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Information management competencies for practicing nurses and new graduates

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Abstract: Nursing informatics skills are required at all levels of nursing practice. Of those basic skills, management of information through the electronic health record (EHR) is paramount. Previous research has explored computer literacy of nurses but has not investigated the competencies that relate specifically to information management. The purpose of this research study was to gather practicing nurses' views of current information management competencies published by the Technology Informatics Guiding Education Reform (TIGER) initiative, as they pertain to new graduates. A convenience sample of members from the InspireNet online user group was surveyed. The results suggest that overall, nurses tend to agree with the information management competencies; however, informatics education is most needed for those who have been practicing nursing for longer, rather than for novice nurses.

Keywords: Information management; New graduate nurses; Nursing informatics; Competencies; TIGER; Education; Medical informatics

Biographical notes: Corina Saratan is a Masters graduate of The University of Victoria's School of Health Information Science. Her research interests include clinical and nursing informatics. She is a Registered Nurse who has implemented and maintained various different hospital information systems across a myriad of clinical departments including radiology, cardiology, oncology, nursing, and health information management. She continues to practice as a Clinical Information Systems Analyst.

Dr. Elizabeth Borycki is an Associate Professor with the School of Health Information Science at the University of Victoria in Victoria, British Columbia, Canada. Dr. Borycki's research interests include health information systems safety, human factors, clinical informatics, organizational behavior and change management involving health information systems. Elizabeth has authored and co-authored numerous articles and book chapters as well as edited several books examining the effects of health information systems upon health professional work processes and patient outcomes. Dr. Borycki is also the Vice Chair of the Health Informatics for Patient Safety Working Group for the International Medical Informatics Association.

Dr. Andre Kushniruk is a Professor of the School of Health Information Science at the University of Victoria. Dr. Kushniruk is also an Adjunct Associate Professor at the Mt. Sinai School of Medicine in New York and was previously an Associate Professor in Information Technology at York University. Dr. Kushniruk conducts research in a number of areas including evaluation of the effects of technology, human-computer interaction in health care and other domains as well as cognitive science. His work is known internationally and he has published widely in the area of health informatics. He focuses on developing new methods for the evaluation of information technology and studying human-computer interaction in health care and he has been a key researcher on a number of national and international collaborative projects. His work includes the development of novel methods for conducting video analysis of computer users and he is currently extending this research to remote study of e-health applications and advanced information technologies, including computerized patient record systems. Dr. Kushniruk has held academic positions at a number of Canadian universities and he has taught courses in areas such as human-computer interaction, database management and systems analysis and design. He holds undergraduate degrees in Psychology and Biology, as well as a M.Sc. in Computer Science and a Ph.D. in Cognitive Psychology from McGill University.

1. Introduction

Medical Informatics is an interdisciplinary approach to the design, development, and application of IT-based solutions in the delivery, planning, and management of healthcare services (<u>http://www.himss.org/clinical-informatics/medical-informatics</u>). Within the discipline of Medical Informatics lies the subspecialty of Nursing Informatics (NI) which is described as, "a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice," (Staggers & Thompson, 2002, p. 260). Over the last three decades, a number of authors and organizations have recommended that all healthcare professionals develop some proficiency and knowledge of computer competency, information literacy, and information technologies (National League for Nursing (NLN), 2008). Nurses, making up the vast majority of healthcare workers, require informatics exposure and training in order to meet today's technological demands in the clinical environment.

All levels of nursing practice require some familiarity and knowledge of informatics and an understanding of how technology affects both their practice and how it ultimately affects patient outcomes. The aim of this study was to ask practicing nurses to rate NI information management competency requirements for new graduate nurses. Additionally, nurses were asked if supplementary competencies should be included in nursing curricula to better prepare new nurses for today's increasingly electronic clinical environment.

This study addresses the following questions:

- 1. In today's clinical environment, which of the TIGER (Technology Informatics Guiding Education Reform) information management competencies should be required of a new graduate nurse?
- 2. Are there additional competencies that should be included with TIGER's clinical information management competencies?

2. Previous work on nursing informatics competencies

Earlier nursing informatics (NI) research has focused mainly on establishment of informatics standards for nurses. A set of informatics competencies specific to nursing practice leads to a minimum level of proficiency required of all nurses. Furthermore, adoption of these competencies enables nurses to be more engaged in the health informatics revolution that is currently transforming and modernizing healthcare (Delaney & Gugerty, 2011).

2.1. Staggers competencies

Staggers, Gassert, and Curran (2001) were leaders in trying to create a standard set of NI competencies. The researchers found that in the literature published prior to 2001, researchers and nursing informatics leaders did not agree on the categories of NI competencies. Therefore, Staggers, Gassert, and Curran (2001) sought to create a master list of competencies and associate them to particular levels of nursing practice. Through an extensive review of the research from the previous fifteen years, the researchers were able to extract all NI competencies mentioned, list all unique competencies, associate each of those competencies with one of four different levels of nursing practice, and conduct a Delphi study to validate the resultant competencies with subject matter experts (Staggers, Gassert, & Curran, 2001). Fetter (2009a) cites these competencies as the landmark for existing NI standards.

The following, is a summary of the four different levels of nursing informatics practice that were defined by Staggers, Gassert, and Curran (2001):

- 1. Beginner Nurse a nurse who is equipped with the fundamental skills required for information management and computer technology; and who is prepared to use existing clinical information systems and available information to manage practice.
- 2. Experienced Nurse a specialized nurse who is said to be proficient in their domain of interest, e.g., public health, administration, education; and is highly skilled in using technology and information management to support their specialization.
- 3. Informatics Nurse Specialist a Registered Nurse (RN) who is baccalaureate prepared and possesses additional knowledge and skills specific to information management and computer technology.
- 4. Informatics Innovator an RN who is educationally prepared to conduct informatics research and generate theory related to the domain.

2.2. Staggers competencies

Nursing leaders from all over the United States gathered at the Technology Informatics Guiding Education Reform (TIGER) Summit in October 2006, offering an exclusive opportunity to team up and to commit to a redesigned, informatics-conscious vision for nursing education and training (Sensmeier, 2007). The resultant TIGER initiative aims to enable practicing nurses and student nurses to actively participate in today's fast-paced digital age of healthcare. Its primary challenge is to support future technology-enabled nursing practice by reshaping today's nursing education (TIGER, 2007). As a result of this work nine collaborative teams were formed to accelerate nursing informatics education reform. One of these work groups, the TIGER Informatics Competencies Collaborative (TICC), was tasked with evaluating the state of informatics preparedness of the current nursing workforce to create a set of minimal informatics competencies that all nurses should comply with (TIGER, 2009). Similar to Staggers, Gassert, and Curran (2002), the TICC also performed a thorough literature review for NI competencies, but also incorporated competencies from over 50 healthcare delivery organizations across the United States. The result was a comprehensive list of over 1000 individual NI competencies which was condensed to create a three-part model with the following three major components: basic computer competencies, information literacy, and information management (TIGER, 2009). Furthermore, TICC aligned these competencies with established competencies belonging to other standard development organizations such as the European Computer Driving License (ECDL) Foundation (n.d.), the American Library Association, and Health Level 7 (HL7). TIGER proposed the implementation of these NI competencies by January 2012, for both nursing programs as well as healthcare organizations (TIGER, 2009).

2.3. Assessing informatics competencies of nurses

Several studies have attempted to evaluate informatics competencies of nursing students (McDowell & Ma, 2007; Ornes & Gassert, 2007; Fetter 2009a; Fetter 2009b; Gassert & Sward, 2007; Elder & Koehn, 2009; Levett-Jones, Kenny, Van der Riet, Hazelton, Kable, Bourgeois, & Luxford, 2009). However, previous research has not examined competencies relating specifically to information management as it pertains to practicing nurses. Much of the evaluation research to date has also been modeled against the competencies outlined by Staggers, Gassert, and Curran (2001) and has only evaluated nursing students. The TIGER competencies are still relatively new and have not previously been evaluated by today's working nurses. TIGER's TICC group has made an effort to utilize existing de facto standards and has aligned them with the three categories of NI competencies for every practicing nurse: computer literacy, information literacy, and information management. This study focuses on the third NI category listed by TIGER; information management, and how it applies to today's Electronic Health Record (EHR) environment. Information management is the process that consists of collecting data, processing the data, and then presenting/communicating the processed data as information or knowledge (Delaney & Gugerty, 2011).

TICC's information management competencies consist of the direct care components of the HL7 EHR system functional model. Additionally, TIGER (2009) states that to supplement the HL7 EHR system functional model, the ECDL health module is utilized as an umbrella set of competencies that addresses both the purpose and intent of the EHR as well as the due care that nurses need to engage in when managing information via these systems. Table 1 depicts how TICC has linked competency statements to individual ECDL health syllabus items.

 Table 1

 TICC competency statements linked to ECDL health items (Adapted from TIGER (2009))

ECDL - Health	
Syllabus Item	TICC-related Competency Statement
	The nurse will:
Concepts	
HIS*	Verbalize the importance of HIS to clinical practice.
HIS Types	Have knowledge of various types of HIS and their clinical & administrative uses.
Due Care	
Confidentiality	Assure Confidentiality of protected patient health information when using HIS under his/her control.
Access Control	Assure Access Control in the use of HIS under his/her control.
Security	Assure the Security of HIS under his/her control.
User Skills	
Navigation	Have the User Skills as outlined in direct care component of the HL7 EHR system functional model, which
Decision Support	includes all of the ECDL-Health User Skills of Navigation, Decision Support, Output Reports and more.
Output Reports	
Policy & Procedure	
Principles	Understand the Principles upon which organizational and professional HIS use by healthcare professionals and consumers are based.

Note: HIS refers to Health Information Systems

3. Literature review

In the next section of this paper we review the subjects and setting; procedure; and results of this research.

3.1. Subjects and setting

This study surveyed practicing nurses, asking them to rate the TIGER information management competencies in terms of what should be required of new graduate nurses working with the EHR. The survey went out to the entire population of InspireNet (Innovative Nursing Services & Practice informed by Research and Evaluation Network) electronic community of practice (eCOP) through InspireNet's electronic newsletter and postings eCOP bulletin boards (Frisch et al., 2014). Additionally, an invitation to participate in the survey was posted on the InspireNet main homepage. InspireNet is a province-wide network in BC (British Columbia), Canada (http://www.inspirenet.ca). The vision of the community is to work collaboratively to advance research and knowledge to develop nursing health services in BC (Frisch et al., 2014). On October 31, 2011 when the survey took place, InspireNet reported a membership of 1400 nurses including nursing researchers, faculty, leaders, and practitioners (http://www.inspirenet.ca).

4. Procedure

The study employed an online survey on <u>www.surveymonkey.com</u> as its instrument for data collection. A demographic data section was included to collect basic information on the participants, including number of years of experience as a nurse as well as number of

years of experience using an EHR. The following section of the survey consisted of the 66 information management competencies listed by TIGER (Delaney & Gugerty, 2011) which formed the basis for the Likert-scale questions. Specifically, participants were asked the following question: With respect to the electronic health record, rate the following competencies in terms of what should be required of a new graduate nurse. A 5-point Likert-scale was provided: 1 = Don't Know, 2 = Strongly Disagree, 3 = Disagree, 4 = Neutral, 5 = Agree, and 6 = Strongly Agree. An option of, "Don't Know," was included for those who were not familiar with the given competency or had limited exposure to EHRs.

Three open-ended questions were included to solicit the participants' opinions and to elicit whether additional competencies were warranted: (1) What are your general thoughts about the above-listed competencies? (2) Please list any other information management competencies (not listed above) that nurses should possess in order to competently work in today's clinical environment. (3) Any other comments or suggestions? By including open-ended questions, the subject was given an opportunity to state an opinion in their own words and to divulge other suggested competencies. Content analysis would later be performed to examine the prevalence of common themes within the participants' responses.

5. Results

1400 members of InspireNet were invited to participate in the survey. There were a total of 50 survey respondents. The overall response rate was 3.57% (which is an adequate response rate for surveys posted online) (Eysenbach, 2005). Of the 50 respondents, 37 participants completed the survey in its entirety.

5.1. Competency ratings

The frequency of each competency rating was converted into a percentage and the mode was determined by the highest frequency of responses in each category. To calculate the mean, a weighted value was given to each of the Likert scale categories: 1 = Don't Know, 2 = Strongly Disagree, 3 = Disagree, 4 = Neutral, 5 = Agree, and 6 = Strongly Agree. Table 2 lists the complete results. The highest frequency of responses for each competency is denoted by an asterisk.

Table 2

	1 = Don't Know	2 = Strongly Disagree	3 = Disagree	4 = Neutral	5 = Agree	6 = Strongly Agree	Response Count	Mean	Mode
 Identify and maintain a patient record. 	0	2	0	1	7	30*	40	5.58	6.00
 Manage patient demographics. Capture data and documentation from external clinical sources. Capture patient- originated data. 	1	1	5	7	13*	13*	40	4.73	5.50
	1	0	5	7	13*	13*	39	4.79	5.50
	1	0	2	2	15	20*	40	5.25	6.00

TIGER information management competency ratings; Question: With respect to the electronic health record, rate the following competencies in terms of what should be required of a new graduate nurse

5. Capture patient health data derived from	3	1	2	8	16*	10	40	4.58	5.00
administrative data. 6. Interact with financial data and documentation	2	8	13*	12	1	2	38	3.21	3.00
7. Produce a summary record of care.	0	1	2	5	14	16*	38	5.11	6.00
8. Present ad hoc views of the health record.	5	1	5	6	14*	8	39	4.21	5.00
9. Manage patient history.	0	0	1	4	12	21*	38	5.39	6.00
10. Manage patient and family preferences.	1	0	1	4	14	18*	38	5.21	6.00
11. Manage patient advance directives.	1	2	2	4	12	17*	38	4.97	6.00
12. Manage consents and authorizations.	1	1	5	4	11	16*	38	4.87	6.00
13. Manage allergy, intolerance, and adverse reaction lists.	1	0	2	1	8	26*	38	5.45	6.00
14. Manage medication lists.	1	2	1	1	11	22*	38	5.24	6.00
15. Manage problem lists.	1	0	0	2	14	21*	38	5.39	6.00
16. Manage immunization lists.	2	2	1	3	13	16*	37	4.92	6.00
and protocols for planning care.	1	0	0	0	16	21*	38	5.45	6.00
 Manage patient-specific care and treatment plans. Manage mediation 	1	0	0	0	15	22*	38	5.47	6.00
orders as appropriate for your scope of practice.	1	0	1	2	10	24*	38	5.42	6.00
20. Manage non-medication patient care orders.	2	0	2	2	12	20*	38	5.16	6.00
21. Manage orders for diagnostic tests.	1	1	1	1	16	18*	38	5.21	6.00
22. Manage orders for blood products & other biologies.	1	0	2	1	16	18*	38	5.24	6.00
23. Manage referrals.	1	0	4	6	17*	10	38	4.79	5.00
24. Manage order sets.	5	0	1	4	14*	13	37	4.65	5.00
25. Manage medication administration.	1	0	0	0	12	25*	38	5.55	6.00
26. Manage immunization administration.	2	0	2	3	16*	15	38	5.00	5.00
27. Manage results.	2	0	2	1	19*	14	38	5.03	5.00
28. Manage patient clinical measurements.	4	0	0	1	15	18*	38	5.03	6.00
29. Manage clinical documents and notes.	2	0	2	1	9	23*	37	5.27	6.00
of clinician response to decision support prompts.	3	1	3	5	11	15*	38	4.71	6.00
 Generate and record patient-specific instructions. Manage health 	1	1	1	1	16	18*	38	5.21	6.00
information to provide decision support for standard assessments.	0	0	2	4	18*	14	38	5.16	5.00

33. Manage health information to provide decision support for patient context-driven assessments.	1	0	1	6	17*	13	38	5.03	5.00
information to provide decision support for identification of potential problems and trends.	2	1	0	3	21*	11	38	4.92	5.00
information to provide decision support for patient and family preferences.	1	0	1	5	20*	11	38	5.00	5.00
support for standard care plans, guidelines, and protocols.	1	0	1	5	19*	13	39	5.05	5.00
37. Interact with decision support for context-sensitive care plans, guidelines, and protocols.	2	0	2	5	17*	13	39	4.90	5.00
38. Manage health information to provide decision support for consistent healthcare management of patient	2	1	4	9	14*	8	38	4.47	5.00
groups or populations. 39. Manage health information to provide decision support for research protocols relative to individual patient care.	4	1	2	14*	13	4	38	4.13	4.00
40. Manage health information to provide decision support for self-	3	0	1	6	14*	14*	38	4.84	5.50
41. Interact with decision support for medication and immunization ordering as appropriate for his/her scope of practice.	1	1	1	5	17*	14	39	5.00	5.00
42. Interact with decision support for drug interaction checking.	2	0	1	4	13	19*	39	5.13	6.00
43. Interact with decision support for patient-specific dosing and warnings.	2	0	3	4	14	16*	39	4.95	6.00
44. Interact with decision support for medication recommendations.	1	2	3	5	17*	11	39	4.74	5.00
support for medication and immunization administration.	1	1	2	5	16*	14	39	4.95	5.00
46. Interact with decision support for non medication ordering.	2	0	1	7	15*	13	38	4.89	5.00
47. Interact with decision support for result interpretation.	1	0	2	8	17*	11	39	4.87	5.00
48. Interact with decision support for referral process.	1	0	2	7	18*	11	39	4.90	5.00

49. Interact with decision		0		_	2 C · I	_	•		- 00
support for referral	4	0	1	7	20*	7	39	4.54	5.00
recommendations.									
50. Interact with decision	n	0	2	2	15	17*	20	5.05	6.00
administration	2	0	2	3	15	17.	39	5.05	0.00
51 Interact with decision									
support for accurate	1	0	1	2	10*	15	29	5 16	5.00
support for accurate	1	0	1	3	10	15	30	5.10	5.00
52 Internet with decision									
52. Interact with decision									
support that presents alerts	2	0	2	7	14*	14	39	4.87	5.00
for preventive services and									
weilness.									
53. Interact with decision									
support for notifications and	1	1	3	9	10	14*	38	4.79	6.00
reminders for preventive									
services and wellness.									
54. Manage health									
information to provide									
decision support for	2	3	10	16*	5	3	30	3 72	4.00
epidemiological	2	5	10	10	5	5	39	5.12	4.00
investigations of clinical									
health within a population.									
Manage health									
information to provide									
decision support for	2	1	11	16*	6	3	30	3 87	4.00
notification and response	2	1	11	10	0	5	39	5.62	4.00
regarding population health									
issues.									
56. Manage health									
information to provide									
decision support for	n	0	0	0	12*	0	20	1 20	5.00
monitoring response	2	0	0	0	13.	0	39	4.30	5.00
notifications regarding a									
specific patient's health.									
57. Access healthcare	2	0	0	4	21*	11	20	1 97	5.00
guidance.	3	0	0	4	21*	11	39	4.07	5.00
58. Interact with clinical	5	0	2	2	15*	12	20	1 62	5.00
workflow tasking.	5	0	2	3	15*	15	38	4.03	5.00
59. Interact with clinical	7	1	1	4	14*	11	38	4.32	5.00
task assignment and routing.									
60. Interact with clinical	11	1	1	2	15*	8	38	3 87	5.00
task linking.	11	1	1	2	15	0	50	5.07	5.00
61. Interact with clinical	10	1	2	2	16*	7	38	3 80	5.00
task tracking.	10	1	2	2	10	/	58	5.69	5.00
62. Facilitate interprovider	0	1	0	2	15*	12	20	1 29	5.00
communication.	0	1	0	2	15	15	39	4.50	5.00
63. Facilitate provider-	5	1	2	2	17*	12	30	1 56	5.00
pharmacy communication.	5	1	2	2	17.	12	39	4.50	5.00
64. Facilitate									
communications between	6	1	1	1	14	16*	20	1 6 1	6.00
provider and patient and/or	0	1	1	1	14	10	39	4.04	0.00
the patient representative.									
65. Facilitate patient,									
family, and care giver	2	0	2	3	14	18*	39	5.08	6.00
education.									
66. Facilitate									
communication with medical	3	1	1	6	17*	11	39	4.69	5.00
devices.									

The five highest ranking information management competencies are listed in Table 3. In column 1 the top competencies by mode are presented. In column 2 the top

competencies by mean are presented. Of note, the highest scoring competency is the same, based on mode and mean score (see Table 3).

The only competency which the majority of respondents disagreed with was interact with financial data and documentation (34.21% of respondents disagreed). Three competencies returned a majority of neutral responses, these included: manage health information to provide decision support for notification and response regarding population health issues (41.03% or respondents rated this as neutral); manage health information to provide decision support for epidemiological investigations of clinical health within a population (41.03%); and manage health information to provide decision support for research protocols relative to individual patient care (36.84%).

Table 3

Highest scoring competencies

TOP 5 MODE	TOP 5 MEAN				
1. Identify and maintain a patient record.	1. Identify and maintain a patient record.				
2. Manage allergy, intolerance, and adverse reaction lists.	2. Manage medication administration.				
3. Manage medication administration.	3. Manage patient-specific care and treatment plans.				
4. Manage medication orders as appropriate for your scope of practice.	4. Manage allergy, intolerance, and adverse reaction lists.				
5. Manage clinical documents and notes.	5. Interact with guidelines and protocols for planning care.				

The five competencies that participants were least familiar with, in descending order, were: interact with clinical task linking (28.95% of respondents chose "don't know"); interact with clinical task tracking (26.32%); facilitate interprovider communication (20.51%) interact with clinical task assignment and routing (18.42%); and facilitate communications between provider and patient and/or the patient representative (15.38%). It was clear that most participants agreed that competencies that involved maintaining the patient record, and managing medication administration were of the utmost importance. However, the majority of survey-takers indicated that documentation relating to financial data was not part of the nurse's role in managing information.

5.2. Comparing responses from different participants

Table 4 shows the response count categorized by the number of years the respondents have been practicing nursing. Analysis of the filtered responses of the new graduates (practicing less than 6 months) showed there were zero, "don't know," replies to the list of competencies, demonstrating that new graduates are familiar with them. Contrastingly, filtering responses for participants who have been practicing nursing for over ten years, there were 44 out of the total 66 competencies that listed at least one, "don't know," response. A second analysis was done comparing novice nurses (those practicing for less than six months; and those practicing between six months – two years) versus more experienced nurses (those practicing between two years – five years; five years – ten years; and beyond ten years) and again, the new nurses had zero, "don't know," responses while 7% of the responses from the more senior group of nurses were "don't know,"

know." Although the response rate from newer nurses was much lower than from more experienced nurses, it is possible that new graduate nurses are being introduced to EHR concepts prior to graduation and seemingly have a better understanding of the listed competencies than nurses who graduated from a nursing program more than two years ago. This would be consistent with some of the opportunities that have been afforded to nursing in BC to use EHRs in the classroom (Borycki et al., 2008; Borycki, Frisch, Moreau, & Kushniruk, 2015). However, these results are limited to a small subset of newer nurses. Additional study/data would allow for more generalizable results.

Table 4

Response count categorized by the number of years of practice

How long have you been practicing as an RN?						
Answer Options	Response Percent	Response Count				
Less than 6 months	4.3%	2				
6 months - 2 years	8.5%	4				
2 years - 5 years	4.3%	2				
5 - 10 years	27.7%	13				
10+ years	55.3%	26				

Table 5

Response count categorized by years of experience with an EHR

How many years of experience do you have with an electronic health record (EHR) e.g., EPIC?							
Answer Options	Response Percent	Response Count					
Less than 1 year	42.6%	20					
1 - 3 years	17.0%	8					
More than 3 years	40.4%	19					

Participants were also asked to specify the number of years of experience they had, using an EHR. Table 5 shows the response count categorized by years of experience with an EHR. In a comparison of inexperienced EHR users to less experienced users, novice EHR users (less than 1 year of experience) were more likely to choose a, "don't know," response, evidenced by 51 of the 66 competencies showing at least one respondent of the group who answered with, "don't know." Intermediate EHR users (1 - 3 years of experience) chose a "don't know" response in only 18 of the 66 competencies but the most experienced users (more than 3 years of experience) chose a "don't know" in 32 of the competencies. Both intermediate and experienced users of EHRs had less competencies that they were unfamiliar with compared to the novice group of EHR users. However, experienced EHR users weren't familiar with 32 competencies whereas their intermediate counterparts only had 18 with which they were unfamiliar. Although experienced EHR users have been exposed to information management for longer than the intermediate group, this does not necessarily mean they have been utilizing the EHR to the same degree. It is entirely possible that some or many of the participants work in hybrid environments, meaning an environment where some information management is still paper-based while others tasks have been integrated with the EHR (Borycki, Lemieux-Charles, Nagle, & Eysenbach, 2009).

5.3. Open-ended question responses

Content analysis was performed on the 19 responses for the first open-ended question: What are your general thoughts about the above-listed competencies? Content analysis involved coding the responses to the open ended questions into concepts and then calculating frequencies for the occurrence of each concept in the responses (Hsieh & Shannon, 2005). Table 6 shows a list of concepts and the relative frequency/count of how many times they appear in the open-ended responses. One of the most prevalent concepts was, "difficulty understanding," followed by "difficulty relating the concepts to nursing practice." This was evidenced by the following quote:

I am completely thrown by your use of the word "manage". Example: No one manages a patient history -- a nurse documents or records a patient history; a nurse uses that history in planning care. An information (IT) person (who could be a nurse) manages data that records such a history and may manage the computer database or system. but no one 'manages' the history. (Participant 34)

Table 6

Concept definitions & frequencies; Question: What are your general thoughts about the above-listed competencies?

Concept	Definition	Frequency
Difficulty	The respondent had difficulty understanding	6
Understanding	the concepts and/or terminology.	
Difficulty Relating to Practice	The respondent had difficulty relating the concepts to nursing practice.	2
Advanced for New Grad	The respondent thought the competencies were advanced or complex for a new graduate.	4
Appropriate for New Grad	The respondent thought the competencies were appropriate for a new graduate nurse.	6
Inappropriate for New Grad	The respondent thought the competencies were inappropriate for a new graduate nurse.	3
Lack of Experience	The respondent admitted to a lack of experience with an electronic health record.	2

For the second open-ended question, participants were asked to list any additional information management competencies that they felt should be required of nurses working with EHRs. A total of ten new suggested competencies were given; however, only three of the ten competencies related specifically to information management. These included: information privacy, information security, and reporting technology-induced errors. Fortunately, TICC has already included those aspects of information management (Table 1) to support the HL7 EHR direct care components (TIGER, 2009). Information privacy and security clearly fall under due care. Technology-induced errors is defined as errors that "arise from (a) the design and development of technology, (b) the implementation and customization of a technology and (c) the interactions between the operation of the new technology and the new work processes that arise from technology's use," (Borycki & Kushniruk, 2008, p. 154). Reporting technology-induced errors,

although not explicitly stated in the TICC ECDL-based competency statements, could also arguably fall under either due care and/or policy and procedure (see Table 1). The ECDL (n.d.) instructs health information system users to understand the ethics, rules, and regulations relating to the system(s) being used. In exercising due care and by following local policies and procedures, the nurse should be aware of how to report errors resulting from use of technology. That said, there remains a need to educate nurses about technology-induced errors and the organizational information systems to whom nurses should report these errors.

6. Discussion

The first research question was: In today's clinical environment, which of the TIGER information management competencies should be required of a new graduate nurse? The study revealed the following conclusions:

- The majority of participants thought that 62 out of 66 TIGER information management competencies were relevant to the new graduate (evidenced by a majority agree or strongly agree rating).
- One competency: "interact with financial data and documentation", was deemed irrelevant (evidenced by a majority disagree rating).
- Three competencies relating to decision support associated with population health, epidemiological studies, and research protocols, received a majority neutral response.

The second research question asked: Are there additional competencies that should be included with TIGER's clinical information management competencies?

• The results show that only three of the participants' responses were exclusively relevant to TIGER's information management category; however, the three competencies are already accounted for in ECDL's health syllabus.

6.1. Contributions to education

Having the largest percentage of, "don't know," responses, the study results also show that the following areas require most emphasis in nursing education: "interact with clinical task linking"; "interact with clinical task tracking"; "facilitate interprovider communication"; "interact with clinical task assignment and routing"; and "facilitate communications between provider and patient and/or the patient representative". Clinical tasks refer to everyday nursing duties such as finding the appropriate link to the patient's blood test results in the EHR (clinical task linking), monitoring changes in vital signs (clinical task tracking), and alerting the transport team that the patient is ready to go for their diagnostic exam (clinical task assignment). In the case of the competencies that involve interacting with clinical tasks, perhaps the participants simply had difficulty understanding the terminology. If this is the case, then education should focus on defining terminology. If this is not the case, then perhaps instruction is required around EHR navigation with an emphasis on assigning and routing tasks to other healthcare providers; finding all clinically relevant patient information; and tracking patient progress in the appropriate health information system(s). Educators also need to teach nurses and nursing students that EHRs have the ability to facilitate interprovider communication. Examples of features that allow nurses to do this are instant messaging, flagging

mechanisms, and email. Additionally, the EHR can enable communication between the providers and patients/families by making the EHR available to clients via the internet, and allowing patients to email their providers. The findings also imply that new nurses are becoming exposed to the EHR or at least, concepts relating to it. Contrastingly, those who have been practicing for more than two years who may be more confused by the terminology and/or competencies themselves and how they relate to current practice. This might indicate that nursing program curricula are progressing according to TIGER's plans to integrate informatics in education while practicing nurses are not finding the appropriate information as easily.

TIGER currently offers a virtual learning environment (VLE) online, which could boost nurses' adoption of the EHR (http://www.thetigerinitiative.org/). The VLE includes technology-enhanced learning such as scenario-based learning and education sessions. Additionally, healthcare institutions need to take responsibility for training their staff on new technologies. Education through in-services could better inform nurses about the health information systems that they utilize. Allowing nurses to participate in the planning and implementation of clinical systems could also contribute to their learning. The survey results also show that those with more EHR experience were less likely to choose a, "don't know," response, indicating that greater exposure to comprehensive EHR systems improves nurses' confidence in information management. Perhaps mentorship and training from "super user" nurses through a robust super user program could benefit those nurses who are less familiar with the EHR. Working with nurse peers to navigate clinical systems in their native work environment could help solidify their knowledge of the systems and build confidence in their abilities to navigate through the EHR. Both new and practicing nurses should be educated and exposed to at least the basic principles of electronic management of information. Health care institutions need to ensure that their staff nurses are receiving appropriate training on new technologies. Furthermore, leaders in nursing education need to make certain that the TIGER competencies become visible through strategic plans which ensure access to the appropriate resources (Hebda & Calderone, 2010).

6.2. Strengths and limitations

Recruitment of survey participants was a challenge. Potential study participants were sent an invitation to participate in the study several times in an effort to increase the survey response rate. There may be a number of other reasons why the response rate may be lower: (a) the survey was lengthy so participants may have chosen to not complete the survey for this reason, and (b) the electronic newsletter invitation to participate in the study appeared near the bottom of the newsletter page (i.e. some potential participants may not have scrolled down the electronic document page and therefore may not have seen the invitation). In an effort to address these issues an invitation to participate was also placed on the InspireNet homepage and the researcher asked that the invitation to participate be placed at the top of the electronic newsletter. The placement of the survey invitation increased the response rate by 28%. This improvement was consistent with prior work done by Andrews, Nonnecke, and Preece (2003). Given that this survey was introduced to a sample of research nurses belonging to an online community, the surveytakers might have been more tech-savvy than the average nurse. According to Andrews, Nonnecke, and Preece (2003), those who participate in online surveys may have stronger Internet skills than those who choose not to participate. Therefore, the results may be more representative of those nurses that have knowledge of nursing informatics.

Although 1400 InspireNet members were invited to participate, it is also not clear how many of the individuals who participated in the study were active eCOP participants. Research has found there are differing levels of interest and participation in eCOPs and that members of an online community can be considered to be active or inactive. A sampling frame was based on a potential of 1400 total members; however, involvement in online communities such as InspireNet can vary immensely from one individual to another. Some members are regular contributors to discussion forums, while others participate only occasionally (Wright, 2006). For example, in monitoring an invitation posting to one of the several eCOPs, it was noted that out of 96 members, there were only 34 reads. This only accounts for 35% of the members involved in the one eCOP – one whose members have a specific interest in nursing and health informatics.

7. Conclusion

The TIGER initiative raises awareness about the need to create a capable nursing workforce that can leverage EHRs to improve healthcare delivery (Hebda & Calderone, 2011). TIGER is now in the third phase of the implementation, integrating recommendations from their work groups, such as TICC, into all areas of nursing (http://www.thetigerinitiative.org/). In the future nursing educators and informaticists could begin to gauge which topics of information management require more focus and continued education for the new graduate to feel comfortable in working with an EHR. As it turns out, new graduate nurses in BC may already be learning the basic principles of nursing informatics; however, those who have been practicing longer are in need of continuing education in information management proficiencies. The level of exposure to the EHR is also a contributing factor to agreement with the competencies. Encouraging nurses to practice their information management skills (Borycki, Frisch, Moreau, & Kushniruk, 2015), supplying them with adequate technological resources (Borycki, Lemieux-Charles, Nagle, & Eysenbach, 2009), and exposing them to the varied aspects of the EHR are essential to the development of NI within BC as described by TIGER. Finally, this study demonstrates that TICC information management competencies coupled with their overarching ECDL-linked principles of concepts, due care, user skills, and policy represent a relatively comprehensive set of nursing informatics competencies. These, along with new emerging competencies such as security and technology-induced error recognition are the information management skills that novice nurses will need to acquire to practice in today's clinical environment.

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