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Impact of Adoption of a Comprehensive Electronic Health Record on Nursing Work and Caring Efficacy

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Nurses in acute care settings are affected by the technologies they use, including electronic health records. This study investigated the impacts of adoption of a comprehensive electronic health record by measuring nursing locations and interventions in three units before and 12 months after adoption. Time-motion methodology with a handheld recording platform based on Omaha System standardized terminology was used to collect location and intervention data. In addition, investigators administered the Caring Efficacy Scale to better understand the effects of the electronic health record on nursing care efficacy. Several differences were noted after the electronic health record was adopted. Nurses spent significantly more time in patient rooms and less in other measured locations. They spent more time overall performing nursing interventions, with increased time in documentation and medication administration, but less time reporting and providing patient-family teaching. Both before and after electronic health record adoption, nurses spent most of their time in case management interventions (coordinating, planning, and communicating). Nurses showed a slight decrease in perceived caring efficacy after adoption. While initial findings demonstrated a trend toward increased time efficiency, questions remain regarding nurse satisfaction, patient satisfaction, quality and safety outcomes, and cost.

KEY WORDS: Electronic health record, Hospital nursing, Nursing work, Omaha system, Time and motion studies

Meaningful use of the electronic health record (EHR) has been highly emphasized in the US since the enactment of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009.[1] The HITECH Act promoted EHR use, stating that it was critical for communication and sharing health records across healthcare institutions and among healthcare professionals.[1] The effort to expand EHR use was led by the Centers for Medicare and Medicaid Services (CMS) with the intent to help patients and families to be more engaged in healthcare and to improve healthcare quality, safety, and efficiency.[1] To encourage widespread use, CMS provided incentives to healthcare facilities to adopt EHRs.[1] Penalties surrounding Medicare/Medicaid reimbursement were imposed for facilities that failed to achieve meaningful use of an EHR by 2015.[1] Additional performance measures related to quality outcomes and clinical improvement have been augmented for 2016 and beyond. Although this initiative was broadly advocated nationally, it is unclear how the adoption of an EHR has affected and/or changed aspects of healthcare work and patient care at the hospital level.

Nursing is the nation's largest healthcare profession. Registered nurses hold approximately 2.8 million jobs in the US.[2] Despite the overwhelming presence of nurses in healthcare, the process of designing EHRs has not always considered their impact on nursing work.[3] Many work analysis studies have been conducted to determine what nurses do[4–10]; however, few time and motion studies have explored the impact of the adoption of an EHR on nursing work.[11,12] Yee et al[11] conducted a time and motion study of nurses to examine documentation time in hospitals with an EHR compared to hospitals without, and observed that nurses spent approximately 19% of their time in documentation; the EHR had no significant impact. Wong et al's[12] time and motion study performed observations in the intensive care unit (ICU) before and after implementation of a third-generation ICU information system, observing that documentation time decreased by almost 10% and that time spent on patient assessment increased by approximately 5%.[12] Though not a time and motion study, McComas et al[13] examined the impact of the implementation of an electronic medication administration record on medication errors and found that mean medication error rates were reduced after implementation.

In addition to nursing interventions and processes, caring is considered an important aspect of nursing.[14] Watson[14] defined caring using 10 caring ("Caritas") processes, ranging

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from assisting patients with basic needs to using scientific problem solving and instilling faith and hope in others. It is important to understand how the transition to EHR use may affect nurses' perceptions of their ability to perform activities and behaviors of caring. To the authors' knowledge, caring efficacy has not been measured in relation to the impacts of EHR adoption and use.

AIMS

The purpose of this study was to measure differences in nursing work and caring efficacy on three units in one hospital, before and 1 year after the adoption of a comprehensive EHR. Specifically, this study aimed to determine whether (1) differences were observed before and after EHR implementation in where nurses were located and the amount of time nurses spent in those locations; (2) observed differences occurred before and after EHR implementation in the amount of time nurses spent on specific nursing interventions; and (3) differences occurred before and after EHR implementation in nurses' responses to the Caring Efficacy Scale (CES).

METHODS

Setting

This observational study was conducted before and after the implementation of a comprehensive EHR at a 446-bed urban, nonprofit, regional hospital that is part of a large healthcare system in the western US. Study methods included both observations of time and motion before and after adoption of a comprehensive EHR, and administration of the CES.[14] Three units were deemed representative across the healthcare system: medical-surgical (med-surg), ICU, and telemetry (tele). Recruitment of study units for the observations and CES was accomplished through the chief nursing officer and managers of the selected units. The hospital adhered to staffing ratios of one nurse to five patients (med-surg), one to four (tele), and one nurse to one or two patients (ICU), mandated by state law. The institutional review board used by this hospital approved this study.

Caring Efficacy Scale

The 30-item CES measures nurses' perceptions of their ability to perform caring behaviors and to develop caring relationships based on responses to items on a Likert scale.[15] This scale has been studied in a variety of clinical settings across the globe.[16–20] In addition, psychometric properties of the CES have been studied; Reid et al[21] reported responses to the CES from 581 RNs. Two subscales were found, each demonstrating adequate reliability (Confidence to Care, Cronbach's α of .78; Doubts and Concerns, Cronbach's α of .78).

In this study, all nurses employed on the previously identified units were invited to participate in the anonymous online administration of the CES. Forty RNs responded in the preadoption sample, and 44 responded in the postadoption sample. The online survey was administered with the permission of the author, through the survey hosting software Qualtrics (Qualtrics, Provo, UT), on a secure site during both observation phases. Administration of the survey was password protected; no information identifying the respondents was collected.

Time and Motion Observations

The data collection tool was developed in a previous phase of this study,[22,23] in which nurses from the study units were interviewed in focus groups to describe essential aspects of their daily work using Omaha System terms. These nurse-selected terms, together with Omaha System nursing intervention terms reported in the literature,[24,25] were then refined through subsequent discussions among participants and expert review until consensus was achieved on the final intervention content. The content was then entered via TimeCaT software (Department of Biomedical Informatics, Ohio State University, Columbus, OH), developed by Lopetegui et al.[26] The TimeCaT interface has separate data entry fields for task, communication, and location, with three timers that run simultaneously. This functionality enables the observation of co-occurrences across these three fields. The TimeCaT data collection tool provided an easy-to-use, handheld, Web-based platform to select from the validated list of common and important nursing interventions. The TimeCaT data collection tool was used for both pre- and post-EHR implementation observations.

The Omaha System[27] is a standardized nursing terminology, taxonomy, and ontology designed for use by nurses and all healthcare disciplines. It consists of three instruments: the Problem Classification Scheme, the Intervention Scheme, and the Problem Rating Scale for Outcomes. The Problem Classification Scheme consists of defined problem concepts arranged within four domains (environmental, psychosocial, physiological, and health-related behaviors). The Intervention Scheme consists of four levels. The first level (Problem) consists of the concepts in the Problem Classification Scheme. The second level (Category) consists of the following four action categories: (1) Teaching, Guidance, and Counseling (TGC; shorthand icon = %); (2) Treatments and Procedures (TP; shorthand icon = *); (3) Case Management (CM; shorthand icon = ::); and (4) surveillance (S; shorthand icon = ✓). The third level (Target) consists of 75 defined targets, which specify the focus of the intervention. The fourth level (Care Description) is not taxonomic and may be customized for a granular description of the intervention. The Problem Rating Scale for Outcomes is a Likert-type ordinal measure relative to each problem in three dimensions, knowledge, behavior, and status, from 1

(lowest) to 5 (highest).[27] The Omaha System exists in the public domain and may be used for research or embedded within software.[27] The Omaha System was embedded within the TimeCaT data collection tool, including the shorthand icons (noted previously) for ease of use.

In the Omaha System, interventions are related to a single Problem concept, such as the circulation problem. At the first level, a Category term specifies the action of the intervention; for example, a nurse might perform Surveillance for blood pressure (BP). At the second level, a Target further specifies the nature of the intervention, for example, "signs/symptoms-physical." At the third level, a suggested care description term is fully customizable; therefore, the facility protocol or other evidence-based vital sign measurement guideline may be referenced as needed. Thus, the intervention in this example consists of four data points (Problem, Category, Target, and Care Description): circulation, surveillance, signs/symptoms-physical, and orthostatic BP. The linguistic syntax of these four data points may be expressed in sentence form as follows: "I (the nurse) addressed the Circulation Problem by performing Surveillance-signs/symptoms-physical, and I used the facility guideline for orthostatic BP measurement."[28] In the TimeCaT interface, these four data points were abbreviated for single-click documentation of the four linked data points as "✓ vitals" with the definition "nurse checks patient vital signs."

Observers

Pre-EHR implementation observers were four RNs familiar with the study units in which the observations were conducted. Training included watching a set of four short videos and recording all observed nursing locations and interventions using the TimeCaT software on a handheld digital device (iPad; Apple, Cupertino, CA). Cohen's κ was calculated for all paired combinations of observers who watched the videos.[29] An average of Cohen's κ was calculated from each observer pair, resulting in a single measurement per video of interobserver agreement. The highest κ calculated pre-EHR implementation was 0.68, indicating substantial agreement among observers. Slight to substantial agreement among observers was found for the remaining training videos scored (cutoff values from 0.00 to 0.80). The post-EHR implementation observers were seven RNs who received the same training as described for pre-EHR implementation RN observers.

Observers followed randomly selected RNs during varied periods to achieve observations of approximately 30 hours per unit before and after implementation of the comprehensive EHR, aligning with previous studies.[25,30] All working RNs were eligible to participate. Names of the nurses on duty at a specific time when an observer was available were selected from a randomization table, and the nurses were asked to participate and sign an informed consent form. Any nurse could decline or accept. Data collection occurred between 5 AM and 5 PM on the three study units over a 3-week period pre-EHR implementation (2014) and post-EHR implementation (12 months later, in 2015). The health record used in the pre-EHR implementation observation was an electronic-paper hybrid that did not include computerized provider order entry (CPOE), bar-coded medication verification (BCMV), or interfaced hemodynamic monitoring or ventilator data acquisition. Documentation of nursing notes and flow sheets was primarily electronic for med-surg and tele and primarily paper-based in ICU. There were no computers for documentation in patient rooms; instead, RNs documented at computer workstations in a patient care unit team area and rarely used workstations on wheels (WOWs) in hallways. The new comprehensive EHR system that was adopted included full interprofessional electronic documentation, CPOE, BCMV, and directly interfaced data acquisition from hemodynamic monitoring devices and ventilators. In addition, EHR workstations were installed in every patient room, and additional WOWs were added in other clinical areas.

Analysis

The percentages of time spent by nurses in nursing locations before and after the EHR implementation were analyzed using a χ^2 test of proportions. Differences in the percentages of time spent performing interventions in each Omaha System category pre- and post-EHR implementation were also analyzed using a χ^2 test of proportions. Interventions were analyzed using a χ^2 test of proportions to compare differences pre- and post-EHR implementation. All results are presented as the χ^2 with associated P values. Significance was considered at $\alpha \leq .05$. All data were analyzed using R version 3.2.2 (R Foundation for Statistical Computing, Vienna, Austria).[31]

RESULTS

Time and Motion

Differences were observed in nurses' locations before and after EHR implementation (Figure 1). Before the use of a comprehensive EHR, nurses spent the most time (50.5%) in the team area. This changed significantly after implementation of the EHR, when only 35% of nurses' time was spent in the team area ($\chi^2 = 13{,}187$, $P < .001$). There was also a significant difference in the amount of time nurses spent in patient rooms before and after EHR implementation. After implementation, significantly more time was spent in the patient room ($\chi^2 = 12{,}872$, $P < .001$; Figure 1). The average number of location changes nurses made per hour decreased post-EHR implementation, from 30.3 to 23.6.

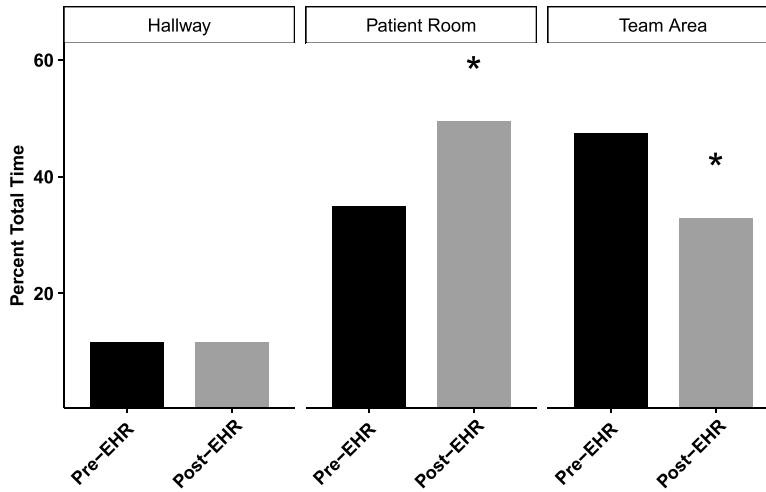

FIGURE 1. Location differences preimplementation and postimplementation of a comprehensive EHR. Asterisks represent statistically significant differences between preimplementation and postimplementation of a comprehensive EHR.

After EHR implementation, there was a reduction in time spent in the Omaha System category Case Management, but an increase in Surveillance; Teaching, Guidance, and Counseling; and Treatments and Procedures (Figure 2). Both before and after EHR implementation, a majority of nurses' time was spent on Case Management interventions, although a significant decrease was observed in this category post-EHR implementation ($\chi^2 = 31.1$, $P < .001$). In addition, a significant increase in time spent on Surveillance ($\chi^2 = 10.0$, $P = .002$); Teaching, Guidance, and Counseling ($\chi^2 = 5.4$, $P = .02$); and Treatments and Procedures ($\chi^2 = 5.6$, $P = .02$) was observed.

Notable differences in specific nursing interventions were observed before and after EHR implementation (Table 1). Overall, interventions requiring the highest percentage of a nurse's time were documentation of notes before (18.6%) and after (21.3%) EHR implementation. The increase in the percentage of time spent on documentation of notes was significantly different from pre- to post-EHR implementation ($\chi^2 = 9.9$, $P = .002$). After EHR implementation, there was a significant increase in the percentage of time nurses spent on the intervention "provides emotional support to the patient/family" ($\chi^2 = 116.5$, $P < .001$). In addition, there was a significant decrease in the amount of time a nurse spent on the intervention "transcribes/manages orders" after EHR implementation from 3.4% to 1.4% of the time ($\chi^2 = 33.1$, $P < .001$). The average number of interventions a nurse performed per hour increased post-EHR implementation,

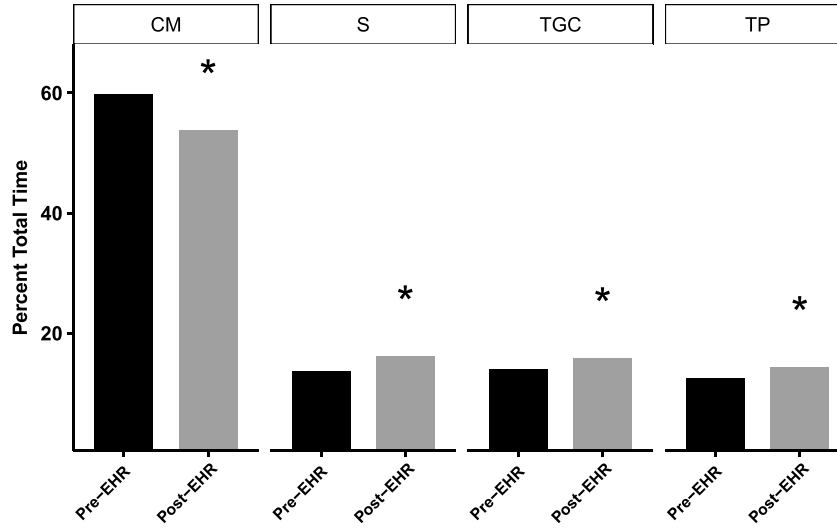

FIGURE 2. Omaha System category differences preimplementation and postimplementation of a comprehensive EHR. CM, Case Management; S, Surveillance; TGC, Teaching, Guidance, and Counseling; TP, Treatments and Procedures. Asterisks represent statistically significant differences between preimplementation and postimplementation of a comprehensive EHR.

Table 1. Observed Time (Minutes) Preimplementation and Postimplementation of a Comprehensive EHR

Intervention Description	Preimplementation		Postimplementation		P
	Time	%	Time	%	
Documents notes	816	18.7	869	21.4	.002
Reviews patient chart/notes	262	6.0	303	7.5	.007
Prepares medications	252	5.8	244	6.0	.63
Provides emotional support to p/f	40	0.9	194	4.8	<.001
Documents medications	187	4.3	180	4.4	.72
Administers medications	147	3.4	153	3.8	.31
Explains plan of care to p/f	126	2.9	126	3.1	.55
Manages non-p/f work	278	6.4	121	3.0	<.001
Gives report on patient care	293	6.7	118	2.9	<.001
Conducts assessment of patient	138	3.2	115	2.8	.39
Uses the telephone	169	3.9	110	2.7	.003
Teaches another professional	173	4.0	110	2.7	.002
Obtains/manages equipment	135	3.1	97	2.4	.05
Consults with patient's provider	100	2.3	92	2.3	.95
Manages IV	68	1.6	91	2.2	.02
Convenes/consults with team	107	2.4	88	2.2	.39
Performs a treatment/procedure	60	1.4	86	2.1	.009
Coordinates care of patient	38	0.9	85	2.1	<.001
Explains patient's condition to p/f	138	3.2	82	2.0	.001
Repositions patient	86	2.0	80	2.0	.99
Explains medication action to p/f	80	1.8	78	1.9	.76
Checks patient's vitals	66	1.5	75	1.8	.23
Maintains patient's room	49	1.1	74	1.8	.007
Gives personal hygiene care	76	1.7	70	1.7	.96
Transcribes/manages orders	147	3.4	58	1.4	<.001
Asks patient about coping	16	0.4	53	1.3	<.001
Manages infection precaution	4	0.1	50	1.2	<.001
Obtains/manages supplies	74	1.7	50	1.2	.08
Assists provider with procedure	25	0.6	40	1.0	.03
Explains procedure to p/f	54	1.2	40	1.0	.28
Monitors patient's laboratory results	68	1.6	34	0.8	.003
Holds patient hand/calming touch	22	0.5	29	0.7	.21
Obtains specimen	20	0.5	15	0.4	.53
Manages dietary needs	12	0.3	14	0.3	.56
Reads written guidelines	5	0.1	10	0.2	.15
Explains laboratory tests/results to p/f	1	0.0	10	0.2	.004
Provides wound care	22	0.5	8	0.2	.02
Gives food to/helps patient eat	20	0.5	8	0.2	.04
Total	4374	100	4060	100.0	

Abbreviation: p/f, patient/family.

from 65.6 interventions per hour before to 80.3 interventions per hour after.

Caring Efficacy Scale

A slight decrease in caring efficacy post-EHR implementation was observed, despite the increase in time spent in the patient room. Of 30 Nursing Care Efficacy Survey questions, 24 moved in the direction of decreased caring efficacy after EHR implementation, and four of those 24 questions showed a statistically significant decrease in caring efficacy (conveying strength to patients, confidence in talking to patients from different backgrounds, trouble relating to patients, and difficulty empathizing with patients). The observed reduction in caring efficacy occurred even with increases in time spent on specific nursing interventions occurring within the patient room (Table 2). Notably, nurses were observed to provide emotional

Table 2. Top 10 Nursing Interventions Occurring in the Patient Room Preimplementation and Postimplementation of a Comprehensive EHR

Activity Occurring in Patient Room	% Time Pre-EHR	% Time Post-EHR	% Change Pre to Post
Provides emotional support to p/f	83.6	92.6	+9.0
Documents notes	10.0	20.9	+10.9
Administers medications	86.2	99.3	+13.1
Documents medications	4.1	73.7	+69.6
Conducts assessment of patient	81.8	95.1	+13.3
Explains plan of care to p/f	79.0	86.5	+7.5
Reviews patient chart/notes	13.0	33.0	+20.0
Prepares medications	17.2	38.8	+21.6
Manages IV	90.3	95.8	+5.5
Performs a treatment/procedure	94.2	99.2	+5.0

Abbreviation: p/f, patient/family.

support, explain care plans, and conduct patient assessment more often in patient rooms after EHR implementation compared to the time before EHR implementation.

DISCUSSION

In this study of acute care nurses within an urban, nonprofit, regional hospital, adoption of a comprehensive EHR was associated with increases in the proportion of time nursing interventions were performed within patient rooms. Nurses changed locations less frequently after the adoption of the EHR, while performing more interventions per hour. Nurse perceptions of caring efficacy slightly decreased.

Not surprisingly, with the introduction of computers into each patient room, nurses spent more of their time in the patient rooms and less in team areas, compared to the preintervention period. Increased time in patient rooms could have advantages, including increased quality and quantity of time with patients and families, and more opportunities for assessment, education, and building relationships. In fact, results demonstrated that caring actions such as providing emotional support, asking how the patient was coping, and using a calming touch occupied 1.8% of the time before the EHR implementation and 6.8% afterward. A slight downward trend was observed postimplementation for interventions involving explaining care to patients/family (plan of care, condition, medications, procedures, and labs), decreasing from 9.1% of time spent in these interventions before EHR implementation to 8.2% after. In summary, potential increases in efficiencies and caring behaviors were observed, although small reductions were observed in activities related to patient education.

Although the sample was small, it was a surprise that caring efficacy scores were slightly decreased after the adoption of the EHR. With more opportunities for patient and family interaction, it could be anticipated that nurses would feel more effective at performing caring behaviors. Perhaps the regular use of the EHR could also present challenges, including a potential sense of disruption of interaction and relationships due to the presence of the computer in the room, mediating many nurse-patient interactions. Our findings of reduced caring efficacy scores call for further study.

In this study, each measured aspect of medication administration took more time after the adoption of the EHR. Westbrook et al[32] found an increase in time spent on medication tasks among physicians in a controlled before-and-after time and motion study to assess the impacts of an electronic medication management system, although there was no measurement of nurses and medication administration related to the EHR. In our study, an increase in time used for documentation was found (documenting notes increased from 18.7% to 21.4% of the total time; reviewing patient charts/notes increased from 6.0% to 7.5% of the total time). Carayon et al[33] found that clinical review and documentation increased from 17.7% to 34.9% of the total time among a sample of medical residents in an ICU; again, that study did not include measurement of nurses and documentation related to the EHR.

Case Management was the most observed Omaha System category both before and after adoption of the EHR. This amplifies the fact that the bulk of nursing work addresses planning, coordinating, and communicating, all roles of the professional nurse. Nonetheless, there were significant differences in all four categories before and after adoption of the EHR. This shift could be related to nurses spending more time in patient rooms. In the rooms, it is easier to conduct surveillance, to teach, and to perform tasks. This may reflect higher efficiency achieved with more documentation occurring in patient rooms. That nurses changed locations less frequently, while performing more interventions per hour, may indicate a more efficient use of time after the adoption of the EHR.

It is not surprising that nurses spent a greater percentage (28.9%) of their time in documentation and chart review after the EHR go-live date. However, the large increase in documentation time begs the question of whether this can be reduced. Is it a value-added use of nurses' time? Is all the documentation utilized? Is the documentation necessary? This too warrants further study.

The use of the Omaha System as a taxonomic and organizing framework offered a coherent, evidence-based platform. Nursing interventions are sorted into categories that describe nursing focus and intention, providing a language that spans the profession. This allows investigators to make meaningful distinctions among the nursing interventions being analyzed, based on professional interventions, rather than an arbitrary distinction such as administrative activity or direct/indirect care.

The results of this time and motion study provide the nursing profession with an improved understanding of the impacts of adoption of a comprehensive EHR on both nursing work and caring efficacy. However, many questions remain, including how EHRs affect patient experience, patient safety, and quality outcomes, including any unintended consequences. Future studies should examine the patient experience with computers present in the patient room and in many nurse-patient interactions, and whether this affects the therapeutic relationship. Studies should address the impacts of the EHR on nursing satisfaction, retention, and engagement, addressing differences in subpopulations of nurses such as practice areas, age, education, computer literacy, or health system. These are all important questions to answer for the sake of a healthy, engaged, capable nursing profession in acute care.

LIMITATIONS

While 90 hours of observations both before and after the EHR was introduced yielded large amounts of data, the observations did not cover all hours of care. All observations were made between 5 AM and 5 PM, and thus this study does not address differences in other hours. A table of random numbers was used to select nurses for observation. They were willing to be followed, and felt confident that it would not disrupt their care. Though the observers underwent training with the software, and interrater reliability was adequately demonstrated, there is a risk that variation existed between how observers recorded observations. During the data collection periods before and after adoption of the EHR, the three units continued to function in real time. Other events or stresses in the life of the units may have affected the observations. Finally, the CES study was based on a small sample and should be considered a pilot study.

CONCLUSION

Impacts of a comprehensive EHR on nursing work and caring efficacy have been measured. We found that nurses spent significantly more time in patient rooms, and more time on documentation and medication administration, after EHR implementation. Although nurses changed locations fewer times per hour, they performed more interventions per hour. As before the EHR implementation, nurses spent the most time performing interventions in the Case Management category, indicative of professional nursing. At the same time, in a pilot study to explore caring efficacy, we found a slight reduction after the adoption of the EHR.

More research is needed to understand the intentional and unintentional impacts of a large systematic change such as adoption of a new EHR. The quadruple aim, including patient experience, quality, cost, and worker satisfaction, is crucial to the success of healthcare, and each may be affected by the information systems that are used. It will be important to understand these impacts further to keep what works well, and eliminate or change what does not.

References

1. Centers for Disease Control and Prevention. Meaningful use. Centers for Disease Control and Prevention Web site. https://www.cdc.gov/ehrmeaningfuluse/introduction.html. Updated May 26, 2016. Accessed December 21, 2016.
2. US Department of Labor Bureau of Labor Statistics. Registered nurses. US Department of Labor Bureau of Labor Statistics Web site. https://www.bls.gov/ooh/healthcare/registered-nurses.htm. Accessed January 3, 2017.
3. Duffy M. Nurses and the migration to electronic health records. *The American Journal of Nursing*. 2015;115(12): 61–66.
4. Douglas S, Cartmill R, Brown R, et al. The work of adult and pediatric intensive care unit nurses. *Nursing Research*. 2013;62(1): 50–58.
5. Doherty-King B, Yoon JY, Pecanac K, Brown R, Mahoney J. Frequency and duration of nursing care related to older patient mobility. *Journal of Nursing Scholarship*. 2014;46(1): 20–27.
6. Darmody JV. Observing the work of the clinical nurse specialist. *Clinical Nurse Specialist*. 2005;19(5): 260–268.
7. Cornell P, Herrin-Griffith D, Keim C, et al. Transforming nursing workflow, part 1: the chaotic nature of nurse activities. *Journal of Nursing Administration*. 2010;40(9): 366–373.
8. Keohane CA, Bane AD, Featherstone E, et al. Quantifying nursing workflow in medication administration. *Journal of Nursing Administration*. 2008;38(1): 19–26.
9. Abbey M, Chaboyer W, Mitchell M. Understanding the work of intensive care nurses: a time and motion study. *Australian Critical Care*. 2012;25(1): 13–22.
10. Hendrich A, Chow MP, Skierczynski BA, Lu Z. A 36-hospital time and motion study: how do medical-surgical nurses spend their time? *The Permenente Journal*. 2008;12(3): 25–34.
11. Yee T, Needleman J, Pearson M, Parkerton P, Parkerton M, Wolstein J. The influence of integrated electronic medical records and computerized nursing notes on nurses' time spent in documentation. *Computers, Informatics, Nursing*. 2012;30(6): 287–292.
12. Wong DH, Gallego Y, Weinger MB, Clack S, Slagle J, Anderson CT. Changes in intensive care unit nurse task activity after installation of a third-generation intensive care unit information system. *Critical Care Medicine*. 2003; 31(10): 2488–2494.

13. McComas J, Riingen M, Chae Kim S. Impact of an electronic medication administration record on medication administration efficiency and errors. *Computers, Informatics, Nursing*. 2014;32(12): 589–595.
14. Watson J. *Assessing and Measuring Caring in Nursing and Health Science*. 2nd ed. New York, NY: Springer Publishing; 2008.
15. Coates CJ. The caring efficacy scale: nurses' self-reports of caring in practice settings. *Advanced Practice Nursing Quarterly*. 1997;3: 53–59.
16. Betcher DK. Elephant in the room project: improving caring efficacy through effective and compassionate communication with palliative care patients. *Medsurg Nursing*. 2010;19(2): 101–105.
17. Eggenberger TL, Keller KB, Chase SK, Payne L. A quantitative approach to evaluating caring in nursing simulation. *Nursing Education Perspectives*. 2012;33(6): 406–409.
18. Khalaila R. Simulation in nursing education: an evaluation of students' outcomes at their first clinical practice combined with simulations. *Nurse Education Today*. 2014;34(2): 252–258.
19. Lamke D, Catlin A, Mason-Chadd M. "Not just a theory": the relationship between Jin Shin Jyutsu® self-care training for nurses and stress, physical health, emotional health, and caring efficacy. *Journal of Holistic Nursing*. 2014;32(4): 278–289.
20. Surr CA, Smith SJ, Crossland J, Robins J. Impact of a person-centred dementia care training programme on hospital staff attitudes, role efficacy and perceptions of caring for people with dementia: a repeated measures study. *International Journal of Nursing Studies*. 2016;53: 144–151.
21. Reid C, Courtney M, Anderson D, Hurst C. The "caring experience": testing the psychometric properties of the Caring Efficacy Scale. *International Journal of Nursing Practice*. 2015;21(6): 904–912.
22. Monsen KA, Schenk E, Schleyer R, Schiavenato M. Applicability of the Omaha System in acute care nursing for information interoperability in the era of accountable care. *American Journal of Accountable Care*. 2015;3(3): 53–61.
23. Schenk E, Schleyer R, Jones CR, Fincham S, Daratha KB, Monsen KA. Time motion analysis of nursing work in ICU, telemetry and medical-surgical units. *Journal of Nursing Management*. 2017;25(8): 640–646.
24. Bowles KH. Patient problems and nurse interventions during acute care and discharge planning. *The Journal of Cardiovascular Nursing*. 2000;14(3): 29–41.
25. Zhang Y, Monsen KA, Adam TJ, Pieczkiewicz DS, Daman M, Melton GB. Systematic refinement of a health information technology time and motion workflow instrument for inpatient nursing care using a standardized interface terminology. *AMIA Annual Symposium Proceedings*. 2011;2011: 1621–1629.
26. Lopetegui M, Yen PY, Lai AM, Embi PJ, Payne PR. Time Capture Tool (TimeCaT): development of a comprehensive application to support data capture for time motion studies. *AMIA Annual Symposium Proceedings*. 2012;2012: 596–605.
27. Martin KS. *The Omaha System: A Key to Practice, Documentation, and Information Management*. Omaha, NE: Health Connections Press; 2005.
28. Monsen K, Foster D, Gomez T, et al. Evidence-based standardized care plans for use internationally to improve home care practice and population health. *Applied Clinical Informatics*. 2011;2(3): 373–383.
29. Hallgren KA. Computing inter-rater reliability for observational data: an overview and tutorial. *Tutorial in Quantitative Methods for Psychology*. 2012; 8(1): 23.
30. Fratzke J, Melton GB, Monsen K. Time and cost of acute care nursing interventions. Paper presented at: First International Conference on Research Methods for Standardized Terminologies; 2013; Eagan, MN.
31. R Core Team. *R: A Language and Environment for Statistical Computing [Internet]*. Vienna, Austria: R Foundation for Statistical Computing; 2013. http://www.r-project.org. Accessed March 5, 2018
32. Westbrook JI, Li L, Georgiou A, Paoloni R, Cullen J. Impact of an electronic medication management system on hospital doctors' and nurses' work: a controlled pre-post, time and motion study. *Journal of the American Medical Informatics Association*. 2013;20(6): 1150–1158.
33. Carayon P, Wetterneck TB, Alyousef B, et al. Impact of electronic health record technology on the work and workflow of physicians in the intensive care unit. *International Journal of Medical Informatics*. 2015;84(8): 578–594.

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