

Facilitating Adoption of an Electronic Documentation System

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DNP Scholarly Project

Abstract

This project was a descriptive, performance improvement initiative intended to evaluate user satisfaction with the Clinical Procedure (CP) Flowsheet, an electronic documentation system. The use of a computerized documentation system has been shown to improve the accessibility, availability, completeness, and accuracy of clinical documentation. The evidence suggests that user satisfaction with information technology improves actual system use. User acceptance of the CP Flowsheet is vital to facilitate successful adoption and optimize the benefits of technology in care delivery settings. The CP Flowsheet application was implemented in a single geriatric extended care (GEC) unit of a large healthcare system. Roger's Diffusion of Innovation and Davis' Technology Acceptance Model were used to guide system adoption and improve user experience of the innovation. Davis' (1989) Perceived Usefulness (PU) and Perceived Ease of Use (PEU) questionnaire was distributed to 24 nursing staff working in the GEC unit nine weeks post-system implementation. Survey results indicated that respondents perceived CP Flowsheet as easy to use (Mean - 35.88; SD - 6.42), and useful in accomplishing their documentation tasks (Mean -36.29; SD - 6.03). The overall mean satisfaction rating of 72.17 (SD=12.13) implied a good level of user satisfaction with the documentation system. These findings provide an excellent defense and a solid argument to elicit support for a facility-wide implementation of the CP Flowsheet. Successful adoption of an electronic documentation system can improve accessibility, completeness and accuracy of nursing care documentation.

Keywords: documentation system, user satisfaction, user acceptance

Facilitating Adoption of an Electronic Documentation System

In 1999, the Institute of Medicine (IOM) report highlighted the issue of patient safety and quality of care in the United States. The report revealed that approximately 98,000 people die annually due to preventable medical errors. The IOM called for a drastic change to improve the delivery of care and made recommendations that propelled the use of technology in the health care arena. These proposals led to several federal initiatives and mandates, as well as financial incentives to facilitate the nationwide adoption of health information technology. However, even with the tremendous progress in the implementation of electronic health records (EHR), the majority of healthcare institutions still employ both paper and electronic documentation systems (American Health Information Management Association (AHIMA), 2010; Keenan, Yakel, Lopez, Tschannen & Ford, 2013; Varga, 2011).

Healthcare providers' reluctance to transition to a computerized documentation system has been cited as a major barrier in realizing the full potential of a robust EHR (Ajami & Bagheri-Tadi, 2013; Gardner & Pearce, 2013). Challenges in utilizing and maintaining a hybrid patient record (paper and electronic) include, retrieval and accessibility of information; legibility of documentation; missing, inconsistent, and incomplete information; timeliness of integration into data stored electronically; and communication breakdown between providers, all of which can adversely affect patient care (AHIMA, 2010; Keenan et al., 2013; Lehnbohm, Raban, Walter, Richardson & Westbrook, 2014; McAllister & Rhodes, 2010; Nguyen, Bellucci & Nguyen, 2014; Varga, 2011).

Clinical documentation is a fundamental component of care delivery processes (Tubaishat, Tawalbeh, Azzam, Albashtawy & Batiha, 2015). Best practice recommends the integration of electronic documentation into the hospital EHR system (AHIMA, 2010;

McAllister & Rhodes, 2010). In a systematic review of the literature, Nguyen et al. (2014) found that electronic health records improved the quality, accuracy, timeliness and availability of clinical documentation. The reviewers also identified EHR usability and usefulness as key factors that promote user satisfaction contributing to the success or failure of system implementation. Evidence suggests that user satisfaction improves utilization of EHRs, thereby increasing consistency and completeness of clinical documentation. The EHR system must be acceptable to the users to facilitate successful implementation (Alawi, Dhaheri, Baloushi, Dhaheri & Prinsloo, 2014; Chow, Chin, Lee, Leung & Tang, 2011; Nguyen et al., 2014; Perry et al., 2013; Yeh et al., 2009).

The persistent use of paper documentation, even with the longstanding presence of electronic health record, has caused major challenges for a large healthcare system located in the northeastern part of the United States. The 727- bed facility provides comprehensive inpatient and outpatient healthcare services and is the setting for this DNP scholarly project. The organization has been a pioneer in the transition toward automation and adoption of an electronic health record. However, certain aspects of care remain documented in paper flow sheets, such as intakes and outputs, safety rounds, activities of daily living, and other nursing care documentation that are better viewed in rows and columns format. Paper flow sheets are integrated into the EHR through a scanning method. However, scanned documents are filed as an image and not as a clinical note; therefore it is not as easily accessible or retrievable in a report format. In addition, the consistency and timeliness of scanning paper documents were found to affect the availability and accessibility of patient care data and information in the EHR. These problems were noted during the last hospital accreditation survey. The purpose of this scholarly project was to pilot an electronic documentation system in a long-term care unit and evaluate

users' satisfaction of the automated system. It is anticipated that the adoption of an electronic documentation system will increase users' satisfaction and will lead to successful implementation.

Theoretical Framework

Rogers' Diffusion of Innovations (DOI) has been widely utilized as a theoretical framework in many studies involving system implementation (Callen, Braithwaite & Westbrook, 2008; Oliveira & Martins, 2011). According to Rogers (1983, 2003), the decision process to adopt a new technology involves five steps: knowledge, persuasion, decision, implementation, and confirmation. The innovation decision process is designed to inform and promote understanding of the benefits of technology to reduce uncertainty and promote adoption. Rogers (1983, 2003) theorized that the rate of adoption is determined by the attributes of the innovation. Technology that is perceived to be better, consistent with the stakeholders' existing values and needs, simple to use, can be tested for a limited time, and provide visible results is more likely to be adopted. The theory was selected to guide the adoption of an electronic documentation system for this scholarly project. The model was utilized to drive the process of adoption, as well as affect users' perception of the innovation.

Davis (1989) Technology Acceptance Model (TAM) provides a theoretical foundation that explains the relationship between users' perception and adoption of technology. The theory proposes two factors that lead to technology adoption, perceived usefulness and perceived ease of use. According to Davis (1989), perceived usefulness is the individual's belief that the system improves job performance, and perceived ease of use is the belief that the use of technology is stress-free. Both concepts are consistent and support the DOI premise that users' perception of the technology predicts acceptance or rejection of the innovation. User's perception of system

usefulness has been determined to greatly influence user satisfaction (Alawi et al., 2014; McLane, 2005). Therefore, both frameworks will be utilized concomitantly to guide the adoption of innovation and improve users' experience to enhance satisfaction.

Review of the Literature

The proliferation of technology in health care has produced a large body of research spawning knowledge on how to realize the potential of technology to improve health care quality and patient safety. The literature yields adequate studies addressing implementation of clinical information systems and user satisfaction. These studies provide data that may facilitate successful adoption of electronic documentation systems.

It is imperative to establish that the review of evidence supports the adoption of health information technology to improve quality of care and patient safety. Lau, Kuziemsky, Price and Gardner (2010) combined existing evidence from systematic reviews spanning 14 years, 1994 – 2008, on health information system (HIS) evaluation. The reviewers found that HIS had positive effects on dimension of care quality in patient safety, medication management, immunization, screening, and assessments. They also found that the quality of patient care data in HIS was largely accurate and complete. In 2014, Nguyen et al. conducted a systematic review of the literature consisting of 98 studies to report the benefits and issues associated with electronic health record adoption. They utilized the DeLone and McLean extended framework and Van der Meijden, Tange, Troost and Hasman's contingent factors to evaluate and analyze EHR quality, use and satisfaction, net benefits, contingent factors, and patient perceptions. Their findings supported and validated results from the review of Lau et al. (2010), indicating that the EHR has the potential to improve care quality and clinical documentation. Investigators from both studies agreed that EHR improved the availability and accuracy of patient data, as well as access to

information. Nguyen et al. (2014) revealed that many clinicians' preferred the EHR over paper-based clinical documentation. They noted that the levels of satisfaction vary between clinicians, but were found highest among registered nurses.

The overall goal of EHRs is to improve the quality of patient care, but this cannot be achieved without understanding the factors that affect successful adoption of technology in clinical practice. Evidence was evaluated pertaining to user satisfaction and attitude pre and post implementation of electronic documentation systems to validate the significance of this performance improvement initiative and support its intended outcomes. Jin et al. (2012) and Chow et al. (2011) utilized a post survey design to evaluate users' attitude and satisfaction after transition to an electronic documentation system. Jin and colleagues (2012) found that users were more satisfied and preferred the automated system over the handwritten paper records. On the other hand, Chow et al. (2011) found that nurses' attitude and levels of satisfaction were highly associated with their perceived ease of use and perceived usability of the system. In other words, nurses tend to have a positive attitude and a higher level of satisfaction with systems that are easy to use and are useful in doing their work. Chow and colleagues (2011) concluded that perceived usefulness is an important predictor of nurses' satisfaction with technology. These findings are significant because it provides insight on factors that affect users' attitude and satisfaction with clinical information systems.

Kirkendall, Goldenhar, Simon, Wheeler and Spooner (2013) and Yeh et al. (2009) both compared nurses' satisfaction, pre and post implementation of an electronic documentation system. Both studies confirmed that nurses' were more satisfied with computerized documentation. In addition, Yeh and colleagues (2009) reported that the use of the computerized documentation system significantly improved organization, consistency and completeness of

nursing documentation. Tubaishat et al. (2015) echoed these findings in their retrospective review of both paper and electronic medical records where they found that electronic records presented a more complete and accurate documentation of pressure ulcer data compared to paper records. Carayon et al. (2011) assessed critical care nurses' acceptance of an EHR at 3 months and 12 months; whereas Hadji, Martin, Dupuis and Campoy (2016) conducted a longitudinal study of clinical information system (CIS) use and satisfaction over 14 years post implementation. Findings from these studies supported the conclusion of other researchers that EHR usability and ease of use predicted system acceptance. Both studies revealed that the overall acceptance and perceived usefulness of the system progressively and significantly increased over time.

Overall, the evidence is clear and supports adoption of electronic documentation systems to improve accuracy, completeness, and access to patient care data and information (Lau et al., 2010; Nguyen et al., 2014; Tubaishat et al., 2015; Yeh et al., 2009). However, the bulk of these investigations are descriptive in nature and are not considered the gold standard of evidence, but nonetheless vital in generating knowledge that can guide practice and improve adoption of technology in the health care arena (see Appendix A). There is a strong consensus found in the literature that user's satisfaction and acceptance of an electronic documentation system is highly associated with perceived usefulness and perceived ease of use (Alawi et al., 2014; Carayon et al., 2011; Chow et al., 2011; Hadji et al., 2016; Nguyen et al., 2014). The evidence confirms the positive correlation between user satisfaction and system utilization (Alawi et al., 2014; Carayon et al., 2011; Hadji et al., 2016). Appropriate and consistent use of an electronic documentation system is crucial to realize the potential of technology in improving quality of care and patient safety.

Methods

Design, Setting, Sample

This scholarly project was a quality improvement initiative involving the implementation of the Clinical Procedure (CP) Flow Sheet to automate the documentation of residents' activities of daily living. A descriptive survey design was used to evaluate users' perception of the innovation. The setting was a 25-bed Geriatric Extended Care (GEC) unit in a big hospital network system located in the northeastern part of the United States. The facility provides comprehensive inpatient and outpatient healthcare services to approximately 54,783 patients annually. The CP Flowsheet is a component of the organization's information system infrastructure since 2008 but has not been implemented due to administrative issues. A convenience sample of 24 nursing staff to include, nurses, licensed practical nurses and nursing assistants working in the GEC unit were the users of the new system and recruited to complete a post-implementation survey for the project.

Procedures

The CP Flow Sheet was introduced to the GEC chief nurse, nurse managers, attending physician, and nursing staff to kick off the project. DOI theory purports that the decision to employ an innovation commences with the awareness of its existence, and the knowledge of its advantages and functionalities (Rogers, 1983). A demonstration of the features and functions of the documentation system was conducted immediately after the introduction, emphasizing the benefits of the system, ease of use and usability. According to Rogers' (2003), it is crucial to provide a convincing argument in favor of the innovation, and highlight the compatibility of the innovation with the existing technology infrastructure. Buy-in and support from key nursing

leaders encourage positive attitude among users and facilitate the spread of the innovation. The purpose and anticipated outcomes of the initiative, implementation plan, and project timeline were discussed following the demonstration. This project required active involvement of the Information Technology (IT) department and was coordinated with the department the same week as the project introduction. IT facilitated system installation, testing, set-up and user access.

End-user training commenced the fifth week of project implementation. Selection of training dates and logistics were arranged through the GEC nursing leadership. The unit nurse manager and assistant nurse manager facilitated the staff training schedule and communication of pertinent project information to their direct reports. Several end-user training sessions were conducted in a five-day period to cover all shifts. Handouts and training materials with screenshots and instructions on basic navigation and application functions were provided as a reference guide during training sessions. Testing of the application was facilitated on test accounts five days prior to “Go live” to ensure optimum system performance.

System Go live was scheduled at the beginning of the sixth week of the implementation process in coordination and with the concurrence of the chief nurse. Two nurse informaticists were on site to provide point of care support during the first three weeks post system Go live. They also continued to provide one to one training with staff members who were having difficulty navigating the system. Survey questionnaires were administered nine weeks post-implementation. Respondents were given five days to complete and return the questionnaires (see Appendix B).

Protection of Human Subject

The proposal was submitted to University of Maryland Baltimore (UMB) Institutional Review Board (IRB) for a Non Human Subjects Research (NHSR) determination (see Appendix C). The proposal was also submitted to the IRB of the organization at which the project was implemented. All appropriate measures were taken to protect the anonymity of the sample population. No personal identifiers were collected. Completed paper and pencil questionnaires were returned in a secure box. Completed questionnaires were kept in a secure, locked filing cabinet. Data were electronically transcribed in a password protected computer.

Data Collection

Data collection was conducted using an instrument, Perceived Usefulness (PU) and Perceived Ease of Use, (PEU) developed by Davis (1989), (see Appendix D). The instrument has been evaluated in measuring end user acceptance of information technology, and its effectiveness in predicting system use. Davis' (1989) Technology Acceptance Model theorizes that perceived ease of use is a fundamental precursor to perceived usefulness, and both constructs predict system acceptance and utilization. The instrument has strong psychometric properties with a Cronbach alpha reliability of 0.98 (PU) and 0.94 (PEU), and has been tested for convergent, discriminant and factorial validity (Davis, 1989). The tool contains twelve items, six for each sub-scale, rated on a 7-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7). The total score for all items in each sub-scale ranges from 6 to 42, with higher scores indicating stronger agreement with each concept. The total score for both sub-scales has a range of 12 to 84 with higher scores indicating greater satisfaction with the technology. The wordings on the questionnaire were slightly modified to fit the CP Flow Sheet context. A licensing fee was paid for the use and reproduction of the instrument (see Appendix E). Demographic characteristics with no identifying data were collected and included in the

survey. Questions on demographics include position, number of years in current position, number of years using electronic health records, and age range.

Questionnaires were directly distributed to the staff on the unit in paper and pencil format nine weeks post implementation. Participation in completing the questionnaire was voluntary, noting the purpose and relevance of the post-adoption evaluation. A locked box was provided and placed in the staff break room. Respondents were instructed to return completed questionnaires in the secure box. The date and time of data collection were posted on the box. E-mail reminders were sent three days and one day prior to the questionnaire collection date.

Data Analysis

Descriptive statistics were primarily used to analyze the demographic data and assess the respondents' satisfaction with the CP Flowsheet. Before analysis, data were manually entered into a spreadsheet program (Excel 2010) and reviewed for missing items and outliers. Frequencies and percentages were used to describe the demographic characteristics of the sample. Measures of central tendency (mean, median, mode), standard deviation, variance, and range were used to evaluate responses to the concepts of PU, PEU and overall satisfaction. The summative score of each sub-scale, as well as the overall score were calculated and the mean score computed. Satisfaction scores were plotted in a graphical format to examine the spread of data, symmetry of the distribution or lack of it, skewness, and for obvious atypical values. Z-scores were also calculated to determine outliers and delineate its relationship to the mean.

Results

Data were collected from 24 users of CP Flowsheet with a response rate of 100%. Missing demographic information (age range, years of experience in current position, and years of experience in using electronic health records) were noted in 11 out of 24 survey

questionnaires. However, these have no direct impact on the survey results since all PU and PEU questions were completed. Taking into account missing demographic data, calculation of percentages and mean were based on the total number of those who responded to the question, rather than the total samples. Survey participants consisted of 10 registered nurses (42%), 13 nursing assistants (54%), and 1 licensed practical nurse (4%). Respondents are ages 50-60 (46%), 40-49 (26%) and 29-39 (26%). The 40 and older age groups made up 72% of the survey participants. The average years of experience in current position was 9.82 (SD=7.92), and 7.84 (SD=5.94) years in relation to experience using the EHR (see Table 1).

Table 1 Demographic Data (n = 24)

Descriptive Variable	Total Sample: n (%)	Mean (SD)
Position		
Registered Nurse	10 (42%)	
Licensed Practical Nurse	1 (4%)	
Nursing Assistant	13 (54%)	
Age		
29-39	5 (26%)	
40-49	5 (26%)	
50-60	9 (46%)	
Years of experience in current position		9.82 (7.92)
Years of experience using EHR		7.84 (5.94)

Missing values include: age (n = 5), years of experience in current position (n = 5), years of experience in using EHR (n = 7)

The mean score for PU was 35.88 (SD=6.42) indicating that respondents perceived the CP Flowsheet as useful in performing their documentation tasks. The mean score for PEU was 36.29 (SD=6.03), slightly higher than PU, suggesting that users perceived the system as easy to use. The overall mean satisfaction rating was 72.17 (SD=12.13) denoting a good level of satisfaction and acceptance of the CP Flowsheet (see Table 2). The data distribution is negatively skewed at -1.54, closely clustered around the mean but with outliers on the left tail (Figure 1).

Calculation of z-scores revealed two atypical observations with scores of -2.73 and -2.24, all others fell within +/- 0 to 1 standard deviation. Converting the observations into standardized scores made it easier to delineate outliers.

Table 2 PU, PEU and Overall Satisfaction with CP Flowsheet (n=24)

Variable	Mean (SD)	Median	Mode	Range
PU	35.88 (6.42)	36	42	6-42
PEU	36.29 (6.03)	36	36	6-42
Overall Satisfaction	72.17 (12.13)	72.50	72	12-84

PU – perceived usefulness, PEU – perceived ease of use, CP – Clinical Procedure, SD – standard deviation, *n* – number of participants

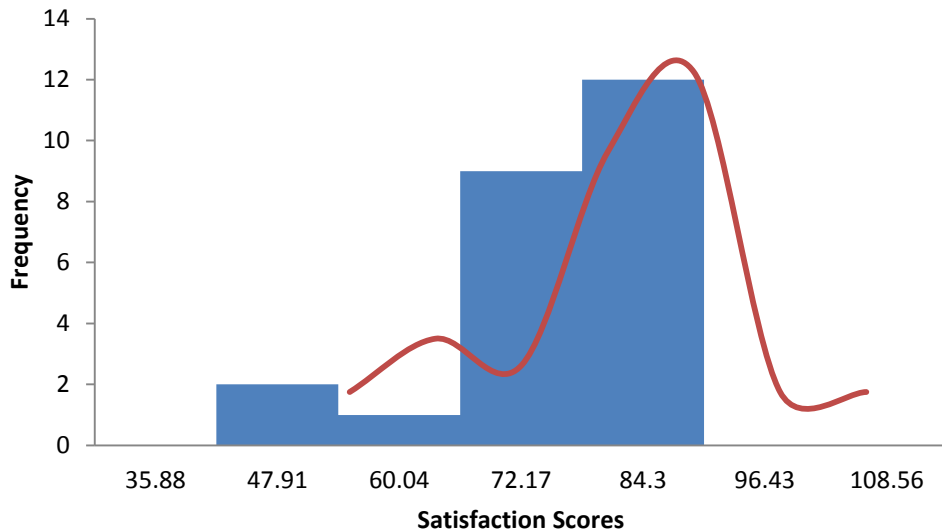


Figure 1. CP Flowsheet overall satisfaction scores

Discussion

This quality improvement project was conducted in one of the geriatric extended care units with the nursing staff on the unit as survey participants. The intent of the survey was to determine the likelihood of system use by measuring participants' satisfaction of the CP Flowsheet. The Technology Acceptance Model framework suggests that system use is influenced by user acceptance of the technology. The overall mean score of 72.17 (SD=12.13) on a scale for

which 84 is the highest score (PU and PEU combined), denotes users' satisfaction and acceptance of CP Flowsheet as an automated tool to document the Residents' Activities of Daily Living. Davis (1983, 2003) pointed out that PEU is an antecedent to PU. This premise was confirmed by the survey results indicating that users' positive perception of the system's ease of use resulted in their agreement of its usefulness. Analysis of the data distribution revealed a closely clustered data, with 87.5% of the participants falling within +/-1 standard deviation away from the mean. This further validated and strengthened the findings that the vast majority of the participants were satisfied in using the CP Flowsheet. However, outliers were noted with z-scores of -2.73 and -2.24. Outliers can be due to the user's level of computer literacy, resistance to change, and the limited time provided to get acquainted with CP Flowsheet. Overall, this has not affected the positive results of the survey.

A positive attitude towards health information technology provides a sense of confidence that system implementation can lead to its intended outcome. Nurses' satisfaction with the CP Flowsheet postulates a reasonable and valid argument to support the facility-wide implementation of the automated system. However, there are other factors that need to be considered when evaluating the favorable perception of users to the system. This project was instituted in one patient care unit with a limited number of users; therefore more time was allocated for training. One to one assistance was provided to all participants who required individualized attention. Informaticists were also accessible and available at the point of care during the first three weeks of system implementation. During one to one training sessions, informaticists were able to meticulously highlight and demonstrate all features and functions of the application and how it can impact the documentation of care. They also emphasized the benefits of the system to the users' as it relates to documentation reviews and monitoring,

particularly the ability to view cumulative data necessary to facilitate a data-driven assessment and care planning. Conscientious and consistent end user support could have influenced the favorable response of the majority of the respondents to the CP Flowsheet.

The substantial emphasis placed on system benefits, both to users and care delivery processes can affect users' attitude toward the innovation. Rogers (1983) DOI theory purports that knowledge of the innovation and persuasions are key constructs that drive the adoption of the innovation. Both were employed in this performance improvement project. The relevance of end-users support, education and training cannot be discounted and can heavily influence the success of system implementation.

Implications

The outcome of this project hopes to strengthen support from key stakeholders, particularly direct care providers for the automation of all clinical documentation. It also provides a platform for those nurses who piloted the CP Flowsheet to express their thoughts, opinions, and recommendations pertaining to system features and functions, as well as its perceived benefits. Allowing end-users to participate in the innovation decision process promotes a sense of ownership, inclusion and shared governance. Nurses listen to their peers and often value their opinions. The positive perception of the nursing staff in the GEC unit suggests a high probability of system use that can enhance the documentation of patient care. Therefore, it is safe to conclude that users' satisfaction with CP Flowsheet can lead to optimum system usage and successful system adoption. Future studies focusing on the implication and correlation of a structured end-user training and support post-implementation to user perception of the technology could enhance understanding of the relationship between these variables and add to the existing body of knowledge.

Limitations

This project is limited to a single unit, involving 24 participants. Respondents were given only nine weeks to use and experience the CP Flowsheet features and functions prior to the administration of the survey questionnaires. Longer usage time might affect participants' perception of system usability and ease of use. In addition, piloting the application to a larger sample size from multiple settings could provide valuable information pertaining to system acceptance and user satisfaction.

Conclusion

Clinical documentation is a key component of care delivery processes. Patient care data and information need to be accessible and available at the point of care. The implementation of Clinical Procedure has provided for the automation of paper flow sheets. Nurses' satisfaction with the documentation system can lead to optimum system usage, thereby improving patient care documentation. Findings from this initiative support the adoption of the CP Flowsheet to improve accessibility, availability, completeness and accuracy of patient care data and information. The outcomes of this project can augment support for the automation of all clinical documentation. It validated the need for a computerized documentation system, as well as system acceptance that is crucial in realizing the optimum benefits of the CP Flowsheet. Monitoring the actual system use will provide further confirmation of successful adoption.

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Appendix A

Table A

Evidence Rating Table

Author, year	Objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	*Level/Quality Rating
Carayon, Cartmill, Blosky, Brown, Hackenberg, Hoonaker.... Walker, 2011	To assess ICU nurses' acceptance of electronic health record (EHR) and examine the relationship between EHR design, implementation factors, and nurse acceptance.	Cross sectional survey	N= 121 (3-month post) N=161 (12-month post)	Perceived EHR usability – Questionnaire User Interface Satisfaction (QUIS) Overall technology acceptance and EHR usefulness – established survey instrument used in previous research and pilot tested.	Nurses' acceptance of EHR is greater at 12 months compared to 3 months. Nursing flow sheet usefulness predicted EHR acceptance at 12 months. Multivariate hierarchical modeling indicated that EHR usability and CPOE usefulness predicted EHR acceptance at both 3 and 12 months.	6 B
Chow, Chin, Lee, Leung & Tang, 2011	To explore nurses' attitude and satisfaction levels in using the Hospital's Information System in clinical practice.	Cross-sectional survey	342 nurses	Nurses' perceptions, level of satisfaction and attitude towards Hospital Information System usage -modified 33-item questionnaire developed by Oroviogicoechea, Watson, Beortegui and Ramirez in 2010.	Nurses with a positive attitude towards the system perceived it as easy to use and were more satisfied with using the system. The 3 predictors of nurses' attitude and level of satisfaction with the system are work units, perceived usefulness, and IT support.	6 B

Author, year	Objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	*Level/Quality Rating
Hadji, Martin, Dupuis & Campoy, 2016	To longitudinally measure and analyze the Clinical Information System (CIS) use and satisfaction determinants in a multi-professional group at the Georges Pompidou University Hospital in (HEGP) Paris.	Longitudinal study	N = 298 (2004); 332 (2008); and 448 (2011-2014)	Six acceptance dimensions: CIS quality (CISQ), facilitating conditions (FC), perceived usefulness (PU), confirmation of expectations (CE), and global satisfactions (GS) – 5 acceptance evaluation surveys performed over 3 post-deployment periods within 10 years after implementation of CIS	Acceptance dimensions progressively and significantly increased overtime. Differences between 3 periods were found to be significant. CIS perceived usefulness by nurses and ancillary staff was better than physicians in the early post-adoption period. Physicians improved their CIS perceived usefulness in the late and very late periods	6 A
Jin, Kim, Lee, Jeong, Choi & Lee, 2012	To evaluate users' attitude concerning Anesthesia Information Management System (AIMS) and to compare it with manual/handwritten documentation in the operating room.	Survey	102 nurses, anesthesiologists, and trainees	Satisfaction with AIMS compared to manual documentation - Structured Questionnaire	Participants were satisfied with AIMS: trainees (96.3%), anesthesiologists (82.2%), and nurses (89.3%). They preferred AIMS over handwritten documentation: trainees (96.3%), anesthesiologists (71.4%), and nurses (97.9%). Less than favorable feedback included: user-discomfort during short, emergency surgeries; doubtful legal status, and inconvenient placement of the system.	6 B

Author, year	Objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	*Level/Quality Rating
Kirkendall, Goldenhar, Simon, Wheeler & Spooner, 2013	To examine healthcare worker's perceptions, expectations, and experiences regarding how work processes, patient-related safety, and care were affected with transitioned from hybrid paper/electronic to full electronic health record (EHR).	Survey Single group, Pre/posttest design	N=377 (5.2%) response rate pre-implementation N=983 (13.6%) response rate post-implementation	Communication, job satisfaction, quality of patient data, quality and safety of patient care, employee understanding and support, organizational support, the Rights of patient care – Information System Expectations and Experiences (I-SEE) survey	Attitudes and expectations were mostly positive with the transition to full electronic health record. All respondents answered more positively at one year after transition in terms of Job Satisfaction, Quality and Safety of Patient Care, Organizational Support for the Transition and the Rights of Patient Care. Nursing responses suggest that their experiences with the transition were more favorable than their expectations.	6 B
Lau, Kuziemy, Price & Gardner, 2010	To consolidate existing evidence from published systematic reviews on health information system (HIS) evaluation studies to inform HIS practice and research.	Meta-synthesis	N=50 systematic reviews (1276 studies)	Infoway Benefits Evaluation (BE) framework - utilized to group evaluation metrics: system quality, information quality, service quality, usage, satisfaction, care quality, productivity, access Non-overlapping review corpus – used as an organizing scheme for associating HIS features, metric, and effects: medication management, preventative care, health conditions, and data quality.	Consolidated findings suggest some evidence for improved quality of care from HIS adoption. Positive effects were found on dimension of care quality in patient safety, medication, immunization, screening, assessments, and accuracy of content and completeness of information.	1 B

Author, year	Objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	*Level/ Quality Rating
Nguyen, Belluci & Nguyen, 2014	Review of electronic health record (EHR) implementation, benefits, and issues associated with adoption.	Systematic reviews of descriptive and qualitative studies	N=98 studies	EHR quality, EHR use and satisfaction, net benefits, contingent factors, patient perceptions regarding EHR - DeLone and McLean's revised information system evaluation framework with Van der Meijden's et al. contingent factors	The researchers confirmed that technology has the potential to improve patient care and clinical documentation. Overall, EHR was found to improve the quality of documentation; improved accuracy, timeliness, and access to information; easy to learn and use. Many clinicians' preferred EHR over paper- based clinical documentation. Mixed levels of clinical satisfaction were found, but high satisfaction of EHR was found among nurses. Doctors and nurses were found to have a positive attitude towards EHR; Adoption rate and usage of EHR were found low, and that EHR contributes to increased workload.	5 - B
Tubaishat, Tawalbeh, Al Azzam, Albashtawy & Batiha, 2015	To compare the accuracy and completeness of pressure ulcer data documentation between a computerized system and paper records.	Descriptive, comparative design with a retrospective review of patient records.	N= 302 (electronic charts) N= 279 (paper charts)	Accuracy and completeness of nursing documentation of pressure ulcers - records audit sheet based on the European Pressure Ulcer Advisory Panel (EPUAP) prevalence tool.	Electronic health records contain more accurate and complete documentation of pressure ulcers compared to paper records.	6 B

Author, year	Objective/intervention or exposures compared	Design	Sample (N)	Outcomes studied (how measured)	Results	*Level/Quality Rating
Yeh, Jeng, Lin, Ho, Hsiao, Lee & Chen, 2009	(1) To implement a computerized documentation system (NPSSC) for nursing home residents; (2) to evaluate the efficiency of the NPSSC; (3) to assess obstacles to the use of the NPSSC; (4) assess nurses' satisfaction with the NPSSC	Quasi-experimental Single group, pre/posttest design	N = 27 nurses	Levels of satisfaction in using the NPSSC - Satisfaction Questionnaire	The use of computerized documentation system significantly improved nursing documentation; residents' records were organized and consistent; nurses' were able to complete a comprehensive care plan within 48 hours. Nurses reported higher satisfaction in nursing documentation after the implementation of NPSSC.	B

***Rating system for the hierarchy of evidence (Melnyk & Fineout-Overholt, 2011)**

Level of the Evidence	Type of the Evidence
I (1)	Evidence from systematic review, meta-analysis of all relevant randomized controlled trials (RCTs), or practice-guidelines based on systematic review of RCTs.
II (2)	Evidence obtained from well-designed RCT
III (3)	Evidence obtained from well-designed controlled trials without randomization
IV (4)	Evidence from well-designed case control and cohort studies
V (5)	Evidence from systematic reviews of descriptive and qualitative studies
VI (6)	Evidence from a single descriptive or qualitative study
VII (7)	Evidence from the opinion of authorities and/or reports of expert committees

Appendix B

Table B

Timeline

Submit Proposal to committee members	April 2016
Present Proposal to committee members	May 2016
Submit proposal to UMB and hospital organization Institutional Review Boards for review	May 2016
Implement project	September to December 2016
Analyze, synthesize and evaluate data	February 2017
Submit final scholarly project manuscript to committee for review	March 2017
Present final scholarly project report to Committee	March 2017

Appendix C



University of Maryland, Baltimore
Institutional Review Board
Phone: (410) 706-5037
Fax: (410) 706-4189
Email: hrpo@umaryland.edu

NOT HUMAN RESEARCH DETERMINATION

Date: May 11, 2016

To: Charlotte Seckman

RE: HP-00069769

Name: Evaluating user satisfaction post adoption of an electronic documentation system

This letter is to acknowledge that the UMB IRB reviewed the information provided and has determined that the submission does not require IRB review. This determination has been made with the understanding that the proposed project does not involve a systematic investigation designed to develop or contribute to generalizable knowledge **OR** a human participant (see definitions below).

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are human subject research in which the organization is engaged, please submit a new request to the IRB for a determination.

Definitions –

Human Research: Any activity that either:

- Is “Research” as defined by DHHS and involves “Human Subjects” as defined by DHHS (“DHHS Human Research”); or
- Is “Research” as defined by FDA and involves “Human Subjects” as defined by FDA (“FDA Human Research”).

Research as Defined by DHHS: A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

Research as Defined by FDA: Any experiment that involves a test article and one or more human subjects, and that meets any one of the following:

- Must meet the requirements for prior submission to the Food and Drug Administration under section 505(i) of the Federal Food, Drug, and Cosmetic Act meaning any use of a drug other than the use of an approved drug in the course of medical practice;
- Must meet the requirements for prior submission to the Food and Drug Administration under section 520(g) of the Federal Food, Drug, and Cosmetic Act meaning any activity that evaluates the safety or effectiveness of a device; OR
- Any activity the results of which are intended to be later submitted to, or held for inspection by, the Food and Drug Administration as part of an application for a research or marketing permit.

Human Subject as Defined by DHHS: A living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through Intervention or Interaction with the individual, or (2) information that is both Private Information and Identifiable Information. For the purpose of this definition:

- Intervention means physical procedures by which data are gathered (for example, venipuncture) and manipulations of the subject or the subject's environment that are performed for research purposes.
- Interaction means communication or interpersonal contact between investigator and subject.
- Private Information means information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public (for example, a medical record). • Identifiable Information means information that is individually identifiable (i.e., the identity of the subject is or may readily be ascertained by the investigator or associated with the information).

Human Subject as Defined by FDA: An individual who is or becomes a subject in research, either as a recipient of the test article or as a control. A subject may be either a healthy human or a patient. A human subject includes an individual on whose specimen (identified or unidentified) a medical device is used.

Please keep a copy of this letter for future reference. If you have any questions, please do not hesitate to contact the Human Research Protections Office (HRPO) at (410) 706-5037 or HRPO@umaryland.edu.

Appendix D

Measurement Scales for Perceived Usefulness and Perceived Ease of Use

Demographic Data

Position: RN LPN NA HT
 Age: 18 – 28 29 – 39 40 – 49 50 – 60 60 and over
 Years of experience in current position: _____
 Years of experience in using electronic health record (EHR): _____

Direction: For each statement, check the box that corresponds to the degree of your agreement or disagreement, and how much they reflect how you feel or think personally. There is no right or wrong answer.

Perceived Usefulness	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
Using CP Flow Sheet in my job enables me to accomplish tasks more quickly.							
Using CP Flow Sheet improves my job performance.							
Using CP Flow Sheet in my job increases my productivity.							
Using CP Flow Sheet enhances my effectiveness on the job.							
Using CP Flow Sheet makes it easier to do my job.							
I find CP Flow Sheet useful in my job.							
Perceived Ease of Use							
Learning to operate CP Flow Sheet is easy for me.							
I find it easy to get CP Flow Sheet to do what I want it to do.							
My interaction with CP Flow Sheet is clear and understandable.							
I find CP Flow Sheet to be flexible to interact with.							
It is easy for me to become skillful at using CP Flow Sheet.							
I find CP Flow Sheet easy to use.							

Appendix E

Permission to Use Perceived Usefulness, Perceived Ease of Use Questionnaire


Confirmation Number: 11548781**Order Date: 03/18/2016****Customer Information****Customer:** Nazarine Jones**Account Number:** 3001010581**Organization:** Nazarine Jones**Email:** jonesnazarine@yahoo.com**Phone:** +1 (443)5709912**Payment Method:** Invoice**This is not an invoice**

Order Details

MIS quarterly

Billing Status:

Invoiced: RLNK501895492

- **Order detail ID:** 69659768
- **ISSN:** 0276-7783
- **Publication Type:** e-Journal
- **Volume:**
- **Issue:**
- **Start page:**
- **Publisher:** Society for Management Information Systems and Management Information Systems Research Center of the University of Minnesota
- **Author/Editor:** Society for Information Management (U.S.) ; University of Minnesota. Management Information Systems Research Center
- **Permission Status:**  **Granted**
- **Permission type:** Republish or display content
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Order ref number:	CAO2755
Requestor type	Not-for-profit entity
Format	Print
Portion	chart/graph/table/figure

Number of charts/graphs/tables/figures	1
Title or numeric reference of the portion(s)	Questionnaire Perceived Usefulness and Perceived Ease of Use
Title of the article or chapter the portion is from	Questionnaire Perceived Usefulness and Perceived Ease of Use
Editor of portion(s)	N/A
Author of portion(s)	Questionnaire Perceived Usefulness and Perceived Ease of Use
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Issue, if republishing an article from a serial	3
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The standard identifier	N/A
The proposed price	N/A
Title	Scholarly Project- Satisfaction Questionnaire for Nurses
Publisher	N/A
Expected publication date	Aug 2016
Estimated size (pages)	10

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Order Total: \$78.50