ORIGINAL RESEARCH

Facilitating adoption of informatics and meaningful use of electronic health records with nursing faculty

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Abstract

Objective: This educational development project focused on increasing nursing faculty adoption of informatics and nursing student use of electronic health records (EHRs) to foster meaningful use in an academic setting. The primary aims of the project were: to increase knowledge, skills, and attitudes (KSA) of nursing faculty about informatics and EHRs; and to increase student use of EHRs in on-campus labs. The secondary goal was to enhance faculty adoption and pedagogical incorporation of informatics into the nursing curriculum.

Methods: A one-group pre-test/post-test program evaluation design was used to survey the impact of a series of seminars and national consultants' presentations to faculty regarding their knowledge, skills, and attitudes about informatics and the use of EHRs. This project occurred over an academic year at a health science center school of nursing.

Results: Pre/post matched pair means survey scores showed faculty experienced an increase in both knowledge and skills about informatics and technologies, and had slightly more favorable attitudes about EHRs and informatics at year end. Nursing student use of EHRs in the clinical laboratory also increased. Limitations to this small scale evaluation pilot were survey design and need for more intensive education with a specific informatics/EHR content-focused faculty task force.

Conclusions: Nursing faculty adoption of informatics and early meaningful use of EHRs requires organizational responsiveness, faculty incentives, equipment purchases, and expert consultants to foster faculty development and student learning in state-of-the-art on-campus labs. Replication of this program development would benefit other schools of nursing.

Key Words: Electronic health records, Meaningful use, Nursing informatics

1 Introduction

As a result of the American Reinvestment and Recovery Act (ARRA) enacted on February 17, 2009, the Health Information Technology for Economic and Clinical Health (HITECH) Act was created. The HITECH Act supports infrastructure development of seamless electronic health records (EHR) - meaningful use (MU), an effort spearheaded by the Centers for Medicare & Medicaid Services (CMS) and the Office of the National Coordinator for Health IT (ONC). Through ARRA, numerous national and regional HITECH programs offered technical support and workforce training on meaningful use of EHRs.[1]

Meaningful use is defined as the use of certified EHR technology in a meaningful manner such as electronic prescribing. It ensures the certified EHR technology is connected for a seamless electronic exchange of health information to improve the quality of patient care. MU is built around

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an incentive model providing payments of $44,000 over five years for the Medicare providers and $63,750 over six years for Medicaid providers starting in 2011.[2] Eligible Professionals, including physicians, nurse practitioners and certified nurse midwives[2] or Eligible Hospitals, must demonstrate they have adopted, implemented, or upgraded certified EHR technology. MU has three phases which span 2011 (data capture and sharing), 2013 (advanced clinical processes), and 2015 (improved outcomes).[3] Three inherent information benefits of MU include completeness/accuracy, enhanced provider accessibility and knowledgeable patients.

With EHR mandates, higher patient acuity, shorter stays in hospitals, and what sometimes seems like a tsunami of patient data, nurses must be ready to make critical, life-saving decisions. EHRs are a twenty-first century tool developed for addressing this challenge. Combining information processing with technology in clinical decision-making is now an integral part of every nurse's reality. From a nursing perspective, nurses are the fleet of professionals across the nation and the globe that are the first-line caregivers for many patients in primary, acute and long term care settings. Availing robust patient information to nurses through an EHR can define safe and quality care, as well as being a fulcrum for patient education; it can also help deter errors by having on-hand point-of-care information about a patient that is accurate, comprehensive and current. An EHR potentially saves time from flipping through pages of forms or medical records during a patient visit; instead it provides real-time "click" access to a patient's health care data. If more than one health care entity or system shares the same EHR platform, or is able to transmit and receive information from a different EHR platform, then there is perceived improved quality of care by the ability to share patient health information across disciplines and settings.[4] However, many nurses and most nursing faculty lack the necessary education and preparation to apply nursing informatics and use e-health technology such as EHRs to improve patient outcomes and student learning, despite federal mandates with companion incentives.[5]

The adoption of EHRs allows multidisciplinary health care team members', such as physicians, nurses, pharmacists and other allied health professionals, access to a patient's comprehensive health record. Having electronic, seamless, ubiquitous access through an EHR on behalf of a patient in any health care setting will allow tangible data, whether basic or comprehensive, to augment improved clinical decision making for a patient's current health care need, while comparing to the patient's health history and documented longitudinal data. In emergent situations, having real-time information, such as a patient's allergies and present medications, can figuratively change a person's life. When managing a patient's chronic health issues, a compendium of his or her health information over extended time allows for more efficient, effective and cost savings care.

The U.S. Department of Veterans Affairs was the first to adopt a form of EHR. They reported over $4.64 billion savings by 2010 through preventing adverse drug events alone.[4] In 2008 only 13.4 percent of non-federal acute care hospitals in the United States had adopted a basic EHR; in 2011 that number grew to 34.8 percent of hospitals. The percentage of acute care hospitals adopting an EHR system had increased by 82 percent between 2010 and 2011.[6] By year end of 2013, 80 percent of eligible hospitals and 50 percent of doctor offices had EHRs according to Health and Human Services.[7] Today the number continues to grow, and now includes long term care facilities that are beginning to integrate EHR systems. They too are finding similar positive outcomes in terms of cost avoidance with increased documentation accuracy.[8] EHRs are projected to save tens of billions of dollars annually once fully implemented.[9]

However, readiness to learn about informatics and how to use EHRs varies with generations of health care providers, particularly nurses.[10] Most young nursing students and registered nurses have grown up using hand-held mobile and computer devices. These young professionals are typically early adopters or digital natives of hospital technology while many more mature nursing faculty and clinical nurses tend to be slower technology adopters or digital immigrants. Additional education both in the workplace and in formal programs of education beyond the associate degree is related to satisfaction with and competency in nursing informatics.[11] As e-health technologies evolve and care is increasingly more complex, education about informatics and EHRs for nurses, the largest group of health care providers, is paramount.

Academic practice partnerships are the transformative model of the future. Blending federal mandates and policies imposed on practice settings into academia is a critical and responsive method to reach and educate the future nursing workforce. When federal mandates impact patient care and subsequently nursing student learning in clinical practicum settings, faculty have an obligation to incorporate this information into the curriculum. Pedagogical teaching/learning strategies and curricula can then be revised to incorporate EHRs and to measure how they have been adopted, implemented, and upgraded in on-campus clinical labs.

This manuscript describes an educational project focused on increasing nursing faculty adoption of informatics and nursing student use of EHRs to achieve a level of meaningful use in an academic nursing school and in practice arenas. The objective was to improve the quality of faculty teaching related to nursing informatics and augment student learning and access to EHRs through on-campus learning. The specific aims were: to increase knowledge, skills, and attitudes of nursing faculty about informatics and EHRs; and to increase the use of EHRs by students in on-campus labs.

1.1 Overview of electronic health records

The idea of documenting health or medical issues and referring to this information dates back to the fifth century B.C. when Hippocrates created the first medical record with the goals of accurately reflecting the course of disease and determining the probable cause of disease.[12] To no surprise to nurses, Florence Nightingale also documented extensively about patient disease cases and necessary medical supplies in her journals and was touted as a thorough statistician, researcher and epidemiologist.

As early as the 1960s, the first EHRs appeared in academic medical centers. EHRs in their basic form have four standard clinical components: (1) order entry with alerts, evidence based order sets, and adverse drug events; (2) review of results for lab values, diagnostic tests, medications, and care plans; (3) documentation of assessments, education, medication administration, care plans, and flow sheets; and (4) care management including referrals, scheduling, and/or patient disease registry.[13] There are more comprehensive forms of EHRs available that include advance directives, consultations requests, and radiology images that provide an even greater integrated decision support program.[6] EHRs provide the distinct capability to mine and manage extensive clinical data and evidence to alert nurses, physicians, and other health care professionals to complex health care problems for patients with multiple organ involvement, numerous medications, and/or abnormal laboratory values[14, 15] particularly across disciplines.[16] The expected overall outcome with EHR use is improved clinical decision making resulting in safe and quality patient care.

Evidence of the impact of EHRs on patient outcomes is mounting across the nation and the globe. Florida hospitals found value in standardizing patient care systems with EHRs.[17] In more than 300 California general acute hospitals, EHRs increased nurse staffing levels during implementation, but subsequently decreased nurse cost per hour and had a significant positive effect on patient sensitive outcomes including decreased mortalities.[18] Given nurses spend more than a third of their time with documentation, EHRs use informatics to provide a significant perceived benefit.[19] In one Midwest state with four hospitals, nearly 600 nurses from eight medical surgical units had a 100% nurse adoption of meaningful use of a web based plan of care (POC) EHR system. They created an extensive database of over 40,000 care episodes; reliability for use of standardized terms during POCs was moderate in magnitude.[20] In four other Midwest hospitals, nurses identified that the early-model EHRs had inadequate data and inconsistent standardized nomenclature during the process to achieve EHR meaningful use as it is defined present day. Similarly in Sweden, a significant knowledge gap with use of a universal standardized taxonomy and local clinical relevance was noted in electronic patient records (EPRs).[21] Another gap noted was nurses' EHR data from nursing flow charts and forms have been sparingly reviewed by other non-nurse providers.[22] In addition, bits of health information obtained still lack clinical logic to create relevant and useful information and data points to be leveraged for safe and quality nursing care.[5]

1.2 Professional organizational standards

Preparing 21st century nurses with the knowledge, skills, and attitudes (KSAs) to provide safe, quality patient care and to be valued for nursing's ongoing contribution to informatics and EHRs is critical.[23] The American Association of Colleges of Nursing (AACN)[24] and the Robert Wood Johnson Foundation (RWJF) have lead the Quality and Safety Education for Nurses (QSEN) national initiative for nursing faculty to effectively develop graduates with KSAs to deliver safe, effective care quality, especially for entry roles. This initiative embraces informatics as one strategy to achieve that end through "the use of information and technology to communicate, manage knowledge, mitigate error, and support decision making".[23]

The term informatics was derived from the French word "informatique" meaning the automation of computers, technology, information, data, communication, and language.[25] Informatics should not be confused with technology; rather it is a specialty information science that results in sound clinical decision making through information structures, processes, and technologies to mine extensive data for better patient outcomes.[26] Technologies such as electronic health records EHRs are tools to apply informatics.

In addition, to QSEN, other national nursing organizations espouse the value of informatics. The American Association of Colleges of Nursing (AACN)[27] *2008 Essentials of Baccalaureate Education for Professional Nursing Practice*, specifically Essential IV, focuses on the knowledge and skills in information management and patient care technology that are critical in the delivery of quality patient care. The *2011 Essentials of Master's Education for Nursing and the 2006 Essentials of Doctoral Education for Advanced Nursing Practice* likewise integrate informatics and health information management through telecommunication technologies as critical content. The AACN Master's Essentials specify that informatics and healthcare technologies encompass five broad areas:

- Use of patient care and other technologies to deliver and enhance care;
- Communication technologies to integrate and coordinate care;
- Data management to analyze and improve outcomes of care;
- Health information management for evidence-based care and health education;
- Facilitation and use of electronic health records to improve patient care.[28]

Similarly, the American Nurses Association[29] and the National League for Nursing[30] build on the Technology Informatics Guiding Education Reform (TIGER) Initiative. TIGER's vision is to "enable nurses and interprofessional colleagues to use informatics and emerging technologies to make healthcare safer, more effective, efficient, patient-centered, timely and equitable by interweaving evidence and technology seamlessly into practice, education and research fostering a learning healthcare system".[12] Numerous nursing organizations are promoting the same essential and necessary content for future health care.

At this time of vast and dynamic changes in health care and professional organizational standards, it is imperative all faculty in the health care professional schools, including nursing, remain informed about these regulated health care changes. Students need to be taught about these changes so they are equipped and job ready to enter the workforce. Nurses in clinical arenas must be able to use EHRs and to apply informatics to practice. Anecdotal data from faculty and students revealed that HIPAA patient privacy regulations and policies of numerous area hospitals, along with high volumes of students needing clinical practicum sites, impeded student access and use of in-patient EHRs during adoption periods. This information also provided the impetus for implementation of this project.

2 Methods

2.1 Design and sample

A computer-based search of several literature databases–CINAHL and Medline/Ovid–was conducted using the following keywords: nursing informatics, EHRs, and meaningful use. More than 50 articles were identified, of which 26 met criteria for inclusion in this review. Inclusion criteria were: (1) at least one outcome variable focused on federal regulations relative to EHR adoption; (2) at least one operational definition of nursing informatics; (3) at least one relative clinical application of meaningful use with EHRs; and (4) published in English between 2006 and 2014. In addition, 15 credible organizations' web links were referenced.

A one-group pre-test/post-test program evaluation design was used to evaluate the impact of the educational project on faculty knowledge, skills, and attitudes about informatics and the use of EHRs. Thirty-one of the 46 (67%) full-time faculty enrolled in the project. Baseline survey data were collected prior to project implementation at the beginning of the academic year in the fall semester; 31 faculty members initially participated. Post-test data were collected at the conclusion of the project in spring semester; 27 faculty members completed the post-test survey. Attrition of four faculty was related to other previously assigned workload demands.

2.2 Measures

A 14-item survey (see Table 1) was developed by a four-member faculty development project team. A certified nurse informaticist led the identification of essential content to be surveyed and taught.

This advanced practice registered nurse was employed at the university hospital as the infection control nurse practitioner and also taught the graduate nursing course in informatics. In developing the survey, the experience of the faculty, their current use of technology in the classrooms and on-campus clinical labs, and their perception of informatics were given careful consideration. The intent of the survey was to capture pre- and post-program knowledge, skills and attitudes about informatics and EHRs. Reliability and validity tests of the developed survey were not evaluated in this pilot project.

Table 1: Nursing faculty perceptions of knowledge, skills, and attitudes about informatics and EHRs

Pre- and Post-Survey Items	Pre-Survey (n = 27) Mean (SD)	Post-Survey (n = 27) Mean (SD)
1. I can easily use all types of technology.	3.0 (0.7)	3.5 (0.6)
2. Computers, in general, are user-friendly.	3.3 (0.8)	3.7 (0.5)
3. I can easily troubleshoot problems on my computer.	2.8 (0.6)	3.1 (0.8)
4. I have a good awareness of different computer operating systems.	2.3 (0.9)	2.9 (0.8)
5. I can easily identify a Clinical Decision Support System.	2.0 (0.8)	2.7 (1.0)
6. I have a good understanding of an electronic health record.	2.7 (0.8)	3.0 (0.9)
7. I have a workable definition of informatics.	3.0 (0.6)	3.6 (0.6)
8. I am knowledgeable of healthcare informatics.	2.8 (0.6)	3.3 (0.7)
9. I have a good understanding of the competencies for nursing informatics.	2.5 (0.8)	3.5 (0.6)
10. Health literacy is a subject with which I am very familiar.	3.0 (0.8)	3.3 (0.6)
11. Nursing informatics competencies are important to me.	3.4 (0.7)	3.6 (0.6)
12. I understand how to integrate nursing informatics into my curricula.	2.5 (0.8)	3.3 (0.6)
13. Standardized data sets are necessary for nursing documentation.	3.0 (0.7)	3.4 (0.6)
14. I understand the core concepts of nursing informatics.	2.7 (0.7)	3.4 (0.6)
Overall mean scores	**2.8 (0.7)**	**3.3 (0.7)**

The survey measured knowledge, skills, and attitudes about informatics and EHRs. Items 6, 7, 8, 9, 12, and 14 measured knowledge; items 1, 3, 5, and 13 assessed skills; and items 2, 4, 10, and 11 evaluated attitudes. Assessment of knowledge questions was broad and included EHR, nursing informatics, and healthcare informatics. Assessment of skills relevant to nursing informatics and EHRs varied and ranged from very basic to more complex. The questions were subjective and actual skills were not validated; however, their relevancy was affirmed in task force review of pre-test responses prior to developing the educational sessions and in the phone conferences with all three external consultants. Lastly, assessment of attitudes about informatics and EHRs were addressed with questions specifically targeting the personal or emotional aspect associated with technology. Assessment of attitudes toward computers and informatics was an essential part of the survey.

The EHR was addressed in item 6 and indirectly assessed in several other items. Use of the EHR is more than an understanding through knowledge; it is the goal of developing the future nursing workforce to be able to effectively use an EHR. The survey incorporated enough concept specific questions to determine future educational needs for this project including the EHR.

Response options for the Likert-scale survey items ranged from 1 *strongly disagree* to 5 *strongly agree*. Individual item responses of each participant were compared pre- and post-project implementation. The parametric paired t-test for 27 faculty responses was used to measure differences in item means from pre- to post-survey and to determine if the summary pre- and post-survey score means differed significantly.

2.3 Development and implementation of the educational program

As planning of the educational program progressed, two additional undergraduate faculty from the school, the school's information technology staff specialist, and several nursing practice partners from the university hospital formed a technology teaching task force. No graduate faculty volunteered. The task force developed the program using the baseline data and incorporated key concepts from the TIGER initiative.

Recognizing the limitations of the 9-month pilot study period and available resources, the task force elected to design and implement an educational program with guidance from the local content expert around the first three of the four TIGER guiding topics which included: (1) informatics competencies; (2) education and faculty development; (3) staff development; and (4) leadership development. Six topical sessions offered over nine hours (see Table 2) were presented to faculty over a nine-month academic year; three additional hours were available for one-on-one or small group consultation.

Table 2: Faculty development sessions on informatics and EHRs

Topic	Number of Attendees
Navigating through Nursing Informatics: Technology, Processes and Systems (1 hour)	28
Frequently Asked Questions for iPad Use (1 hour)	29
Consultant #1: Informatics Tools for Improving the Future of Nursing (3 hours) and Curriculum Gap Analyses (2 hours)	31 (+ 30 nurses, other faculty, IT/ community members)
Security, Sim Lab Planning, and Sharing Session	30
Consultants #2 and #3: Synthesizing Informatics in Pedagogy and Practice (3 hours) Individual/small group consultation (2 hours)	31 (+30 nurses, other faculty, IT/ community members)
Tech Tips, Best Apps for Faculty and Teaching, Integrating EHRs into Clinical Lab Teaching (1 hour)	24

The task force sought additional content expert consultation from three national nursing experts in informatics. Phone conferences were held with the consultants prior to their on-campus visits to provide baseline data about the faculty knowledge, skills, and attitudes. Two all-day consultation sessions were scheduled by the task force to accommodate faculty. The first consultation session covered the macro perspective on informatics. The second session provided more information related to faculty teaching and hands-on student learning with EHRs and novel simulation pedagogies. Continuing education units were also provided at each session; the sessions were also stored on Tegrity for later viewing. The consultants' presentations were open to the nursing staff of the practice partners which accounts for the additional numbers of attendees in Table 2.

The three national consultants were consistent in their definitions of informatics. They defined informatics as the ability to create interprofessional knowledge management through data processing that transforms information and knowledge to wisdom to afford health care providers the skill set to make quality decisions, reduce health costs, and improve patient safety and overall positive outcomes of efficiency and effectiveness.[26, 31, 32]

As part of the consultants' on-campus visits following their half-day formal presentations, the national consultants met with the faculty curriculum committees and provided one-on-one consultations with faculty for curricular revisions. They also met with hospital practice partners who were anticipating EHR rollouts and who expressed interest in gar-

nering additional knowledge about informatics. Informatics content and technologies were reinforced in the six development sessions and in committee curriculum gap analyses. The curriculum committee chair also met with project team members to clarify informatics content needed at each level of the curricula. Informatics content was subsequently integrated into undergraduate and graduate courses, aligning with AACN's *Baccalaureate and Master's Essentials*.[27]

As the faculty development sessions progressed throughout the academic year, the school's technology teaching task force researched and purchased essential equipment including 200 licenses for NurseSquared, an interactive educational EHR,[33] and 24 bedside computers with wireless communications for the undergraduate student and graduate nurse practitioner clinical learning labs. A high-fidelity METI® iStan, a high-performance patient simulator mannequin with fully articulated movements and wireless capabilities (software and interfaces made by Medical Education Technologies, Inc.)[34] and the METI Man simulator were also purchased and augmented the importation of data into the EHRs. Faculty received numerous training sessions on the new equipment offered by the nurse coordinator of the clinical lab who was an early adopter of the technology. The information technology staff specialist met one-on-one with faculty to support them in learning to effectively use the technology based on their understanding, experience, and comfort levels. Faculty were highly receptive to this one-on-one approach.

The NurseSquared software provided students with simulated electronic health records that could be customized to match patient information from faculty developed simulation scenarios, such as a middle aged patient with congestive heart failure. In addition, the software allowed for new patient records to be created and accessed by students as they progressed in the health assessment course and clinical experiences related to foundational nursing skills. Through the use of this software, students had an opportunity to gain exposure to NANDA-International's (NANDA-I) Nursing Interventions Classification (NIC) and Nursing Outcomes Classification (NOC) standardized systems. NIC and NOC are used internationally and assist in improving the effectiveness and safety of patient care through the use of standardized definitions when selecting and evaluating nursing diagnosis, interventions, and outcomes. Students' abilities to demonstrate skills in using patient technologies and standardized terminology in NurseSquared and uphold ethical standards relating to data security and patient confidentiality and privacy through password protection were all achieved, consistent with the AACN *BSN Essentials*.[35]

2.4 Procedure

The faculty development project proposal was submitted to the Institutional Review Board and received an exemption certification. All nursing faculty who elected to enroll in this project were asked to complete pre- and post-project implementation surveys. Participation was voluntary. Creating a strategy for faculty buy-in and adoption was the key priority. Just as meaningful use is built around an incentive model, enrolled faculty received an incentive of an iPad to foster faculty meaningful use of technology in classroom/clinical teaching and virtual meetings. Each faculty member retained the iPad while employed at the school.

3 Results

Comparisons of the pre- and post-survey items measuring faculty perceptions of knowledge, skills, and attitudes about informatics and EHRs are reported in Table 1. Items were summed and mean scores across all 14 items were calculated. The pre-survey revealed faculty perceptions of minimum to moderate understanding of informatics, EHRs, and technologies. Knowledge did increase over the academic year as evidenced by significant increases in ratings for five of the six knowledge items. Only *understanding of electronic health records* (item 6) did not increase significantly. All four skills items and three of the four attitude items increased significantly from pre- to post-survey. It was disappointing to see that attitude item 11 *nursing informatics competencies are important to me* did not increase more significantly. Overall, favorable perceptions about informatics and the use of technology increased on mean scores for 12 of the 14 items over the course of the academic year in which the project was implemented.

Consistent faculty participation over time in the six educational sessions appeared to contribute to the majority of increased survey scores. The iPads clearly incentivized academic year-long project participation. The faculty made extensive use of their iPads to access websites regarding drug interactions and diseases and cite credible health web links or take notes in meetings. Although faculty recommended to no longer offer a stand-alone graduate course in informatics, the content is now integrated throughout many master's core and specialty courses, particularly for nurse practitioner majors. Informatics and EHRs remain integrated into the undergraduate curriculum. As a result of this educational program, three faculty were incentivized to attend the QSEN conference and summarized the patient quality and safety information at a fall faculty meeting.

All incoming upper division pre-licensure baccalaureate students were provided an eighteen-month access code for NurseSquared to use as the school's EHR over the course of their four upper division BSN semesters. Faculty began creating patient scenarios for students to use in their EHR charting throughout their course work. Students' initial exposures to using the on-campus EHRs occurred in their first semester courses where they documented health assessment data and basic nursing interventions. At the end of their first semester, the students were able to efficiently chart a com-

plete head-to-toe assessment or new admission assessment on a patient. They transferred these EHR skills, knowledge, and attitudes in their next two subsequent semesters when they took adult health and mother/baby upper division courses. By the end of their fourth upper division semester, students were able to confidently apply their EHR knowledge, skills, and attitudes in their precepted practicum capstone experience where many students had full access to the hospital EHRs. Graduate nurse practitioner students also benefited from the use of the on-campus EHRs since they will be required to use EHRs in their future practice or else experience imposed penalties for failure to adopt after 2015.

In terms of student feedback, course evaluations and anecdotal comments revealed that populating and then extracting data from on-campus lab EHRs was perceived positively since the majority of students were not provided access to hospital EHRs during clinical practicum. Students in the first semester health assessment course wherein EHRs were introduced described the course as the best one ever taken. Senior nursing students also reported satisfaction with the on-campus lab EHRs and had an improved sense of confidence with charting in their final senior clinical practicum. In general, students anticipated the on-campus lab training on EHRs would help ease the transition from the on-campus lab to the actual workplace clinical setting, requiring much less time to orient themselves to the documentation systems and thus be more job ready.

Faculty believed the application of their clinical scenarios with the use of the EHRs in the on-campus laboratory setting helped to better prepare students for actual clinical practica, although faculty still readily deferred to the clinical lab coordinator to primarily teach EHR use. The faculty recognized that some hospitals did expect students to document their nursing care activities in the EHRs at various clinical settings without much attention given to training or development of the students on EHRs in the hospital. As hospitals have transitioned to or successfully adopted EHRs, student use has been increasingly more restricted in the clinical practicum. This restriction is due in part to most nursing programs not including this type of training and education in their curriculum consistent with the hospital based EHR system. It is also a result of the increased burden on information technology departments to manage and deploy student users and meet their requirements for tracking disclosures of protected health information.

Limitations

This faculty development occurred over the course of an academic year, largely because the announcement of the one-year grant award came in early fall and the majority of faculty had contracts ending in May. This nine-month calendar clearly limited the amount of time for faculty development and consultation exposure for effective faculty learning and assimilation of the content into the curriculum. The heavy workload of the faculty and the competing academic demands of teaching, research, service and/or practice were limitations. Some attrition of faculty participants may also have contributed to limited curriculum content adoption. The findings of differences between pre- and post-program implementation are not generalizable due to the small non-random sample of this pilot project.

A recommended approach that may prove more effective for enhanced adoption outcomes in the future may be to recruit a smaller number of faculty with a programmatic focus, such as undergraduate baccalaureate courses, and offer training over a week-long intensive session, such as during fall and spring breaks. Providing even more incentives, such as other technologies beyond an iPad, and adding workload credit for a special project may prove beneficial.

Had the external content experts had more time or been paid for additional Skype consultation or YouTube sessions, the faculty outcomes may have been augmented. In addition, the survey could have been more robust and developed from a systematic literature review as compared to seeking the local and national experts' guidance on topics to be covered. To enhance the faculty utilization of the EHR with students in the labs, there may also have been value in using some grant funds to subcontract an EHR information technology trainer from the hospital to attend the faculty development sessions with EHR content and contribute to actual on-campus faculty training. This approach may have eased the personal or emotional anxieties of some faculty in learning new technologies, but may have burdened the hospital partner. Asking faculty to conduct on-campus lab return demonstrations of EHR usage prior to teaching students was not considered, as such an approach may have inhibited faculty participants in the development training and decreased buy-in for future student adoption of EHRs.

Given a no-cost grant extension was approved, this extension allowed remaining funds to be expended to purchase additional equipment. Further faculty education, systematic curricular integration and more structured student evaluation of EHR use could have also been advantageous during this additional year-long period. Design of future educational programs such as developing a specific simulated case study about pharmacologic concepts[36] may prove more effective with graduate faculty teaching nurse practitioners to enhance their engagement.

Clearly EHR meaningful use was not achieved during this one academic year faculty development project as faculty were not well versed in EHRs, and NurseSquared would not be considered a certified EHR technology. One could argue that student use of EHRs in the on-campus labs leveraged their comfort level to access and add patient data with the various EHRs to which they were exposed in a large number of clinical practica hospital settings. Hence, EHRs became more meaningful to student learning while preparing them

for a generalist entry level role. On the other hand, faculty adoption seems to be running parallel to hospital lag times during EHR rollouts.

Despite these limitations, there was definite value to this educational project. Nursing faculty would greatly benefit from replication of this type of faculty development in other schools of nursing, including smaller and private universities with schools/department of nursing. Such science would benefit all nursing faculty challenged with learning numerous technologies for future student learning.

4 Discussion

Although faculty are often hesitant to use new technologies and software, given all their other existing demands with teaching, research, scholarship, service and practice,[37] it remains imperative to be sensitive to the faculty's expert role[38] and acknowledge and respect their discipline or content specific expertise which rarely includes informatics or technologies. Faculty who participated in this project gained new knowledge, especially in informatics, but less skills related to EHRs. They did progress greatly in using iPads for their teaching, research, and service related activities. However, attitudes toward nursing informatics competencies which includes EHRs did not greatly improve.

Students, on the other hand, continued to transition more readily to adoption of the new technologies and performed more effectively in practice when they had prior experience such as documenting in EHRs from on-campus lab learning. As digital natives, their attitudes toward embracing new technologies will be expected to continue to increase in the future.

Over the students' four academic semesters in a subsequent academic year beyond the nine-month educational session, faculty observed that students demonstrated greater collaboration with their peers, faculty, and hospital nurses while using EHRs. Faculty reported that students were more familiar with the EHR layout and were more likely to request assistance when entering their own assessment findings rather than deferring to staff nurses to enter findings. Students also demonstrated increased critical thinking when applying patient data from EHRs as a result of knowledge regarding the NIC and NOC systems. These student outcomes are consistent with other schools' integration of EHRs into the curriculum[39] and with the QSEN aims.

Just as EHR adoption and meaningful use proved gradual with nursing faculty, we are reminded that the same occurs in practice. Anecdotal data from nurse practice partners conveyed adopting EHRs in practice is not a naturally smooth transition, given the demands of high patient acuity and complex disease conditions to manage, along with technology malfunctions. Readiness for adoption, systematic planning, and ongoing implementation with phased training rollouts all help to achieve the goal of meaningful use. Individual users are at different places in their learning curves. Patience, reinforcement of content and ongoing improvements are all essential throughout the full rollout. Many nurses do recognize the value of EHRs to improve patient quality and safety and build efficiencies to foster patient engagement. Information technology staff can play an integral role for adoption and to ensure privacy and security of personal health information with EHRs.

5 Conclusion

This pilot faculty development project provided an initial starting point to improve knowledge and skills of the faculty about informatics and EHRs. The faculty pedagogical and student technological generation gap must be narrowed to ensure a job-ready workforce. For schools of nursing in the academy to thrive, they must be nimble and responsive to external and internal factors. While federal mandates stimulated incorporation of EHRs and informatics into this faculty development project, meaningful use of EHRs in academic learning may not be as robust as in practice. Yet, we must strive to incorporate EHRs and informatics in academia to best prepare our students for clinical practice. Offering of faculty development topics, such as EHRs and informatics competencies, must remain balanced with the other competing demands from research, teaching, service, and practice.

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Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest statement.

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