



THE USE OF NURSING INFORMATICS TO IMPROVE HEALTHCARE OUTCOMES

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The ongoing focus on providing patient care based on evidence has implications for the necessary abilities in informatics that should be included into all levels of nursing education programs. The objective of this literature study was to assess the current knowledge and understanding of clinical informatics abilities among registered nurses, as well as to identify the most effective instructional programs for nursing students and faculty. Findings indicate that nurse training programs lack consistent adherence to established criteria when it comes to teaching nursing informatics competence. Another literature gap that was highlighted is the lack of research on the informatics training needs of nurse educators. The findings affirm the need for ongoing study to provide precise guidelines on the anticipated clinical informatics skills of graduate nurses and the specific training requirements for faculty to enhance student learning. The complexity of informatics skills needed of registered nurses has significantly expanded during the last decade. The elevated proficiency level suggests the need for clarity on the current requirements for nursing informatics capabilities. In order to adequately equip graduates, nurse educators must possess the necessary expertise to teach the most up-to-date informatics information. The objective of this integrative review research was to assess the current knowledge and understanding of clinical informatics competences among registered nurses, in order to guide the development of effective instructional programs.

Keywords: Nurses, clinical informatics, healthcare, outcomes, patient, review article, instructional programs.

1. Introduction

Decisions on patient treatment should be based on up-to-date clinical information that reflects the highest quality evidence available (Institute of Medicine, 2013). Proficient utilization of informatics and technology is imperative for contemporary and forthcoming nursing professionals in order to enhance vital decision-making and achieve ideal patient outcomes (Massachusetts Department of Higher Education Nursing Initiative, 2016). Nursing clinical informatics abilities include the acquisition and use of patient data for the purpose of analysis



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and distribution. In order for graduates to acquire expertise in informatics, it is essential to implement efficient instructional methodologies and provide faculty development.

The study conducted by the Quality and Safety Education for Nurses (QSEN) Institute found that nursing faculty expressed ambiguity about the most effective methods for teaching informatics to students (Cronenwett et al., 2007). In a 2015 article by the National League for Nursing (NLN), the need of making changes to teaching methods was discussed. These changes are necessary to improve the preparedness of graduate students to provide excellent care in the modern healthcare system, which heavily relies on technology. The nurse professors were instructed to enhance their informatics competences in order to facilitate the growth of technological skills in students. However, there continues to be a persistent absence of appropriate instructional methodologies, and nursing faculty members still lack the necessary competence.

According to a recent nationwide poll, college students said that the use of technology enhanced their overall academic experience. However, less than half of the participants believed that faculty members effectively employed technology to stimulate attention and foster critical thinking (Skiba, 2017). The lack of effective use of technology among the majority of students is evident in health care education. According to Skiba (2011), in order for students to learn effectively about participating in healthcare, it is necessary for them to have a strong understanding of technology and informatics. Research has shown a persistent absence of integration of informatics education in nursing curriculum (De Gagne, Bisanar, Makowkis, & Nuemann, 2012; Hunter, McGonigle, & Hebda, 2013.)

The research revealed gaps in understanding informatics capabilities and their impact on the nursing workforce when integrated into nursing courses. The objective of this study was to collect up-to-date information on the most effective techniques for nursing students and teachers to acquire informatics capabilities. This was achieved by reviewing relevant literature. The report presents the synthesized results and research suggestions.

2. Methodology

2.1. Research Design

A systematic search was conducted on the CINAHL, OVID, and PUBMED electronic databases using the keywords: clinical informatics, competences, computers, nursing, students, and skills. The time period spanned from January 2011 to June 2018. Additional searches were performed using the Google Scholar, Google, and Bing search engines. Further online Boolean searches revealed gray literature. The gray literature included of five dissertations, one thesis, one teaching toolkit, and one Technology Informatics Guiding Education Reform (TIGER, 2007) e-repository document.

The searches yielded a cumulative count of 1,834 items. In addition, we conducted further manual searches of the electronic table of contents from CIN: Computers, Informatics, Nursing

and the Online Journal of Informatics Nursing. The reference portions of the found papers were also examined. The manual search procedures discovered an extra 1,092 items. After eliminating duplicate articles, the total number of records found was 2,810.

2.2. Inclusion and Exclusion Criteria

In order to improve the accuracy of the findings, the inclusion criteria included assessing if there was a need for nursing students and/or nursing professors to undergo formal clinical informatics training. The exclusion criteria were any studies that did not pertain to nursing students, newly graduated nurses, or nursing professors. Articles without any connection to practical computer-based skills or instructional techniques connected to informatics were also removed. After reviewing the abstracts, a total of 2,712 publications were removed. The study team thoroughly reviewed a total of ninety-eight publications, while excluding an additional 29 articles. The study team critically rated a total of 69 papers. A university librarian confirmed the search techniques, parameters, and results. Refer to the Supplemental Digital Content at <https://links.lww.com/NEP/A170> for a Figure that visually represents the search procedure.

2.3. Data evaluation

The 69 papers were evaluated in a thorough and careful manner using review rubrics specifically designed for this research, which were based on Melnyk and Fineout-Overholt's (2015) critical appraisal approach. Distinct criteria were used to evaluate quantitative and qualitative research. The qualitative assessment rubric assessed six categories: research design, study significance, sample size, methodology, data analysis, and findings. The quantitative assessment rubric assessed seven categories: levels of evidence, research goal, sample size, reliability, variability, theoretical framework, and findings. The quantitative evaluation rubric was used to assess the mixed-methods study. The research team independently examined and assessed each publication. The use of the rubric grading method was an endeavor to mitigate researcher bias.

3. Technology Informatics Guiding Education Reform

The findings about work based on TIGER nursing informatics competences were derived from many sources, including research on instrument development by Hill, McGonigle, Hunter, Sipes, and Hebda (2014a, 2014b), Hunter et al. (2013), and Saratan, Borycki, and Kushniruk (2015). Hill et al. (2014b) developed a dependable and accurate online tool, named TIGER-based Assessment of Nursing Informatics (TANIC), allowing individuals to evaluate their own perceived nursing informatics skills. This instrument was established based on TIGER competencies. The research team conducted a further study where they built upon the original TANIC and developed a tool to accurately evaluate the abilities of nursing informatics at the graduate level (Hill et al., 2014a). Saratan et al. (2015) used the TIGER competencies in their mixed-methods study to ascertain the necessary information management competences for a

newly graduated nurse. According to the study, the participants considered 62 out of the 66 TIGER information management abilities to be applicable to new graduates (TIGER, 2007).

4. Nursing Informatics Competencies Scale for Self-Assessment

The creation of the Self-Assessment of Nursing Informatics Competencies Scale (SANICS) instrument was founded on the influential research conducted by Staggers, Gassert, and Curran (2001). Choi and DeMartinis (2013) used a 30-item instrument to assess and evaluate the self-reported informatics skills of undergraduate, RN-to-BSN, and doctor of nursing practice (DNP) students. The results of the study showed that students ($n = 289$) had better average competence ratings in three specific areas: clinical informatics role, clinical informatics attitude, and wireless device abilities. Nevertheless, the survey findings revealed that students did not consider themselves to possess the necessary proficiency in applied computer skills and the clinical informatics function.

Godsey (2015) conducted a psychometric assessment of the SANICS instrument with a sample size of 458 entry-level nursing students. Proficiencies were assessed before to and during an educational intervention. The Cronbach's alpha values ranged from .95 to .97, indicating high internal consistency. Additionally, almost half of the factor loadings were .90 or above after the educational intervention.

5. Electronic Health Care Record

The literature frequently reported the use of an electronic health record (EHR) as an educational strategy (Boyd, 2014; Choi, Park, & Lee, 2016; Jansen, 2014; Jones & Donelle, 2011; Kowitlawakul, Chan, Tan, Soong, & Chan, 2015; Miller et al., 2014; Mitchell, 2015; Pobocik, 2014; Warboys, Mok, & Frith, 2014; Wheeler, 2016). The findings from both qualitative and quantitative research studies shown that the use of a realistic electronic record enabled an exact representation of patient care and facilitated students in documenting nursing actions in real-time within the care plan (Jansen, 2014; Kowitlawakul et al., 2015; Pobocik, 2014).

A study conducted by Boyd (2014) revealed that out of a total of 63 students, there was a consensus that greater practical experience using Electronic Health Records (EHR) was required. The qualitative findings revealed that the student participants reported that practicing with the EHR helped them provide nursing care that was safer. Two separate studies ($n = 222$, $n = 62$) conducted surveys on recent graduates and found that they viewed EHR system documentation as a key educational need (Miller et al., 2014; Mitchell, 2015).

Certain nursing students acquired proficiency in using Electronic Health Record (EHR) systems via hands-on experience at hospitals or other clinical facilities during their clinical rotations, while others received EHR system instruction inside the school setting. The study used both Open Source and researcher-developed Electronic Health Record (EHR) software systems (Kowitlawakul et al., 2015). Survey findings suggested that both students and professors

considered the use of Electronic Health Records (EHRs) to be crucial for the development of clinical abilities, despite it being recognized as a challenging skill to acquire (Choi et al., 2016).

Qualitative findings from previous studies have shown that repeated use and use of electronic health record (EHR) software led to an enhanced level of comfort (Jones & Donelle, 2011). According to Warboys et al. (2014), there is a positive correlation between the frequency of a student's access to the EHR software and their level of confidence in using it. Furthermore, their research demonstrated higher average ratings in the domains of patient safety, documentation, patient requirements, prioritizing, and nursing process while using EHR software.

6. ICT Competency Tool

In 2013, the Canadian Association of Schools of Nursing created a tool to assess the information and communication technology (ICT) skills required by nursing students and faculty. This tool also provides guidance on integrating informatics training into nursing education programs. The objective of the toolkit was to cater to the informatics knowledge requirements of nursing students before they graduate (Nagle et al., 2014). The primary competence topic is on the use of ICT to facilitate the integration of information and provide high-quality patient care that aligns with regulatory requirements and the scope of nursing practice. According to researchers, including these skills in the undergraduate nursing curriculum should produce a vigilant clinician who recognizes the limits of the system and knows how to minimize mistakes when working with patients (Nagle et al., 2014).

A study by Kleib, Simpson, and Rhodes (2016) found that the ICT competence tool was effective in developing intense informatics training sessions for Canadian practicing nurses and educators. This task required the acquisition of knowledge and skills in informatics systems via schooling.

7. Quality and Safety Education for Nurses (QSEN)

One of the informatics competences for prelicensure students outlined by the QSEN Institute (2018) is specifically dedicated to informatics. This competence centers on evaluating the nursing student's proficiency in using informatics-related abilities in real-world scenarios. A study conducted by Bryant, Whitehead, and Kleier in 2016 focused on the psychometric examination of a tool that is based on the QSEN skills.

In Boyd's (2014) research, a combination of qualitative and quantitative methodologies was utilized to evaluate the level of academic readiness among recent graduates with a bachelor's degree, using the QSEN project as a framework. The qualitative findings revealed that the graduates saw the acquisition of QSEN knowledge, abilities, and attitudes throughout their academic preparation as very significant for their daily professional activity. The quantitative survey findings indicated that around 33% of the participants ($n = 63$) expressed the opinion that their nursing program should have given more importance to the use of electronic health records (HER).

8. Additional Pedagogical Approaches

A significant number of studies choose to construct their own informatics competence lists in order to assess the level of proficiency of nursing students in informatics. These competence lists were derived from the influential research conducted by Staggers et al. (2001) in many cases. Choi and Zucker (2013) conducted a three-year longitudinal research to investigate the initial informatics skills of 132 DNP students. The researchers developed an informatics set consisting of 86 items, categorized into three groups: computer abilities, informatics knowledge, and informatics skills. These items cover 18 different areas of proficiency. The results demonstrated that 17 out of the 18 competencies should be included in the curriculum. These competencies include decision support systems, tools for clinical decision-making, retrieving and extracting data from clinical data sets, conducting literature searches, utilizing RefWorks or other resource files, and evaluating statistical data.

Chung and Staggers (2014) conducted a psychometric analysis of the Nursing Informatics Competencies Questionnaire, which is a questionnaire that was developed based on the work of Staggers et al. (2001). The questionnaire consisted of a total of 112 questions, including 53 competence for novice nurses and 59 competencies for experienced nurses. Results from the study, which included a group of 228 recent graduates, showed that they reported having above average levels of skill in informatics.

Van Houwelingen et al. (2016) conducted a Delphi survey to identify the necessary competences for performing telehealth in the field of educational strategy research. A group of 51 specialists identified 14 nursing telehealth entrustable professional tasks and 52 categories of knowledge, abilities, and attitudes that are essential for delivering virtual nursing care. The findings of a mixed-methods research study, which aimed to evaluate the proficiency, expertise, and understanding of associate degree nursing students ($n = 90$), indicated a positive relationship between a computer training program and higher levels of student satisfaction and better rates of student retention (Edwards & O'Connor, 2011).

Research indicated the need of well-structured and all-encompassing faculty informatics training programs. Nguyen et al. (2011) carried out a survey to determine the requirements of the faculty. The objective of the research was to outline the knowledge and training requirements of nursing faculty in relation to distant learning, simulation, telehealth, and informatics technologies. The majority of faculty respondents ($n = 193$, 66 percent) expressed confidence in their proficiency with remote learning and informatics technologies. However, 70 percent of them identified themselves as either novices or advanced beginners when it came to telehealth. Furthermore, the qualitative study findings from interviews conducted with a group of nine nurse faculty members revealed that the challenges to the implementation of academic electronic health records (EHRs) in nursing education include insufficient school resources, opposition from faculty members, and a lack of understanding (Chung and Cho, 2017).

The TANIC competence instrument had a dual purpose of assessing student ability level and enhancing teacher knowledge and abilities in informatics (Hill et al., 2014b). A research assessed the computer proficiency of nurse educators both before and after a 24-month informatics project. Rajalahti et al. (2014) evaluated the progress of nurse educators in developing their skills in informatics and compared their findings to those of other healthcare professionals. The participants, who had an average of 15 years of teaching experience, expressed a deficiency in their capacity to successfully instruct EHR documentation. The survey findings revealed that nurse educators need further training in advanced informatics. The research suggested that health care institutions should provide assistance for informatics training to nurse educators.

Fulton et al. (2014) conducted a study on the characteristics of faculty members in relation to the adoption of informatics by Doctor of Nursing Practice (DNP) faculty. The study included 114 educational programs throughout the United States. Only 21 schools indicated that a minimum of 50 percent of their teachers has knowledge and comprehension of TIGER skills. Furthermore, a mere 55.4 percent of the institutions said that their teaching members had a certification in nursing informatics or had received graduate-level training in informatics. Roney et al. (2017) conducted a survey among faculty members who educate undergraduate nursing students at institutions recognized by the Commission on Collegiate Nursing Education. The survey aimed to gather information regarding the use of technology and the level of confidence in using technology among these faculty members. The results indicated that 86 percent of the teachers, namely 272 individuals, claimed that they had not received any training related to the TIGER program. There was a strong negative correlation between the number of years of teaching experience and the degree of technology usage in the classroom.

9. Discussion

Findings indicate that nurse training programs lack consistency in teaching nursing informatics abilities according to established criteria. There was unanimous consensus about the significance of incorporating informatics skills into nursing curriculum, however there was no clear consensus on the most effective method of delivering competence education. Another notable observation was the absence of diversity in the diagnosis of deficiencies in informatic ability. The majority of the competence instruments consisted of student self-assessments rather than objective evaluations of students, which posed a problem in terms of research quality. The absence of a reliable assessment of informatic competency may have led to an amplification of bias, as students may have had varying interpretations of their own competency levels. This has been demonstrated by multiple studies employing psychometric analysis, as documented in the literature (Chung and Staggers, 2014; Godsey, 2015; Hill et al., 2014a, 2014b). Hill et al. (2014a, 2014b) conducted research on the TANIC tool and its applicability to both undergraduate and graduate nursing students. Chung and Staggers (2014) established the reliability and validity of the Nursing Informatics Competencies Questionnaire. However, it is important to note that their study sample consisted of practicing nurses (n = 228), rather than nursing students. Godsey

(2015) conducted a psychometric examination of the SANICS instrument using a substantial sample size of 498 entry-level BSN students.

The literature search uncovered novel methodologies for enhancing educational readiness in the field of informatics capabilities. A research conducted by Byrne and Senk (2017) used Google Glass, a hands-free device that has resemblance to conventional eyeglasses, for the purpose of clinical training. The technology enabled students to use doctors instructions, access the Internet, send emails, and make phone calls while providing care for patients. The use of this technology has the capacity to enhance the safety of patient treatment.

E-simulation was recognized as an innovative method used to enhance informatics capabilities. The research conducted by Foronda et al. (2014) showcased the use of virtual clinical simulation in a mixed-methods approach for a master's-level nursing education course's clinical practicum. A module was developed to provide an atmosphere for student educators to improve their self-assurance while teaching. While several students had increased self-assurance after their use of the e-simulation, others initially felt anxious and encountered disappointments due to technological issues. The researchers suggested that future studies could include a rubric to assess both the real skill level of students and their clinical performance simultaneously (Foronda et al., 2014).

Another study examined the efficacy of using an electronic medical record (EMR) as a teaching tool for nursing students, either in a clinical environment or via the use of a simulated EMR in a classroom setting. Engaging in EMR practice helped students develop skills in prioritizing patient care, get immediate feedback, and enhance their confidence in documenting medical information (Warboys et al., 2014). Despite data indicating that students had a preference for EMR practice, nursing instructors expressed a lack of confidence in their ability to give this kind of training (Chung and Cho, 2017).

Due to the limited amount of research on informatics training for nurse educators, there are currently no recognized minimum competence levels for nursing professors in the field of informatics. The study conducted by Nguyen et al. (2011) found that 69 percent (n = 193) of nursing professors surveyed expressed a need for further formal training in informatics. Additional studies have shown faculty reluctance as a hindrance to enhancing the informatics curriculum (Edwards and O'Connor, 2011; Warboys et al., 2014). The phenomenon of faculty resistance is a subject that requires more investigation.

While not specifically focused on evaluating the informatics ability or knowledge of nursing faculty, some study provided support for training initiatives in informatics. The research conducted by Choi and DeMartinis (2013) offered broad pedagogical recommendations for nurse educators. The findings of the SANICS study, which included 289 undergraduate and graduate nursing students, revealed the need for more student instruction in applied computer skills and clinical informatics responsibilities. Furthermore, nursing professors emphasized the need of informatics training.

Ultimately, these study findings suggest that more investigation is required, particularly with regards to a wider range of sample groups. The majority of the individuals involved in this study were nursing students pursuing a bachelor's degree. There is a limited amount of research that has investigated the levels of informatics skill among associate degree nursing students and professors. Despite the fact that 65 percent of the current registered nurse (RN) workforce has achieved a bachelor or higher degree, a significant proportion of nurses in the United States are still equipped with an associate degree in nursing (ADN) (National Council of State Boards of Nursing, 2015). Further study is crucial in order to accurately ascertain the educational requirements of diverse levels of nursing students and instructors.

Whittermore and Knafl (2005) recognize that a significant drawback of the integrative review approach is the reliance on electronic resources for conducting the search. The integrative review approach is inherently flawed due to the amalgamation of several study designs. This may result in a deficiency in thoroughness, imprecise explanations, and the possibility of bias from the researcher.

10. Conclusion

While there is a consensus on the need of teaching nursing informatics clinical competence, research indicates that there is no established set of best practices for teaching clinical informatics. Training aids for nursing students and nurse educators are readily accessible, and professional organizations such as the NLN and Healthcare Information and Management Systems Society (HIMSS) provide valuable resources. The NLN website provides comprehensive information to faculty members on how to integrate health information technology into their courses. Furthermore, the HIMSS website provides access to many training tools that are suitable for both nursing students and nursing instructors (HIMSS, 2017). It may be beneficial to focus the future training of nursing students and professors in clinical informatics on evaluating the efficacy of tools used in training.

References

1. Boyd T. M. (2014). *New BSN nurse informatics competencies: Perceptions of academic preparedness for practice* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database (UMI No. 3631548).
2. Bryant L., Whitehead D., & Kleier J. (2016). Development and testing of an instrument to measure informatics knowledge, skills, and attitudes among entry-level nursing students. *Online Journal of Nursing Informatics*, 20(2).
3. Byrne P. J., & Senk P. A. (2017). Google glass in nursing education: Accessing knowledge at the point of care. *CIN: Computers, Informatics, Nursing*, 35(3), 117–120. doi:10.1097/CIN.0000000000000339
4. Canadian Association of Schools of Nursing. (2013). *Nursing Informatics Teaching Toolkit: Supporting the integration of the CASN Nursing Informatics Competencies into nursing*

- curricula*. Retrieved from <https://casn.ca/wp-content/uploads/2014/12/2013ENNursingInformaticsTeachingToolkit.pdf>
5. Choi J., & De Martinis J. E. (2013). Nursing informatics competencies: Assessment of undergraduate and graduate nursing students. *Journal of Clinical Nursing*, 22(13–14), 1970–1976. doi:10.1111/jocn.12188
 6. Choi J., & Zucker D. M. (2013). Self-assessment of nursing informatics competencies for doctor of nursing practice students. *Journal of Professional Nursing*, 29(6), 381. doi:10.1016/j.profnurs.2012.05.014
 7. Choi M., Park J. H., & Lee H. S. (2016). Assessment of the need to integrate academic electronic medical records into the undergraduate clinical practicum: A focus group interview. *CIN: Computers, Informatics, Nursing*, 34(6), 259–265. doi:10.1097/CIN.0000000000000244
 8. Chung J., & Cho I. (2017). The need for academic electronic health record systems in nurse education. *Nurse Education Today*, 54, 83–88. doi:10.1016/j.nedt.2017.04.018
 9. Chung S. Y., & Stagers N. (2014). Measuring nursing informatics competencies of practicing nurses in Korea: Nursing Informatics Competencies Questionnaire. *CIN: Computers, Informatics, Nursing*, 32(12), 596–605. doi:10.1097/CIN.0000000000000114
 10. Cronenwett L., Sherwood G., Barnsteiner J., Disch J., Johnson J., Mitchell P., ... Warren J. (2007). Quality and safety education for nurses. *Nursing Outlook*, 55(3), 122–131. doi:10.1016/j.outlook.2007.02.006
 11. De Gagne J. C., Bisanar W. A., Makowski J. T., & Neumann J. L. (2012). Integrating informatics into the BSN curriculum: A review of the literature. *Nurse Education Today*, 32(6), 675. doi:10.1016/j.nedt.2011.09.003
 12. Edwards J., & O'Connor P. A. (2011). Improving technological competency in nursing students: The Passport Project. *The Journal of Educators Online*, 8(2), 1–18.
 13. Foronda C., Lippincott C., & Gattamorta K. (2014). Evaluation of virtual simulation in a master's-level nurse education certificate program. *CIN: Computers, Informatics, Nursing*, 32(11), 516. doi:10.1097/CIN.0000000000000102
 14. Fulton C. R., Meek J. A., & Walker P. H. (2014). Faculty and organizational characteristics associated with informatics/health information technology adoption in DNP programs. *Journal of Professional Nursing*, 30(4), 292–299. doi:10.1016/j.profnurs.2014.01.004
 15. Godsey J. A. (2015). *Towards an informatics competent nursing profession: Validation of the Self-Assessment of Nursing Informatics Competency Scale (SANICS) before and after online informatics training* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database (UMI No: 3717257).
 16. Healthcare Information and Management Systems Society. (2017, October 6). *The evolution of TIGER competencies and informatics resources*. Retrieved from www.himss.org/library/evolution-tiger-competencies-and-informatics-resources

17. Hill T., McGonigle D., Hunter K. M., Sipes C., & Hebda T. L. (2014a). An instrument for assessing advanced nursing informatics competencies. *Journal of Nursing Education and Practice*, 4(7), 1–4-112. doi:10.5430/jnep.v4n7p104
18. Hill T., McGonigle D., Hunter K. M., Sipes C., & Hebda T. L. (2014b). *TIGER-based assessment of nursing informatics (TANIC)*. Proceedings of the Nursing Education Research Conference 2014, Virginia Henderson Global Nursing e-Repository. Retrieved from <https://www.nursingrepository.org/handle/10755/316870?show=full>
19. Hunter K. M., McGonigle D., & Hebda T. (2013). The integration of informatics content in baccalaureate and graduate nursing education: A status report. *Nurse Educator*, 38(3), 110–113. doi:10.1097/NNE.0b013e31828dc292
20. Institute of Medicine. (2013). *Core measurement needs for better care, better health, and lower costs: Counting what counts, workshop summary*. Washington, DC: National Academies Press. doi:10.17226/18333
21. Jansen D. A. (2014). Student perceptions of electronic health record use in simulation. *Journal of Nursing Education and Practice*, 4(9), 163–172. doi:10.5430/jnep.v4n9p163
22. Jones S., & Donelle L. (2011). Assessment of electronic health record usability with undergraduate nursing students. *International Journal of Nursing Education Scholarship*, (8), 28. doi:10.2202/1548-923X.2123
23. Kleib M., Simpson N., & Rhodes B. (2016). Information and communication technology: Design, delivery, and outcomes from a nursing informatics boot camp. *Online Journal of Issues in Nursing*, 21(2), 5. doi:10.3912/OJIN.Vol21No02Man05
24. Kowitlawakul Y., Chan S., Pulcini J., & Wang W. (2015). Factors influencing nursing students' acceptance of electronic health records for nursing education (EHRNE) software program. *Nurse Education Today*, 35(1), 189–194. doi:10.1016/j.nedt.2014.05.010
25. Massachusetts Department of Higher Education Nursing Initiative. (2016). *Massachusetts nursing of the future nursing core competencies*. Retrieved from https://www.mass.edu/na/hi/documents/NOFRNCompetencies_updated_March2016.pdf
26. Melnyk B. M., & Fineout-Overholt E. (2015). *Evidence-based practice in nursing & healthcare: A guide to best practice* (3rd ed.). Philadelphia, PA: Wolters Kluwer.
27. Merriam S. (1998). *Qualitative research and case study applications in education*. San Francisco, CA: Jossey-Bass.
28. Miller L., Stimeley M., Matheny P., Pope M., McAtee R., & Miller K. (2014). Novice nurse preparedness to effectively used electronic health records in acute care settings: Critical informatics knowledge and skills gaps. *Online Journal of Nursing Informatics (OJNI)*, 18(2).
29. Mitchell J. (2015). Electronic documentation: Assessment of newly graduated nurses' competency and confidence levels. *Online Journal of Nursing Informatics*, 19(2).
30. Nagle L. M., Crosby K., Frisch N., Borycki E., Donelle L., Hannah K., ... Shaben T. (2014). Developing entry-to-practice nursing informatics competencies for registered nurses. *Studies in Health Technology and Informatics*, 201, 356. doi:10.3233/978-1-61499-415-2-356

31. National Council of State Boards of Nursing. (2015). *The 2015 National Nursing Workforce Survey*. Retrieved from <https://www.ncsbn.org/workforce.htm>
32. National League for Nursing. (2015). *A vision for the changing faculty role: Preparing students for the technological world of health care* [NLN Vision Series]. Retrieved from www.nln.org/docs/default-source/about/nln-vision-series-%28position-statements%29/nlnvision_8.pdf?sfvrsn=4
33. National League for Nursing. (n.d.) *Faculty resources*. Retrieved from www.nln.org/professional-development-programs/teaching-resources/toolkits/faculty-resources
34. Nguyen D. N., Zierler B., & Nguyen H. Q. (2011). A survey of nursing faculty needs for training in use of new technologies for education and practice. *Journal of Nursing Education*, 50(4), 181–189. doi:10.3928/01484834-20101130-06
35. Pobocik T. (2014). Using an educational electronic documentation system to help nursing students accurately identify patient data. *International Journal of Nursing Knowledge*, 26(1).
36. QSEN Institute. (2018). *QSEN competencies*. Retrieved from <http://qsen.org/competencies/>
37. Rajalahti E., Heinonen J., & Saranto K. (2014). Developing nurse educators' computer skills towards proficiency in nursing informatics. *Informatics for Health and Social Care*, 39(1), 47–66. doi:10.3109/17538157.2013.834344
38. Roney L. N., Westrick S. J., Acri M. C., Aronson B. S., & Rebesch L. M. (2017). Technology use and technological self-efficacy among undergraduate nursing faculty. *Nursing Education Perspectives*, 38(3), 113–118. doi:10.1097/01.NEP.0000000000000141
39. Saratan C., Borycki E. M., & Kushniruk A. W. (2015). Information management competencies for practicing nurses and new graduates. *Knowledge Management & E-Learning*, 7(3), 378–394.
40. Skiba D. J. (2011). Informatics and the learning health care system [Emerging Technologies Center]. *Nursing Education Perspectives*, 32(5), 334–336.
41. Skiba D. J. (2017). Students, technology, and teaching: Findings from the 2016 ECAR report [Emerging Technologies Center]. *Nursing Education Perspectives*, 38(1). doi:10.1097/01.NEP.0000000000000117
42. Staggers N., Gassert C. A., & Curran C. (2001). Informatics competencies for nurses at four levels of practice. *Journal of Nursing Education*, 40(7), 303–316. doi:10.3928/0148-4834-20011001-05
43. Technology Informatics Guiding Education Reform. (2007). *The TIGER initiative: Evidence and informatics transforming nursing: 3-Year action steps toward a 10-year vision*. Retrieved from www.aacn.nche.edu/education-resources/TIGER.pdf
44. Van Houwelingen C. T., Moerman A. H., Ettema R. G., Kort H. S., & ten Cate O. (2016). Competencies required for nursing telehealth activities: A Delphi study. *Nurse Education Today*, 39, 50–62. doi:10.1016/j.nedt.2015

45. Warboys I., Mok W. Y., & Frith K. H. (2014). Electronic medical records in clinical teaching. *Nurse Educator*, 39(6), 298–301. doi:10.1097/NNE.0000000000000072
46. Wheeler B. (2016). *The integration of nursing informatics in Delaware nursing education programs* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database (10012947).
47. Whitemore R., & Knafl K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, 52(5), 546–553.