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Competency Assessment in Simulation of Electronic Health Records Tool Development

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Rapid deployment of electronic health records has resulted in a need for simulation centers to integrate the use of electronic health records into simulation-based learning activities within the clinical workflow. To assess the quality of the documentation in the electronic health record, the Competency Assessment in Simulation of Electronic Health Records Tool was developed. Lynn's method of content validity, combined with nominal group and Delphi techniques, was used to identify 15 domains of best practice in documentation. Participants with expertise in academic education, simulation, and informatics provided input into the development of the tool. The tool evolved over three rounds of Delphi that refined the language and provided anchors to promote accurate assessment of student and nurse documentation. The results of the Delphi narrowed the 15 domains down to 10 domains for scoring best practices in electronic documentation within simulation-based learning activities. The Competency Assessment in Simulation of Electronic Health Records Tool was developed to address the electronic health record competencies of both nursing students and practicing nurses in a simulation environment.

KEY WORDS: Competencies, EHR, Electronic health records, Informatics, Interprofessional, Simulation, Technology

The Health Information Technology Economic and Clinical Health Act[1] and the proliferation of electronic health records (EHRs) across the United States have created a significant need within simulation centers to integrate EHRs to develop student competencies in electronic documentation. Certified EHRs across the nation are complex and require education and training for effective and safe use in patient care.[2] Furthermore, methods and tools to assess EHR competencies for clinical documentation need to be developed.[3,4] Incomplete systems pose challenges to the development of competencies. It is critical that nursing programs across the country successfully integrate EHRs into curriculum. Simulation centers provide a safe, effective way for nursing students to develop competencies.

Students and clinicians are frequently trained in computer-classroom settings. This approach to training is ineffective as regards retention and application of documentation practices encountered in the practice setting.[5] Frequently, this method of education results in poor practices within the use of an EHR.[6] This article describes a strategy and methods for the development of the Competency Assessment in Simulation of EHRs (CASE) Tool to evaluate best practices for documentation in the EHR within simulation.

BACKGROUND

To identify previous research on EHR competency evaluation in simulation, a search of MEDLINE and CINAHL was conducted using the terms *simulation*, *computer simulation*, *competency*, *electronic health record*, *EHR*, and *nursing education*. Patient safety and regulatory requirements are national issues that require a shift in thinking to evidence-based educational strategies. Methods recommended include better tools to assess competencies related to health information technology (HIT), and the integration of interprofessional education (IPE) skills into curricula, coupled with HIT.[7,8] Simulation-based learning (SBL) experiences provide a unique educational strategy to assist the development of the knowledge, skills, attitudes and clinical judgment necessary to provide safe, quality patient care.[8–10] As such, educators are working to integrate the EHR into SBL experiences as an important method to increase student competencies in information technology. Technical challenges to the integration of EHRs into existing simulation technology, such as high-fidelity manikins and device integration, are significant barriers to the full adoption and implementation of EHRs into simulation centers. The research team has addressed many of these barriers and reports our technical implementation in *Nursing Informatics for the Advanced Practice Nurse, 2nd Edition* (see Chapter 24: Developing Competencies in Nursing for an Electronic Age of Healthcare).

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The National Council of State Boards of Nursing[11] simulation study found that increasing the number of hours that students spent in simulation can be as effective as education in the traditional clinical environment when the appropriate guidelines are used in designing and implementing the activity. However, simulation centers without EHRs cannot provide students with practice in electronic documentation skills that are essential for all healthcare providers.[2] Healthcare facilities provide students with varying levels of access to the EHR. It is no longer feasible to depend on the clinical setting to provide practice with documentation skills. When simulation is integrated appropriately into the curriculum, learning can be improved in relation to (1) clinical judgment; (2) skills acquisition and retention; (3) interprofessional teamwork; and (4) improved patient outcomes.[10]

Electronic health records integrated within simulation centers and developing best practices in use of EHR within the clinical workflow is important to the quality and safety of patient care. Current methods for training healthcare professionals reinforce documentation at the end of the shift or after a nursing intervention rather than within the clinical workflow. Without EHRs incorporated within simulation centers, these poor practices will continue in the clinical setting.

In the literature, few studies explored the impact of integrating EHRs into simulation-based activities to develop specific informatics competencies.[12–14] Competencies that were evaluated included the skills required to use EHRs to obtain data and information promptly, the appropriate use of the information to support clinical judgments, and the documentation of care as part of the patient-care routine. Donahue and Thiede[15] reported on a project to integrate a fully functional EHR into nursing education for simulation. The faculty using the system observed nursing students delivering clinical care while transferring knowledge gained through virtual and high-fidelity SBL experiences that integrated an EHR. While this project, referred to as "the Athens Project," has positive results and expanded use of the system to other institutions, they do not report an evaluation tool for evaluating best practices in documentation practices within the EHR. Herbert and Madigan[16] assessed documentation competency by counting the number of keystrokes or mouse clicks, timing each task, and assessing student satisfaction with the use of the EHR. Similarly, George et al[17] found that measuring accuracy and time to complete an EHR scavenger hunt improved students' speed and maintained accuracy when using the EHR. Other studies that integrated the EHR into SBL experiences did not assess student competency with documentation.[2,18] Satisfaction with the EHR product and ability to use the system were assessed, and use of the system was considered successful based on student and faculty satisfaction.[18,19]

Academic versions of vendor software with limited functionality have been used by numerous schools and are typically a pared-down version of the vendor software system.[5] Even with these limitations, researchers found that students reported feeling more prepared for the clinical setting after using the EHR in simulation.[20,21] Although these studies demonstrate improvement in students' ability to use the EHR, they do not develop and evaluate clinical competencies in documenting with best practices as they use the EHR within clinical workflow.[20,21]

There have been additional studies to measure informatics competencies for clinical practice. However, many are self-assessment tools[22–24]; others are focused on nurses in clinical practice[25–27] or nurses in administrative positions.[28] Forman et al[29] report an integrative review of the literature to examine the state of the science with informatics competencies and best practices in education. The majority of the tools identified were self-assessment, there was minimal research related to nursing faculty competencies, and there is a gap in the literature for best practices for teaching clinical informatics competencies.[29]

PROBLEM

Competency development in computer literacy and HIT has been recommended for students and healthcare professionals since the 1970s.[27,29–33] The use of EHRs continues to infiltrate every aspect of healthcare. Students and practicing nurses must be assessed for competency with documentation skills in a safe, realistic environment for learning. The simulation center provides a practice environment where nurses can learn to document without affecting patient safety. A competency assessment tool for use in simulation-based activities is needed to evaluate students and healthcare professionals in accurately documenting and utilizing the EHR effectively for patient care.[29,34,35]

The CASE Tool was developed to address a gap in existing tools to evaluate clinical competencies in use of the EHR during simulation. This tool is a component of a comprehensive EHR-Enhanced Simulation Program (ESP), which has two primary aims. The first aim is to develop and test for validity of the CASE Tool. The second aim and long-term goal is to design an EHR-ESP for use in both academic and practice settings. The program will be used to develop and evaluate informatics competencies within an interprofessional team for safe and effective use of EHRs in the clinical workflow. This innovative project is a significant contribution to address competency measurement of student and clinician documentation in the EHR as part of simulation-based learning experiences.

APPROACH

As part of a comprehensive plan to develop an EHR-ESP Toolkit, the CASE Tool was developed to evaluate informatics competencies in clinical workflows. Simulation-based

learning experiences using complex high-priority patient populations, including diagnoses of sepsis, septic shock, acute myocardial infarction, congestive heart failure, and stroke, were given priority in development.

The unique ability to integrate a certified EHR platform using deidentified patient data during a simulation activity allows the replication of complex cases that a clinician would experience in the practice setting. This approach to the use of deidentified clinical data makes the development and maintenence of a simulation EHR platform more efficient. Case replication is defined as a simulation-based learning experience in which the patient (simulator) and diagnostics (electrocardiogram, chest x-rays, and laboratory values) reflect a patient's response to both the pathologic state and initiated treatment modalities. Therefore, a case replication would provide a high level of fidelity. Fidelity is defined as the degree to which an experience approaches reality.[36] Fidelity is determined by multiple factors, including the environment, equipment, and resources used in a simulated experience, and has a direct impact on the participant's learning.[36] Clinical scenarios have been prepared fully utilizing the EHR within the workflow to address clinical conditions representative of high-impact patient safety areas. These clinical scenarios are coupled with the CASE Tool for pilot testing and evaluation of validity and reliability. These components are part of a larger tool kit. The EHR-ESP Toolkit includes the following:

1. use of clinical scenarios for simulation-based learning activities designed from a case replication method using clinically deidentified data for patient, staff, and provider[6];
2. education modules enhancing existing IPE curriculum focused on developing knowledge and skills in best practices for the use of EHRs within clinical workflow;
3. a tool for evaluating knowledge acquisition and competency (the CASE Tool) with the EHR through a simulation-based learning activity while caring for high-priority complex cases; and
4. a test bank for evaluating knowledge of best practices with use of the EHR for clinical documentation.

The development of the EHR-ESP Toolkit followed national evidenced-based guidelines with oversight of an interprofessional team of clinicians, simulation experts, educators, and informatics specialists. The oversight team aligned the Toolkit to support the World Health Organization's definition of IPE as follows: "when students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes."[37,38] The oversight team developed a framework to guide the project that is reflected in Figure 1. This framework emphasizes

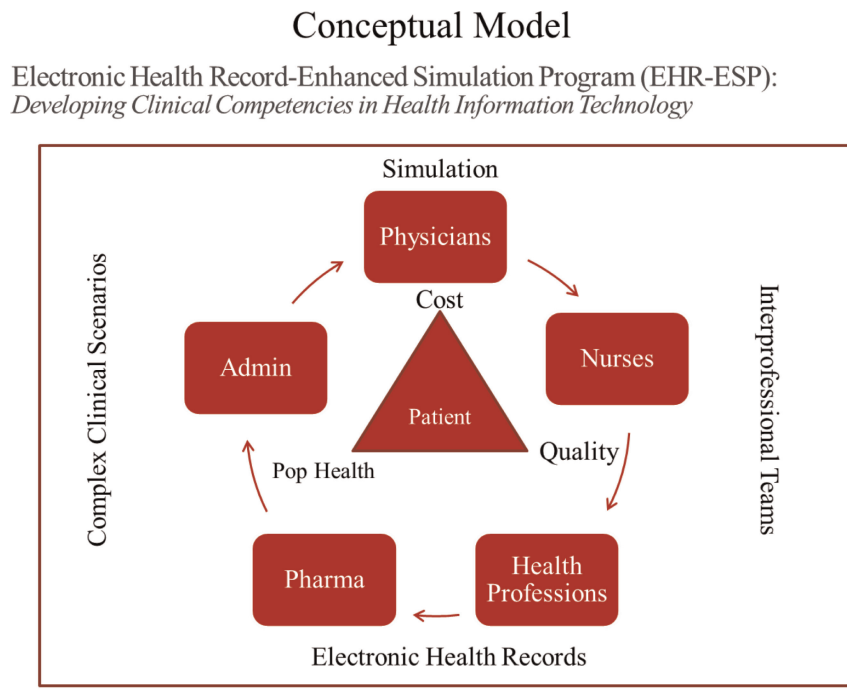

FIGURE 1. Framework for EHR-ESP.

interprofessional teamwork and patient-centered care reinforced by simulated use of the EHR within the clinical workflow to improve quality, cost, and population health.

NOMINAL GROUP AND DELPHI TECHNIQUE TO IDENTIFY DOMAINS OF BEST PRACTICE FOR THE USE OF ELECTRONIC HEALTH RECORDS

The initial step to the development of a tool to evaluate best practice of use of the EHR in simulation was a review of the literature to identify any validated instruments. The review identified self-assessment tools that reflected use of computers but the tools were not specific to the use of an EHR.[22–24] However, during a full-day workshop at the 2014 American Nursing Informatics Association (ANIA) Annual Conference, approximately 80 attendees identified and discussed poor practices and unintended consequences in use of the EHR. The 80 attendees also discussed strategies to identify and mitigate unintended consequences and legal implications of documentation within the EHR.[39] The attendees, composed of experienced nursing informaticists and nursing researchers, concurred that documentation issues and errors were significant within their institutions, and these issues were often associated with near-misses or patient safety events. The issues noted at the ANIA conference are included in Table 1 and were also reported in Conference Proceedings.[40]

The next step was to take these poor practices identified in 2014 and use a nominal group technique (NGT). "The NGT is an approach that was first described in the 1960s as a procedure to facilitate effective group decision-making in social psychological research."[41] This technique was used to facilitate discussion addressing the following question: If this poor practice were not present, what would be the proper approach to documentation? The NGT was supported by a consultant with expertise in program evaluation, research methodology, and medical simulation research. The NGT included a group of 15 subject matter experts composed of informaticists, academic educators, clinicians, simulation experts, faculty, and HIT staff from the educational and practice settings. Subject matter expertise is reflected in Table 2 and constitutes expertise from across the United States and one from Canada. A total of 5 to 10 experts are considered adequate for content validation.[42] The initial idea generation netted 15 domains of EHR best practice, followed by consensus on definitions of the domains. The team recognized that these domains did not constitute 100% representation of best practice, but the intent was to identify top priorities within this assessment strategy that could be relevant to the use of the EHR within simulation.

Subsequently, the project team conducted three rounds of the Delphi method to refine the evaluation strategy for the identification of domains of best practice in the use of an EHR. Delphi is a technique that measures the judgment of a group of experts for making decisions regarding content for instrument development.[43]

To establish content validity, the domains of best practice in the use of an EHR were assembled into an instrument. The 15 domains were refined and reduced to 14 areas and underwent the second and third round of Delphi analysis. Using Lynn's[42] content validity methods, the team calculated a content validity index (CVI) for the relevance of the

Table 1. EHR Documentation Poor Practices

Consideration	Description	Clinic Examples and Implications
Inconsistencies	Inconsistencies in documentation are those items that are documented in one place, but then a conflicting item may be documented in a different place.	The nurse documents an assessment that is within normal limits but then enters a note about abnormal breath sounds.
Incomplete	Incomplete documentation leaves gaps in providing a complete record of care. Again, this occurs because documentation takes place in multiple places in the EHR, and omissions may exist in one of the documented places.	Incomplete documentation is orders not being completed, or pain assessed and medications given, but no follow-up documentation.
Sloppiness	Sloppiness refers to documentation that raises concerns through a lack of professionalism. This includes misspelled words, writing in a "texting" format, or use of slang.	The use of flow sheets has decreased sloppy documentation but is often prevalent in notes and comment fields.
Note bloat	Notes are repetitive and are not relevant to the specific note being written.	Information is copied or pulled in from other parts of the record that inflate content and include redundancy.
Lack of follow-up	Documentation that falls short of providing complete information.	Failure to reassign vital signs after a change in condition or no documentation of follow-up to specific interventions.
Devil in the details	Too much detailed information.	Too much detail can be detrimental since it is hard to capture everything that occurs, and often gaps may be more easily exposed. Also increases the potential for contradictory information.

From Considerations and Tips for EHR Documentation, presented and discussed at the ANIA Annual Conference 2014 Workshop.[39]

Table 2. Subject Matter Experts Informing CASE Tool Development

Composition of NGT and Delphi Round Stakeholders and Experts			
	Nominal Group	Delphi Survey Participants	Credentials of Participants
Simulation expertise	4	13	Executive director of simulation at a large health sciences center in Southwestern United States; NLN simulation education leaders nationwide; consultant researcher in simulation research (1)
Nurse educators academic	3	6	Nurse educators/undergraduate nursing faculty in a large health sciences center in Southwest
Practice	3	7	Chief nursing officer of a large hospital in Southwest United States (1); nurse educators in the hospital system; chief nursing informatics officers and national informatics leadership
Nursing informatics	2	9	Texas Nurses Association–Texas Organization of Nurse Executives Health Information Technology Committee of Subject Matter Experts (8); Canadian nursing informatics researcher (1)

Abbreviation: NLN, national league of nursing.

There is duplication in some categories of experts: total NGT = 12; Delphi = 33.

items on the instrument using a 4-point ordinal rating scale, with 1 connoting an irrelevant item and 4 denoting an extremely relevant item. The CVI is the proportion of items that received a rating of 3 or 4. The second stage Delphi resulted in more precise definitions of the domains and was included in the third stage. A total of five questionnaires were received in the first round, and the experts' scoring of EHR best practices with notes from participants were collated, with consistent or conflicting viewpoints identified and resolved to inform round 2. The proposed domains of best practice were then modified according to the responses collected and further analyzed. A total of 14 questionnaires were returned in the second and third round of Delphi analysis, for a total of 33 completed questionnaires.

RESULTS AND NEXT STEPS

According to Lynn,[42] content validity development has three steps: domain identification, item generation, and instrument formation. The initial NGT resulted in 15 domains of best practices of EHR use.

Further definition and clarity resulted in a reduction of 15 domains to 14. The results of the Delphi rounds narrowed the 14 domains to a tool with 10 items for scoring best practices for the use of an EHR within simulation-based learning activities. The overall instrument CVI in round 1 was 0.80, 0.81 in round 2, and 0.97 in round 3.

Subsequently, the project team convened a group of undergraduate nursing faculty with expertise in simulation and again used NGT to determine how the domains might be used in simulation. All 10 domains were discussed with further suggestions. Consensus was reached as to how each of the items could be evaluated (scored) within a simulation-based activity. For example, items 1, 2, and 3 (see Supplemental Digital Content 1, http://links.lww.com/CIN/A60) might include an anchor that could justify all three items. The team defined anchors as a type of instruction that places learning in a meaningful, problem-solving context. The group discussed an example of a clinical scenario as an amputee assessed with "bilateral pedal pulse" after amputation surgery. Another example considered is a copy-forward documented in the EHR, but no change to status introducing conflict in the EHR; therefore, the data would not reflect a change in the patient status post amputation.

Another example was domain 4. A student could be evaluated as to how effectively he/she used clinical information and navigated the EHR for the location of information relevant to patient care. The strategy that will be used is to simulate the EHR and the patient condition to develop clinical reasoning skills and promote safe patient care within the clinical workflow. Final instrument formation included all 10 of the items noted in the tool (see Supplemental Digital Content 1, http://links.lww.com/CIN/A60) with the scoring approach for evaluation and anchors for simulation-based learning experience. The final CASE Tool, provided as supplemental content, uses a scale for scoring that ranges from strongly disagree (0) to strongly agree (4). In preparation for a pilot test and further validation, we worked with a psychometric instrumentation subject matter expert and biostatistician and updated the scoring to a recommended Likert scale. In this case, the faculty score the participant to rate performance based on their opinion.

This tool will be used to evaluate the knowledge and performance of BSN students in a pilot study to test the tool at a large health sciences center in the Southwestern United States. The BSN degree plan within this traditional program is completed in four consecutive semesters, levels I through IV. These levels are reflected in the tool (see Supplemental

Digital Content 1, http://links.lww.com/CIN/A60) as to when the research team determined these competencies would be introduced within the program. Accordingly, the pilot will engage level IV students with the expectation that the students are prepared to exhibit all 10 competency items in the CASE Tool. The full study protocol has been approved by Texas Tech University Health Sciences Center Institutional Review Board and qualifies as exempt.

Additionally, the research team examined the competencies in light of the international initiative to define HIT competency levels. This initiative is the result of a European-US consortium to map, quantify, and project the need, supply, and demand for digital workforce skills and HIT competencies.[43] This group identified levels of competencies, including baseline, basic, intermediate, advanced, and expert. The five definitions for HIT competency levels are reflected as follows:

- Baseline: A foundation level upon which all other skills and competencies are based.
- Basic: An entry-level or beginning skill or competency level, equating to "understanding" and "knowing" in Bloom's Taxonomy. Could potentially align with associate-level degree academic programs or curricular competencies in eHealth/HIT.
- Intermediate: A midlevel incumbent skill or competency level, equating to "applying" and "analyzing" in Bloom's Taxonomy. Could potentially align with baccalaureate-degree level academic programs or curricular competencies in eHealth/HIT.
- Advanced: A high-level incumbent skill or competency level, equating to "evaluating" and "synthesizing" in Bloom's Taxonomy. Could potentially align with baccalaureate to master's degree academic programs or curricular competencies in eHealth/HIT.
- Expert: The highest level of skill or competency, also equating to "evaluating" and "synthesizing" in Bloom's Taxonomy. Could potentially align with master's to postdoctoral degree academic programs or curricular competencies in eHealth/HIT.[44]

We mapped the 10 competencies within the CASE Tool to this international effort using the first three levels of competency, basic through intermediate (see Supplemental Digital Content 1, http://links.lww.com/CIN/A60). Undergraduate nursing students would not be expected to reach advanced and expert levels of competency as noted in the EU-US HITComp definitions.

CONCLUSION

In conclusion, the CASE Tool will be used to facilitate and explicitly evaluate the student's use of the EHR following the best practices within the instrument. Additionally, it is not necessary for all 10 of the domains to be present in any given evaluation strategy but can be used as appropriate to supplement existing evaluation strategies for the performance of the student delivering clinical care. The next step is to pilot the CASE Tool within simulation in an undergraduate nursing program and to perform empirical validation.

This article reports an important effort to develop the CASE Tool and methods used to establish the content validity. Ten domains of best practice for the use of the EHR are reported with a discussion of how these domains will be evaluated within simulated clinical experiences with the CASE Tool. Finally, the CASE Tool aligns with international efforts to create education materials and methods to evaluate HIT competencies for the digital age of healthcare. As such, this tool should be helpful to educators and the practice setting to evaluate nursing competencies for best practices in the use of the EHR.

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