaction	40	26.10±10.61	65.25	37.23±8.0 8	93.07	38.30±5.9 5	95.75	8.492**	1.720*	9.403**
Total access to information	22	11.46±5.8 7	52.09	17.43±6.9 3	79.22	18.03±6.1 5	81.95	8.272**	2.497*	9.306**
Total preferences	14	6.73±5.52	48.07	12.93±2.9 3	92.35	13.50±2.1 8	96.42	9.050**	2.129*	9.472**
Total scores	172	90.8140.79	52.79	147.5532.0 6	85.78	150.8526.2 9	87.70	14.471*	2.289*	15.235**

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

Table 5: Correlation matrix between studied variables of intern-nurses (total knowledge, skills and attitude) through the program phases

Studied variables	Intern-nurses								
	Pre-program (N= 60)			Post-program (N= 60)			Follow up (N= 60)		
	Knowledge	Skills	Attitude	Knowledge	Skills	Attitude	Knowledge	Skills	Attitude
Knowledge	1	.805**	.784**	1	.895**	.786**	1	.652**	.618*
P value	---	.000	.000	----	.000	.000	-----	.000	.000
Technological skills and data entry	.805**	1	.749**	.895**	1	.863**	.652**	1	.862**
P value	.000	-----	.000	.000	----	.000	.000	-----	.000
Attitude	.784**	.749**	1	.786**	.863**	1	.618**	.862**	1
P value	.000	.000	-----	.000	.000	-----	.000	.000	-----

Discussion

The present technology era has been expanded to every domain tremendously, including health care, education, business, customer relationship management, marketing, project management. In health care domain among the nursing personal, there is great concern over increasing the speed and accuracy with which the patients are treated. All over the world the details about patients and their disease related data can be managed reliably and keep available for required treatment. Hence it has become mandatory for medical organizations maintain records in electronic form. The healthcare industry has also started looking at cloud computing with a greater interest as it makes available huge amount of secured data and that too in a fraction of seconds (Jagli, Purohit, & Chandra, 2017).

The importance of the availability of timely medical information for health care professionals to optimize diagnosis and the clinical decision process to determine treatment has been well-documented. With

the advancement of digital technologies, electronic medical records (EMRs) have emerged as the preferred method for recording, storing, retrieving and collating health and medical information. The potential advantages of EMR have been widely recognized. EMRs are the electronic format of medical records that replace traditional paper based medical records used by the health professionals (Samadbeik, et al., 2020)

Regarding to the personal characteristics of intern-nurses, the findings of the present study revealed that more than half of intern-nurses had age more than 22 years old with Mean ± SD (22.33±.54), the majority of them were female, and more than three quarters of them were single and are living at rural areas.

The result of the present study was consistent with Chan, et al., (2020) as they found that the majority of the respondents were females with an average age of 22.3 years.

As regarding to **intern-nurses' feeling levels toward AMDs utilization in clinical practice** the findings of the present study illustrated that half of intern-nurses had

positive feeling toward AMDs utilization in clinical practice and one third of them had strongly positive feeling toward AMDs utilization in clinical practice. While fifth of them had negative feeling toward AMDs utilization in clinical practice. This might be due to that mobile technologies have been developed and trialed in nursing education as a way to provide better access to quality educational material that is accessible anywhere and anytime.

This result was in agreement with **De Groot, (2020)** who reported that most of the study participants had slightly positive feeling and more than one third of them had strongly positive feeling toward AMDs utilization in nursing care

Concerning intern-nurses' knowledge regarding electronic health records software the findings of the present study indicated that there were a highly significant improvement in knowledge levels regarding electronic health records software after intervention both post and follow up phases after three months of program from the preprogram phase. From the researcher point of view this result may be due to using an AEHR helps “create a technology rich learning environment for students, exposing them to evidence-based practice, standardized nursing language, and informatics competencies and the researcher ability to diversify in communicating content with the use of different educational methods and utilization of such advanced mobile devices as these generations are very passionate about AMDs and any way of modern technology.

This finding is supported by **Jenkins, et al., (2018)** as they stated that the benefits to nursing faculty of implementing an AEHR are found in the type of learning that takes place when students interact with this technology and found that students using an AEHR were constructing their own knowledge by learning

from clinical cases, learning by analyzing clinical problems, and learning in a collaborative manner.

In the same line **VanLangen, et al., (2020)** and **Fennelly, et al., (2020)** as they reported that Academic EHRs are an important addition to the nursing curriculum. Exposure to this technology throughout professional education allows nursing student to begin acquiring knowledge and skills related to health informatics in order to be an effective member of the healthcare team.

The findings of current study indicated that there was a highly significant improvement in intern-nurses' technological skills for using electronic health records software after intervention both post and follow up phases after three months of program from the preprogram phase.

From researcher point of view From researcher point of view this improvement may be due to application of EHRs software by using advanced mobile devices for intern-nurses and teaching them how to send an email with attachment, use search engine & accessing the internet, enter her or his email and his password, move between EHRs different sheet, enter complete and accurate data quickly with allowed time, save the entered data and can recall the folders at next time all of this making the students deal more with PDAs and technological issues.

In addition to , this improvement in the performance of the intern-nurses could have resulted from their readiness to learning new skills to facilitate their work and increases their efficacy as after their graduation they may be wok in hospital use such this system at this time they already receive an experience which make them more confident and proficient. While the increase that occurred in skills scores at the follow-up phase could be explained in the light of appearance of corona virus as it has forced a sudden migration to

Designing and Implementing Electronic Health Records Software for Intern-Nurses by Using Advanced Mobile Devices

online learning by using either desktop computers or handheld computers and activating blended learning. As the pandemic accelerated, colleges shifted into emergency mode, shutting down campuses in an effort to prevent the spread of COVID-19. All of this makes intern-nurses more skilled.

The foregoing findings were in agreement with **Bowling, (2016)** who showed that there was an increase in electronic documentation skill performance. All students rated the ease of completing the electronic documentation systems as very easy and easy.

In this regard, **Samadbeik, et al., (2020)** they reported that there is an improvement in EMR proficiency and technical skill of nursing intern after implementation of mobile AEMR academic EHR.

The result of present study illustrated that there was a highly significant improvement intern-nurses' attitude toward EHRs software level after intervention for both post and follow up phases after three months of program from the preprogram phase. Additionally more than half of intern-nurses had a negative attitude toward electronic health records software at pre-program implementation phase before intervention.

From the researcher point of view this may be due to intern-nurses during their academic training they already saw paper documentation and how it consume nursing staff time not only this but also patient ticket is not organized, in some time nurses leave the patient ticket on the counter and thus threatening the patient's privacy and nurses consume a great time in documentation and not have enough time to stay with patient but after implementing the EHRs software program they notice the big difference between it and paper documentation in terms

of the organization, saving time and effort as result nurses will have enough time to stay with patient and maintain patient privacy.

This result of the present study was matched with **Secginli, Erdogan & Monsen, (2014)** as they found that overall positive attitudes towards EHRs among primary care health professionals. In the same line **Kipturgo et al., (2014)** as they reported that nurses had a favorable and positive attitude towards computerization and other computing system and tend to become ready to use computing systems in clinical practice. In addition to **Wesam, et al., (2016)** they reported that the nurse's overall readiness toward EHRs is considered at a high level.

The foregoing findings were in agreement with **Olok, Yagos, & Ovuga, (2015)** they reported that majority of healthcare team had positive attitudes towards e-health attributes. The level of skills was moderate and **Dhopeshwarkar, Kern, & O'Donnell (2012)** they found that respondents were generally comfortable with storage of information on a single, central database that can be accessed over a secure password-protected connection. Moreover **Andrew, Taylorson, Langille (2018)** they reported that the majority of participants enjoy using technology, believe it is useful for learning and their future jobs.

Findings of the present displayed that there was a highly Statistically significant positive correlation between intern-nurses' technological skills required for using electronic health record software with their knowledge at pre- program, immediate post and follow up program implementation phases Also, there was a highly Statistically significant positive correlation between intern-nurses' attitude toward using electronic health record software with their knowledge

at pre- program, immediate post and follow up program implementation phases.

The result of the present study was in accordance with **Olok, Yagos, & Ovuga, (2015)** as they reported that there is positive correlation between intern-nurses attitude toward EHRs with AMDs and their skills and **Mijin, Jang, Choi, & Khongorzul, (2019)** as they found that there is a positive relationship between perceived ease of use and perceived usefulness and attitude and knowledge.

Conclusion

Implementing electronic health records (EHRs) software was effective. The highest percent of intern-nurses had adequate knowledge scores about EHRs at immediately post-program implementation phase, the majority of them had high technological skills level required for using EHRs, and positive attitude toward EHRs at follow up and immediately post-program from the preprogram implementation phases. There was highly statistically significant positive correlation among intern-nurses' knowledge regarding EHRs software with their technological skills required for toward using EHRs software, with total performance scores and attitude toward EHRs software at pre-program, immediate post and follow up program implementation phases.

Recommendation:

- The hospital administration should take the necessary steps to develop proper ICT infrastructure required for EHRs records utilization with AMDs in clinical practice.
- Academic nurse leaders should establish nursing informatics skills for nursing students and nurses by continuing education, training and classroom teaching with practical classes. Also need to integrate IT based NI into the nursing theory and practical session in order to improve nursing informatics skills and

address unwarranted variations and enhance outcome.

- Nursing students had a positive attitude about EHRs software, so in order to make more use of this software in providing qualitative care to the patients, using this software in the areas of teaching, research and clinical practice of students is recommended.

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تصميم وتنفيذ برنامج الكترونى للسجلات الصحية لمرضى الامتياز باستخدام الاجهزة النقالة المتطورة

سماح السيد راشد- نرمين محمد عيد - هويدا حسن السيد

اليوم هو عصر تكنولوجيا المعلومات التي غيرت كل مجالات الحياة والعمل حيث تلعب المعلومات دورا كبيرا في جميع مجالات الحياة . وخاصة في نظم الإدارة الصحية فإن المعلومات لها دور خاص في التخطيط والتدريب والتقييم والجوانب القانونية والبحوث. لذا هدفت هذه الدراسة تصميم وتنفيذ برنامج الكترونى للسجلات الصحية لمرضى الامتياز باستخدام الاجهزة النقالة المتطورة وقد أجريت هذه الدراسة على ٦٠ من مرضى الامتياز المتدربين بمستشفى بنها الجامعى فى الأقسام المختلفة التى يتدرب بها مرضى الإمتياز. حيث أظهرت النتائج بوجود علاقة إيجابية ذات دلالة إحصائية عالية بين المعرفة الكلية للممرضات المتدربات فيما يتعلق ببرنامج سجلات الصحة الإلكترونية مع مهاراتهم التكنولوجية المطلوبة لاستخدام برنامج سجلات الصحة الإلكترونية ، مع الأداء واجاههم نحو برنامج سجلات الصحة الإلكترونية في مرحلة ما قبل البرنامج وبعد تنفيذ البرنامج مباشرة و ما بعد البرنامج بثلاث أشهر. وقد اوصت الدراسة بأنه يجب على إدارة المستشفى أن تتخذ الخطوات اللازمة لتطوير البنية التحتية المناسبة لتكنولوجيا الاتصالات والمعلومات المطلوبة لاستخدام السجلات الصحية الإلكترونية في الممارسة السريرية والتقديم التدريجي لنظام برمجيات السجلات الصحية الإلكترونية في المستشفى العام.