CONTINUING

EDUCATION



Evidence-Based Use of Electronic Clinical Tracking Systems in Advanced Practice Registered Nurse Education

An Integrative Review

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The use of electronic clinical tracking systems (ECTSs) in healthcare education has been cited for nearly three decades in advanced practice RN (APRN), medicine, physical therapy, and radiology technology literature.^{1–7} We have defined ECTS as "a technology system by which students' clinical experiences are recorded for the purpose of reviewing and analyzing populations and healthcare management information." Graduate nursing programs are moving toward the use of ECTSs to assist in documenting students' clinical experiences. Intended goals of utilizing ECTSs in graduate clinical education of APRNs were to provide an accurate, searchable, reproducible, and efficient method of tracking students' clinical documentations.^{7,8} Another benefit of ECTSs was to improve utilization of limited faculty resources,^{4,7} a critical component in meeting APRN practice core competency requirements.

Several factors have influenced the use of ECTSs in graduate nursing education. Information technology (IT) has become an integral part of healthcare education, safety, quality, and management in the US healthcare system. In 2001, the Institute of Medicine (IOM) addressed the need for the reinvention of healthcare with a focus on safety and quality.⁹ President George W. Bush echoed the need for safety and quality in healthcare by advocating for a national electronic health record (EHR) system.¹⁰ In 2009, the Technology Informatics Guiding Education Reform supported the prior EHR recommendations and addressed specific suggestions for IT areas of competency, literacy, and management in nursing education and practice.¹¹ President

Over the past decade, the federal government has mandated healthcare providers to incorporate electronic health records into practice by 2015. This technological update in healthcare documentation has generated a need for advanced practice RN programs to incorporate information technology into education. The National Organization of Nurse Practitioner Faculties created core competencies to guide program standards for advanced practice RN education. One core competency is Technology and Information Literacy. Educational programs are moving toward the utilization of electronic clinical tracking systems to capture students' clinical encounter data. The purpose of this integrative review was to evaluate current research on advanced practice RN students' documentation of clinical encounters utilizing electronic clinical tracking systems to meet advanced practice RN curriculum outcome goals in information technology as defined by the National Organization of Nurse Practitioner Faculties. The state of the science depicts student' and faculty attitudes, preferences, opinions, and data collections of students' clinical encounters. Although electronic clinical tracking systems were utilized to track students' clinical encounters, these systems have not been evaluated for meeting information technology core competency standards. Educational programs are utilizing electronic clinical tracking systems with limited evidence-based literature evaluating the ability of these systems to meet the core competencies in advanced practice RN programs.

KEY WORDS

Electronic clinical tracking systems • Graduate nursing education • Information technology

Barack Obama continued to address healthcare concerns by advocating use of EHRs in providers' practices to reduce healthcare costs and medical errors.¹²

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In 2011, the IOM's key message included the integration of IT into APRN education and practice. The National Organization of Nurse Practitioner Faculties (NONPF), in partnership with the American Association of Colleges of Nursing (AACN), has developed APRN core competencies for the national standardization of APRN practice.¹³ Technology and Information Literacy^{14(p3)} is one of the NONPF core competencies, which can be addressed through the use of ECTSs. The purpose of this integrative review was to evaluate current research on APRN students' documentation of clinical encounters utilizing ECTSs to meet APRN curriculum outcome goals in IT as defined by NONPF core competencies.

METHODS

A comprehensive, computer-assisted search of the literature was conducted in the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Academic Search Premier, Ovid MEDLINE, Web of Science, TopSCHOLAR, ProQuest, Virginia Henderson Global Nursing e-Repository, and Google Scholar electronic databases to identify current relevant research studies published from 1996 to 2013, in English, and limited to humans. In CINAHL, the keyword graduate nursing education resulted in 254 abstracts. The keyword graduate nursing education resulted in 381 abstracts from Academic Search Premier, 985 abstracts from Ovid MEDLINE, and 597 abstracts from Web of Science. The keyword *electronic clinical tracking* resulted in zero abstracts from CINAHL, Academic Search Premier, Ovid MEDLINE, and Web of Science. TopSCHOLAR, ProQuest, and Virginia Henderson Global Nursing e-Repository were queried using the keyword graduate nursing education, which resulted in 14 059, 320, and 66 abstracts, respectively. The keyword electronic clinical tracking resulted in no abstracts in TopSCHOLAR and Virginia Henderson Global Nursing e-Repository. In Google Scholar, the keyword graduate nursing education (n = 24 200) was combined with electronic clinical tracking (n = 17 500), resulting in 3200 abstracts. Abstracts of published studies were reviewed for relevance utilizing inclusion and exclusion criteria.

Inclusion Criteria

Studies included in this integrative review addressed the following criteria: electronic clinical tracking and graduate nursing education.

Exclusion Criteria

Studies that focused on electronic medical records, EHRs, telemedicine, handheld mobile learning devices, e-learning,

distance education, e-books, clinical decision making tools, diagnostic screening, instrument testing, curriculum development, concept mapping, precepting, mentoring, and undergraduate education were excluded.

Abstracts were reviewed until it became evident that no additional studies were found that met inclusion criteria. This review of abstracts resulted in 10 peer-reviewed studies from the following electronic databases: CINAHL (n = 3), Academic Search Premier (n = 1), Ovid MEDLINE (n = 1), Web of Science (n = 2), and Google Scholar (n = 3). Ten studies were retrieved and further reviewed for inclusion and exclusion criteria. Four studies met initial inclusion criteria but were excluded from this integrative review as these studies did not meet the inclusion criteria of ECTSs and instead focused on electronic medical records and e-portfolios. Six of the 10 studies were found to meet this study's inclusion criteria.^{8,15–19} A reference review in these six studies found two additional publications that met inclusion criteria.^{20,21} A total of eight studies were identified for inclusion in this integrative literature review (Table 1).

RESULTS

Using Melnyk and Fineout-Overholt's criteria,²² the highest level of evidence in this integrative review was a Level VI: evidence from a single descriptive or qualitative study. No published integrative or systematic reviews were found for inclusion in this review. The following trends were identified in the studies reviewed.

Major Trends Identified

Review of the current state of the science revealed several major trends. Only one study overtly addressed NONPF core competencies as a data source for evaluation of APRN students' competencies.¹⁶ The remainder of the studies provided trends in student and faculty attitudes, preferences, opinions, and descriptors of demographics in students' clinical encounters. Potential applications of ECTSs in APRN education were expressed as broad statements alluding to national core competencies but not specifically stated as the basis for utilization. The study by Hallas et al¹⁶ is presented first, followed by the prevalence of major trends among the remaining studies.

The NONPF core competencies are the education standard utilized by APRN programs within the US and universities accredited by AACN.¹³ One study¹⁶ was identified as stating NONPF core competencies as a reference for APRN education requirements but did not specifically evaluate ECTSs' capacity to meet these competencies. The focus of the study of Hallas et al¹⁶ was to evaluate the requirement of 500 clinical hours for APRN graduation and entry level into practice. The authors were unable to conclude

Table 1					
Electronic Clinical Tracking	g Systems				
Author/Year/Level of Evidence	Title of Study	Purpose	ECTS	Description of Population	Implications
Cullen et al ¹⁵ (2010)	A database for nurse practitioner clinical education	To describe the utility of a Web-driven subscription database service for NP clinical education	NPST	WHNP students ACNP students	Enhance technology skills of student and faculty, reduction in informatics-practice gap, trend and configure student data
Level VII: descriptive report Fontana et al ²⁰ (2001)	A computerized system for tracking practice and prescriptive patterns of family nurse practitioner students	To describe a student-generated computerized clinical log program using faculty-developed software and Epi Info software to evaluate individual and aggregate advanced practice student clinical data	FNPLOG	FNP students	Computerized clinical tracking systems allow for faculty and student appraisal of clinical experience to correlate with didactic material
Level VII: description of student practice patterns Hallas et al ¹⁶ (2012)	Evaluation of the clinical hour requirement and attainment of core clinical competencies by nurse practitioner students	To analyze the national practice of 500-clinical-hour graduation requirement for MS APN compared with a comprehensive approach of evaluating clinical competencies using a comprehensive approach (including the use a subscription database service)	L SAN 6	16 PNP and 30 ACNP students postgraduation	Outcome measurement methods need a comprehensive strategy to reflect student obtainment of core competencies. Web-driven subscription database service data used to evaluate core data used to evaluate core competencies related to age, acute and chronic disease exposure; coding; other
Level VI: retrospective, nonexperimental, correlational study desigr Joy et al ⁸ (2012)	Evaluating the implementation of an online clinical log system for family nurse practitioner students	To describe the attitudes, preferences, and opinions of students and faculty members regarding the newly adopted Web-driven subscription database service	NPST	9 FNP students	be comprehensive: performance-based assessments, case-based evaluation, high-fidelity simulations, or OSCEs improvement in clinical log methods; integration of technology with benefits to the student; outcome improvement yet to be determined (continues)

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Table 1					
Electronic Clinical Tracking	Systems, Continued				
Author/Year/Level of Evidence	Title of Study	Purpose	ECTS	Description of Population	Implications
Level VI: pilot study Qualitative and quantitative approaches Longworth and Lesh ²¹ (2000)	Development of a student nurse practitioner computerized clinical log	To pilot computerized logs and describe the educational, curricular, and employment purposes in an FNP program	Spreadsheet, log, and code book	6 FNP faculty 4000 FNP encounters over three semesters	Non-Web-based computerized log had problems with compatibility of hardware and software. Did identify potential benefits to faculty with evaluating student experiences and meet
Level V: descriptive study McNelis ¹⁷ (2012)	Improving quality and safety in graduate education using an electronic student tracking system	Examines informatics and IT integration from the viewpoint of the psychiatric/mental-health nurse practitioner	NPST	Psychiatric/ mental-health nurse practitioner students	competency goals Web-driven subscription database service student users were more prepared to use IT in healthcare system; potential for evaluating outcomes with IT
Level VII: opinion Olson and Fauchald ¹⁸ (2011)	A transdisciplinary approach to developing a Web-based nursing experiential log system for advanced practice nursing clinical experiences	To develop a nursing experiential log system solution as a transdisciplinary project between the graduate nursing and the computer information systems department in a university setting	NELS	APRN students	Self-designed programs from educational institutions may lack the ability to fulfill the full scope of need for NP programs

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(continues)

Table 1					
Electronic Clinical Tracki	ng Systems, Continued				
Author/Year/Level of Evidence	Title of Study	Purpose	ECTS	Description of Population	Implications
Level VII: description of transdisciplinary proje Walker ¹⁹ (2003)	a ct Web-based data collection in midwifery clinical education	To further understand the characteristics of client encounters in the antepartum care course	FNPLOG	14 Midwifery students; 1417 patient encounters	Autonomy of coding visits; data entry at point of care may increase accuracy of input; provides individualized picture of student clinical encounters and evolution from
Level VI: descriptive stu-	dy				-
Abbreviations: ACNP, acute care r objective structured clinical exami Hierarchv of evidence ²² ; Level I: ev	urse practitioner; FNP, family nurse practi nations; PNP, pediatric nurse practitioner idence from systematic review or meta-ar	titoner; FNPLOG, family nurse practitioner log; N ; WHNP, women's health nurse practitioner. alvsis of all relevant randomized controlled trial	VELS, nursing experie Is; Level II: evidence c	ntial log system; NPST, nurse obtained from well-designed i	 practitioner student tracking; OSCE, randomized controlled trials: Level IIII:

that students were exposed to core competencies in their clinical experiences. $^{16}\,$

Need for Improved Clinical Documentation

Seven of the eight studies^{8,15,17–21} reviewed explicitly stated a motivating factor for adoption of ECTSs. The motivating factor was to improve paper log documentation of students' clinical experiences. Specific encounter variables, including demographic information, were collected in ECTS format. The format provided the ability to easily and objectively assess one student in an individual course or multiple courses across a program. Additionally, a cohort of students' clinical data could be assessed. The variation in content and legibility of paper logs^{8,21} were cited as a secondary consideration along with storage problems associated with paper logs.⁸ In the study by Joy et al,⁸ the authors reported academic dishonesty as the most concerning issue in paper clinical logs and notes. Interpretation and quantification of free text within the ECTS remain a labor-intensive component but provide a rich description of students' clinical encounters.¹⁹ Faculty and students cited Web-based ECTSs beneficial for ease of data entry into logs at clinical sites.^{15,18}

Faculty Benefits

evidence obtained from well-designed controlled trials without randomization; Level IV: evidence from well-designed case-control and cohort studies; Level V: evidence from systematic reviews of descriptive and

qualitative studies; Level VI: evidence from single descriptive or qualitative studies; Level VII: evidence from the opinion of authorities and/or reports of expert committees

Faculty members were able to review and adjust students' clinical experiences based on encounters documented in ECTSs. Review of ECTSs was a process to provide feedback in order to improve students' clinical encounters and widen their range of clinical experiences.¹⁹ The use of ECTSs was not felt to enhance communication between faculty and students.⁸ Cullen et al¹⁵ identified four advantages that enhanced informatics skills for both faculty and students. The advantages were that (1) data entry was facilitated by point-of-care access when using Web-based products, (2) enhanced informatics skills allowed knowledge management and a reduction in errors, (3) informaticspractice gap was decreased, and (4) charts and graphs were produced to trend experiences.¹⁵ All of these benefits were supported in the literature.^{8,18,19}

Additional benefits were faculty reflections of an individual student over a single clinical course and/or an entire academic period by transforming a student's data into reflective knowledge.¹⁵ Accurately documenting the work students performed, the acuity level of patients being evaluated, and the progress of students in clinical sites were positive for faculty, students, programs, and future employers.^{15,19,20} In addition, faculty were able to track a student's experience in his/her clinical rotation according to patient complexity and student decision making.¹⁵

Faculty further reported using ECTSs for program and course evaluations as a benefit when they compared

expected versus actual clinical experiences of APRN students.¹⁵ Electronic clinical tracking systems provided a means for observation of uncommon trends in students' clinical experiences. Faculty's use of ECTSs provided a method of evaluation of clinical site appropriateness for APRN students, allowing for early intervention and optimal students' clinical placements aligned with their education goals.^{15,17,21} Electronic clinical tracking system data have provided opportunities for change in course progression, program progression, students' clinical opportunities, and program curriculum.^{15,17,21}

Several authors noted that ECTSs provided evidence for evaluating and revising curricula over previously utilized faculty intuition.^{15,17,20,21} Identification of top diagnoses codes^{15,20,21} allowed for faculty reflection of content presented in didactic courses. Faculty awareness of prescriptive practice patterns^{15,20} and patients' social problems²⁰ presented opportunities to prepare students for clinical encounters across the program. The electronic clinical tracking system was described as beneficial for tracking students' prescribing patterns as reflections of APRN preceptors' prescriptive activities, which is an area of limited data.^{15,20}

Finally, faculty reported benefits of ECTS integration into their APRN programs. The studies described various commercial Web-based^{8,15–19} and in-house^{20,21} tracking systems. One essential ECTS component was the ability to customize a clinical tracking system to meet specific program needs.^{8,17} Next, authors reported the need for adequate accessible IT support for faculty and students.^{8,15,17–19} Walker¹⁹ noted that faculty require ongoing and comprehensive IT support. Another common feature of ECTS success in a program was that designated faculty served as IT resources to both students and faculty members.^{16–19}

Student Benefits

Students adapted to ECTSs more readily than did their faculty counterparts.⁸ Electronic clinical tracking system benefits to APRN students included progressive independence in patient encounters,^{15,19} achievements of increased clinical responsibilities,¹⁹ and development of clinical portfolios.^{15,19,20} First, faculty observed a sense of technology mastery among APRN students, especially with coding functions.^{15,20,21} Students reported improvements in their clinical autonomy with progressive increases in their levels of interaction in clinical settings.^{8,15}

Next, APRN students' evaluations of their professional roles were important to identify their clinical strengths and weaknesses. Through self-evaluations, APRN students become adult lifelong learners.²³ Electronic clinical tracking systems permitted students' self-evaluations to trend and stratify their clinical experiences.^{8,15,17} Advanced practice RN students' early identification of course competency deficits provided opportunities to rectify discrepancies and

evaluate learning.¹⁷ Furthermore, students reported reassurance when they compared their clinical practice experiences to their classmates.²¹ McNelis et al¹⁷ described midterm evaluations of ECTSs as a tool for students' negotiations with their preceptors to gain further clinical experiences.

Lastly, ECTSs provided data sets useful in documentation of students' clinical experiences for their portfolios. Electronic clinical tracking systems afforded a consistent framework for data collection and charting, which improved APRN students' clinical logs and documentation.^{8,21} Advanced practice RN students utilized ECTSs in describing their clinical experiences, identifying diverse practice experiences, and providing descriptive clinical experiences to prospective employers.^{20,21}

Meeting the Competency Standard

Significant learning occurred during APRN students' clinical experiences.¹⁵ When faculty assessed students' performances, they found that multiple evaluative methods were necessary to meet competency standards.^{8,15,17–20} An electronic clinical tracking system is one method for documenting these standards. In these studies, ECTS was utilized to document hours required by certifying bodies,^{15–17,21} hours required for competency attainment,^{8,21} and meeting program benchmarks.^{15,21}

Four of the studies in this review utilized ECTSs in documenting their certifying body's clinical hour requirements.^{15–17,21} Hallas et al¹⁶ studied the 500-hour APRN clinical practice requirement as the basis for determining core competency attainment utilizing ECTSs. The authors concluded that APRN clinical practice hours correlated with applicable clinical experiences, but they could not translate clinical hours to exposure to all core competencies.¹⁶ Electronic clinical tracking system use facilitated demonstration of students' clinical hours in programs with multiple APRN specialties^{15,16,21} and a program transitioning from one certification specialty to another.¹⁷

There was no consensus on using ECTSs to document APRN clinical core competencies outside quantifying clinical hour requirements. In one small study,⁸ half of surveyed faculty (n = 3) reported that ECTSs assisted in confirming that students met core competencies, while two remaining faculty strongly disagreed. Longworth and Lesh²¹ decided that detailed clinical documentation was a means of identifying students' competencies in an APRN program using electronic spreadsheets; however, the authors did not address meeting standardized competencies.

Lastly, the authors of two studies stated that ECTSs had the potential for benchmarking APRN programs among universities based on students' clinical experiences.^{15,21} Cullen et al¹⁵ illustrated two ECTS benefits to meet specific program benchmarks. First, ECTSs documented areas of clinical health required within an APRN specialty. The second benefit identified was the ability to plot students' and cohorts' clinical experiences progression from simple to complex¹⁵ as a means of meeting core competencies. Longworth and Lesh²¹ concluded that sharing of collected data could be a positive influence on healthcare systems.

Bridging the Gap Between Education and Practice

Electronic clinical tracking systems allowed APRN students to obtain detailed portfolio data for marketing themselves to prospective employers.^{20,21} Students were able to provide potential employers with evidence of clinical experiences reflective of their new APRN role. The ability to objectively quantify the number and type of procedures performed during clinical experiences aided students in their APRN certification process as well as provided information for facilities credentialing processes.¹⁵

Students' perceived mastery of coding was reported to be a vital skill in bridging the gap between APRN education and practice.^{15,20,21} McNelis et al¹⁷ concluded that APRN students using ECTSs were prepared to apply IT skills in self-evaluation and patient education. Both coding and use of electronic resources are valuable in APRN transition between education and practice.

DISCUSSION

Preparation of current and proficient APRNs to meet healthcare needs in the population foci served is the goal of every graduate education program in nursing. Graduate programs obtain this information from regular and ongoing conversations with corporate partners (clinical instructors, preceptors, and clinical agencies). Faculties produce program curricula to reflect current technology and changes within APRN practice. Electronic clinical tracking systems offer a bridge to the gap in education and practice with IT.

Research studies investigating ECTS utilization by APRN programs, although limited, have begun to raise awareness among faculty to the necessity of ECTS documentation in graduate programs. Faculty's ability to demonstrate that APRN programs are meeting NONPF Technology and Information Literacy competencies, in part, is dependent upon utilization of ECTSs. Assessments of APRN students' documentation of clinical encounters can be enhanced by ECTSs. These electronic systems have improved students' clinical documentation, providing several benefits to faculty and students.

This integrative review has identified a gap in the literature. Although graduate programs have moved toward utilization of ECTSs to capture students' clinical encounter data, the studies in this review did not evaluate APRN students' documentation of clinical encounters utilizing ECTSs to meet APRN curriculum outcome goals in Technology and Information Literacy as defined by NONPF core competencies. Therefore, further studies addressing ECTS utilization to meet NONPF core competencies are needed.

Graduate programs need to show that students in APRN programs are able to meet NONPF core competencies. In this integrative review, research studies did not identify the ability of ECTSs to meet core competencies. Therefore, it appears that ECTSs are not being utilized to their fullest capacity. Future research is needed to evaluate the link between ECTSs and NONPF core competencies that address the areas of information competency and literacy. This linkage is important to bridge the gap between APRN education and practice. Bridging the gap between APRN education and practice benefits graduate programs, APRN students, and students' potential employers.

One limitation of this integrative review included a small sample of eight research studies. The highest level of evidence in this integrative review was descriptive and qualitative studies. Another limitation of this integrative review was that the studies included four different ECTSs with varying degrees of functionality.

CONCLUSIONS

There are an increasing number of APRN programs utilizing ECTSs. Studies in this integrative review did not evaluate ECTSs to meet APRN core competencies. Therefore, more research is needed in this area to evaluate ECTS utilization to meet APRN core competencies of Technology and Information Literacy.

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