

NURSING INFORMATICS PRACTICE INTEGRATION:  
A BASELINE ASSESSMENT OF NURSE LEADER INFORMATICS COMPETENCY

By

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**Nursing Informatics Practice Integration:**  
**A Baseline Assessment of Nurse Leader Informatics Competency**

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## Abstract

**Background:** Evidence-based practice and informatics competencies are critical nursing skills. Informatics capabilities must exist at all levels of nursing practice to meet the demands of complex patient care, changing care delivery models, and alternative payment methods.

**Project Problem Statement:** Despite the inclusion of informatics content in accredited nursing programs, many practicing nurse leaders have limited informatics skills. This lack of knowledge limits their ability to lead from a position of strength and may sideline them when critical technology decisions are made. Mitigation of this gap requires the assessment of nurse leader informatics knowledge and the delivery of role-specific informatics educational content.

**Project Purpose:** The objective of this project was to assess the self-reported level of informatics competency of the nurse leaders working in a three-hospital, integrated, academic health system. The results of this study will foster collaboration and inform the development of informatics focused nursing leader education materials.

**Project Methods:** Baseline nursing leader competencies were assessed using the Nursing Informatics Competency Assessment for the Nurse Leader tool. Descriptive statistics were generated from the response data. Correlations between the item level responses and respondent demographic data were determined using the Clopper-Pearson (exact) method.

**Results:** Responses were received on all 26 items. The respondents rated themselves highest on ethical and legal concepts (Median score 4.0 on both questions) followed by strategic implementation management (Median 3.55), and requirements and system selection (Median 3.25). Respondents reported limited competencies in two factors – information systems concepts (Median 2.67) and executive planning (Median 2.13). Respondents who had received informatics education integrated within their nursing training consistently reported higher median responses.

**Conclusion:** Contemporary nurse leaders must have the requisite informatics competencies to effectively use technology within the workplace, and to lead the evaluation and selection of clinical tools. Though significant gaps exist in the nurse leaders' informatics knowledge, these gaps can be bridged through engaging, relevant educational offerings. These survey results set the stage for the development of tailored nurse leader education to fill the academic-practice gap.

Table of Contents	
Problem Statement.....	6
Background.....	7
Significance to Practice .....	10
Project Purpose and Aims .....	10
Theoretical Framework .....	10
Domain of Nursing .....	11
Socio-Technical Systems Theory .....	11
Nursing Informatics .....	12
Competency Assessment .....	13
Literature Review and Synthesis .....	13
Methods .....	15
Human Subject Protection .....	16
Setting and Sample .....	16
Survey Design.....	17
Results .....	18
Respondent Demographics .....	19
Survey Results Overall .....	20
Responses by Professional Position.....	21
Responses by Years of Experience .....	22

Total Years of Nursing Experience.....	22
Total Years of Leadership Experience.....	22
Total Years of Experience in Current Position .....	23
Responses by Cohort.....	24
Discussion.....	24
Conclusion.....	28
References .....	30
Appendix A .....	38
Appendix B.....	40
Appendix C.....	43
Appendix D .....	45
Appendix E.....	46
Appendix F .....	47
Appendix G .....	52
Appendix H .....	53
Appendix I.....	56
Appendix J.....	58
Appendix K .....	59
Appendix L.....	60
Appendix M.....	61

Appendix N .....	63
Appendix O .....	66
Appendix P .....	68

## Nursing Informatics Practice Integration:

### A Baseline Assessment of Nurse Leader Informatics Competency

Nursing is a knowledge-based practice within the human service industry. It is based on science (e.g., nursing, biological, social, behavioral, organizational), informed by the nursing process, and supported by practice-specific theory. Nursing is a profession, not merely a “subsidiary function of medicine” (Wolf, 2013, p. 6). As such, nurses are a unique category of knowledge workers, not only generating knowledge through the gathering of data and information but also spurring innovation and transformation based on insights (Turriago-Hoyos, Thoene & Arjoon, 2016).

Evidence-based practice and informatics competencies are critical nursing skills that are necessary to meet the demands of complex patient care, changing care delivery models, and alternative payment methods. If nursing leaders hope to remain relevant within and lead innovative and potentially disruptive care delivery models, they must be proficient in essential nursing informatics competencies (Fineout-Overholt, Cox, Robbins, & Gray, 2005; Institute of Medicine [IOM], 2001; IOM, 2011; Mantas & Hasman, 2017; Skiba, 2017; Westra et al., 2015; Williams & Benner, 2013). Therefore, this project aims to assess the informatics competency of nurse leaders within an academic health system. The results will guide the future development of educational content for nursing leaders.

### **Problem Statement**

Informatics knowledge is integral to the practice of nursing and is no longer the sole purview of the nursing informatics specialist (Collins, Yen, Phillips, & Kennedy, 2017; Hussey & Kennedy, 2015; Strudwick, Nagle, Kassam, Pahwa, & Sequeira, 2019a). Thus, informatics capabilities must exist at all levels of nursing practice (Collins et al. 2017; Simpson, 2013).

Despite the inclusion of informatics content in accredited nursing programs (bachelor, master, and doctorate), many practicing nurse leaders have limited informatics skills (American Association of Colleges of Nursing [AACN], 2006; AACN, 2008; AACN, 2011; Mantas & Hasman, 2017). This lack of knowledge leads to missed opportunities for cross-departmental collaboration and clinical process improvement. Additionally, gaps in informatics knowledge can lead to misuse of enabling technology (Hussey & Kennedy, 2015). Yen, Phillips, Kennedy, and Collins (2017) posit that mitigation of this gap requires the assessment of nurse leader informatics knowledge and the delivery of role-specific informatics educational content.

### **Background**

Traditionally, the definition of nursing informatics reflects a set of competencies at the intersection of "nursing science, computer science, and information science" (American Nurses Association [ANA], 2008, p.1). Florence Nightingale's use of statistics and data visualization in the mid-1800s reflects early nursing informatics practice (Betts & Wright, 2003; Betts & Wright, 2009; Mitchel, 2018; Ozbolt & Saba, 2008; Skiba, 2017). However, professional publications regarding nursing informatics and data analytics remained limited until the 1970s. During this period, the use of computerized tools in health care expanded, and articles about the foundational principles of informatics began to emerge in the professional nursing literature (Grave & Corcoran, 1989; Ozbolt & Saba, 2008; Skiba, 2017).

The 1980s saw the rapid adoption of personal computing technology both within and outside the workplace. During this period, healthcare computing technologies such as order entry, result lookup, and clinical documentation systems became increasingly commonplace (Grave & Corcoran, 1989; Skiba, 2017). Despite this expansion and the growing international

professional dialogue on the subject, the ANA did not recognize nursing informatics as a practice specialty until 1992 (ANA, 2008; Skiba, 2017).

Over the ensuing 27 years, health care technology has not only proliferated; it has fundamentally changed the manner and locations of care delivery (Booth, 2016; Hussey & Kennedy, 2015). Concurrently, the role of the nurse leader has expanded to include strategic and operational responsibilities such as health information technology adoption, clinical outcomes improvement, care delivery innovation, as well as improved staff engagement and patient experience (Collins et al, 2017; Strudwick et al., 2019).

In 2001, the Institute of Medicine (IOM) identified six overarching improvement tenets focused on safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity, and established guidelines for clinical system redesign. Key areas of focus included alternative approaches to the patient-provider relationship, the use of information technology resources to meet patient needs, care personalization, the patient as the source of control within the care relationship, as well as providing patients direct access to their health records (IOM, 2001). After this landmark publication, the healthcare industry realized incremental advancements in the use of technology to improve care; however, progress was slow.

To spur the adoption of EHR technology, the United States Congress passed the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 (HITECH, 2009). The HITECH Act incentivized healthcare organizations to implement enabling technology with the overarching goal of improving care and driving down healthcare costs. The incentive structure within the act initially referred to as Meaningful Use now labeled Promoting Interoperability, fueled a dramatic increase in information technology (IT) implementation within health care (The Office of the National Coordinator for Health Information Technology

[ONC], 2013). This proliferation of computer-based tools dramatically increased the demand for informatics capabilities and competencies (Skiba, 2017).

To better reflect the expanded role and knowledge base of informatics, the ANA updated the definition of nursing informatics in 2015. The revised definition incorporates analytical sciences into the long-standing informatics framework (data, information, knowledge, wisdom). Consumers and patients are specifically identified as key constituents reflecting the trend to increased consumerism and patient self-management (ANA, 2015). Though improved in breadth, this definition does little to reflect the vital and active role nursing informatics plays in healthcare delivery, product design, or innovation. The linguistic challenges evident in this definition reflect the continued struggle to identify where nursing practice ends, and nursing informatics practice begins.

Today, a wide variety of computer-enabled technologies augment the cognitive processes of diagnosis, monitoring (individuals), surveillance (populations), consultation, and intervention (Panth & Acharya, 2015; Reed, 2018). However, healthcare organizations, and thus nursing leaders, have been disproportionately focused on EHR adoption tactics for over ten years. Even though the majority of United States hospitals (96%) and clinics (86%) have implemented EHRs (ONC, n.d.), organizations have not fully realized the anticipated benefits of improved care and cost savings. Additionally, clinicians continue to express high degrees of frustration with available health information technology. This frustration is a combination of clinician confidence in using technology; poor system design leading to cognitive overload and interruption; as well as unrealistic expectations that technology will solve all the ills of the US healthcare system (Gawande, 2019; McGinnis, Olsen, Goolsby, & Grossmann, 2011; Remus, 2016; Seaman & Erlen, 2015; Yin, Ou, Davison, & Wu, 2018).

### **Significance to Practice**

Despite significant advancements in enabling technology, the unique interventions, contributions, and value of nursing may not be adequately reflected in HIT systems, most notably EHRs. Considering the critical role nurse leaders play in the delivery of high-quality, cost-effective care, their full participation in clinical care model design and system acquisition is imperative. If organizations hope to realize their full return on investment in technology, nursing leaders and nursing informaticists must move from technology selection, use, adoption, and optimization efforts to strategic business transformation. Nurse leaders must be fluent in leadership principles, business management, and informatics competencies. Therefore, heightened nurse leader understanding of informatics capabilities coupled with essential nurse leader competencies (see Appendix A) is necessary to improve patient outcomes, safety, and staff satisfaction (Bini, 2018; Dreyer & Allen, 2018; Frith, 2019; Hussey & Kennedy, 2015; Linnen, Javed, & D'Alfonso, 2019; Mantas & Hasman, 2017; Skiba, 2017; Strudwick et al., 2019a).

### **Project Purpose and Aims**

The purpose of this quality improvement project was to measure the baseline informatics competencies of the nursing leaders working in a three-hospital, integrated, academic health system. The results of this study will foster collaboration and inform the development of informatics focused nursing leader education materials.

### **Theoretical Framework**

The domain of nursing, socio-technical theory and the nursing informatics organizing framework guided this work. First, the domain of nursing provided context and insight into the practice of nursing in general and the responsibilities of nurse leaders. Secondly, socio-technical

theory offered insight into the human-technology intersection. Thirdly, the informatics organizing framework served as the scaffolding upon which to apply socio-technical theory.

### **Domain of Nursing**

The domain of nursing is both complex and nuanced. Theorists and thought leaders such as Nightingale (1859/1992), Donaldson and Crowley (1978), Fawcett (1984), as well as Smith and Parker (2015), define the discipline of nursing as residing at the intersection of the person, the environment, health, and the practice of nursing. Specifically, nursing practice attends to the well-being of humans and their patterns of interaction through systems and processes. The overall goal of the nursing process, regardless of location or focus, is the optimal well-being of all involved. Simply put, the focus of nursing is to elevate the human condition.

As such, the role of the nursing leader is not only to manage the human and business resources of nursing practice but also to ensure the delivery of optimal patient care through well-designed systems and processes. This responsibility includes the safe, appropriate, and effective use of information technology (Booth, Sinclair, Brennan, & Strudwick, 2017; Borycki, Cummings, Kushniruk, & Saranto, 2017).

The modern healthcare environment is a dynamic amalgamation of people, processes, and technology, resulting in a highly complex system. The integration of technology into the healthcare ecosystem is simultaneously informative (useful) and disruptive. As such, the benefits of technology deployment are dependent on the artful navigation of the human-technology intersection. Socio-technical systems theory offers a grounding framework for understanding the interplay of humans and technology within complex systems. (Booth, et al., 2017; Systems Academy, 2015).

### **Socio-Technical Systems Theory**

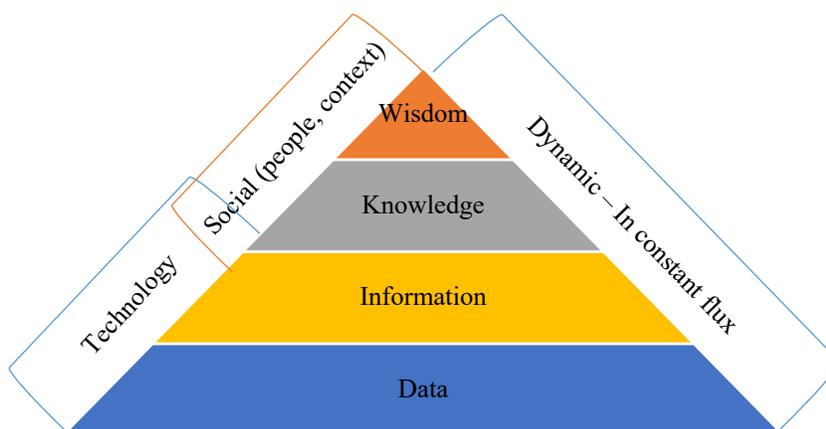
Socio-technical systems theory posits that the intersection of people and technology requires thoughtful design. If systems are designed or deployed without ample understanding of the context (e.g., end-user value, environment, social, emotional) within which they will be used, adoption is at a minimum problematic, at its worst, alienating and doomed to fail. Likewise, if the system and process design over-emphasizes the social (human) aspects, operations may remain inefficient and cumbersome, minimizing the effectiveness of the change. Therefore, adoption of technology within a complex system requires a balanced approach that maximizes technical capabilities while supporting (augmenting) the people using the system (Booth et al., 2017; System, Academy, 2015).

### **Nursing Informatics**

The informatics paradigm offers a structural framework to which socio-technical systems theory can be applied (Matney, Brewster, Sward, Cloyes, & Staggers, 2011; System Academy, 2015). Figure 1 represents the symbiotic relationship between the nursing informatics framework and socio-technical systems theory. The technology domain is primarily associated with the foundational informatics elements of data and information. The social domain aligns with the informatics knowledge and wisdom elements. Note the overlap, however, between the social and technology domains. This overlap not only represents the interface between people and technology, but it also reflects the advancement of evolving technologies and their ability to generate new knowledge.

Nursing leaders are responsible for ensuring that their staff is well-prepared to render safe and effective care, particularly in times of significant system change. Socio-technical adoption theory addresses the contextual (qualitative) elements of technology adoption, including things such as meaning and role identity, as well as the actual use of the technology itself (quantitative,

reductionist, logical). Technology adoption depends on the successful integration with the socio-cultural dynamics of the organization. That intersection represents the nurse leader's inflection point. When armed with adequate informatics competencies, nurse leaders are uniquely qualified to navigate the human-technology interface with a keen understanding of the social impact the changes will have on the organization.



*Figure 1* Informatics and Socio-Technical Theory relationship (Matney et al., 2011; System Academy, 2015)

### **Competency Assessment**

This project includes the assessment of nursing informatics competencies at the nurse leader level. Competency refers to the ability to use role-specific knowledge, skill, and behaviors in the performance of an individual's duties. The critical element of nursing competency is the acquisition and appropriate application of knowledge to a given situation while developing and maintaining professional (therapeutic) relationships (Barbosa, 2017; Fukada, 2018; Honey et al., 2017).

### **Literature Review and Synthesis**

Utilizing a reliable and validated instrument is essential to evidence-based practice (Polit & Beck, 2012) and assessing competency. The purpose of this literature review was to identify the availability of validated nursing informatics assessment tools that reliably measure the nurse leader's informatics competencies. The analysis of the literature included ten years from January 2009 to September 2019. The search included two electronic bibliography databases, PubMed and the Cumulative Index of Nursing and Allied Health Literature (CINAHL), with particular attention to leading clinical informatics and nursing leadership publications. Additional hand searches, as well as inquiries within Google Scholar, were conducted to ensure completeness of the search. Due to the limited available empirical studies, the search included scope and standards documents and descriptive articles. Using the search terms "nursing," "leader," "director," "manager," "executive," "informatics," "competency," and "assessment," 71 articles were identified for possible examination. Following the review of the abstracts for relevance, eight articles were reviewed in detail (see Appendix B).

The discussion of competencies in the literature reflects a range from useful to insufficient. As reflected by the limited number of articles included in the review, this search revealed a significant gap in the literature regarding nurse leader informatics competencies. Three articles identified nursing informatics competencies based on role (novice to expert: early career, leader, specialist, innovator). However, the search revealed only one validated competency instrument: The Nursing Informatics Competency Assessment for the Nurse Leader (NICA-NL) (Yen et al., 2017).

The NICA-NL tool is the byproduct of a multiyear study that assessed core informatics competencies relevant to the nursing leader (Collins et al., 2017). The assessment instrument contains 26 items categorized into six groupings (see Appendix C):

- 1) Strategic implementation management (10 items)
- 2) Advanced information management and education (5 items)
- 3) Executive planning (4 items)
- 4) Ethical and legal concepts (2 items)
- 5) Information systems concepts (3 items)
- 6) Requirements and system selection (2 items) (Yen, Phillips, Kennedy, & Collins, 2017, p.273)

The instrument creators used expert input (consensus-building multivariate voting, industry expert instrument use via a survey) and psychometric evaluation through exploratory factor analysis (parallel analysis, Eigenvalues-greater-than-one, and model fit) to narrow the available competencies (74) to the final six-factor 26 item instrument. Reliability testing revealed a high degree of internal consistency for all six factors (Cronbach's  $\alpha$  0.81-0.96). The tool has been further evaluated for use in Canada, with minor alterations to align with the Canadian practice standards (Strudwick, 2019b).

### **Methods**

The focus of this project was to conduct a baseline assessment of nurse leaders' perceptions of their role-relevant nursing informatics competencies. The following questions guided this work:

- Do nurse leaders feel confident in their knowledge of nurse-leader role-relevant informatics competencies (as defined by the NICA-NL instrument)?
- Is there a relationship between a nurse leader's role and self-reported informatics competencies?

- Is there a relationship between nursing educational preparation and self-reported informatics competencies of nurse leaders?
- Is there a relationship between informatics education and self-reported informatics competency?

Nursing leadership was defined, for this project, as an employed, Registered Nurse who has operational, financial, and resource (e.g., human, equipment, process) management responsibility for an established business unit (e.g., nursing unit, office clinic practice, clinical service line).

### **Human Subject Protection**

The Chief Nursing Officers (CNO) of the organization endorsed this study. The University of Kansas and the study site Internal Review Boards (IRB) deemed this study as a quality improvement project. Surveys were distributed using the Research Electronic Data Capture (REDCap) tool, a secure, web-based research data collection platform (Institute of Translational Health Sciences, n.d.). Responses were deidentified during the analysis process, and only the project director had access to the identifiable information. The project results were and remain confidential.

### **Setting and Sample**

This project was implemented at a three-hospital academic health system in the Pacific Northwest using a convenience sample of 90 nurse leaders. The target audience included employed registered nurse leaders in the role of the nurse manager, program manager, assistant director, director, senior director, or executive. Due to the complexity of the organizational structure and unique business units, additional roles were invited to participate based on their

leadership responsibilities (e.g., trauma program educator). The nurse leaders' names and email addresses were obtained from an internally published patient care services leadership directory.

### **Survey Design**

This project utilized a cross-sectional survey methodology. The survey consisted of eight demographic questions chosen by the project director (age, highest licensure, nursing education, professional position, years in current position, total years of leadership experience, total years of nursing experience, and receipt of nursing informatics education) and the validated 26-item NICA-NL instrument. Due to the high degree of variability in informatics training within nursing programs (Fulton, Meek, & Walker, 2014; Vottero, 2017), the demographic questions provide both role and educational context within which to evaluate the instrument responses. The results of this contextual analysis will inform the development of future educational offerings. A standardized REDCap importable file, provided by the instrument authors, was used to import the assessment questions into the survey platform. This file eliminated the need for manual data entry and decreased the risk of inadvertent edits of the assessment instrument.

### **Participant Enrollment**

Nurse leaders were invited to participate in the project during nursing leadership meetings as well as through email (electronic mail) communication and the distribution of a project related flyer (Appendix D). Following IRB approval, the CNOs sent an informational email, including the project flyer, to members of their leadership teams, encouraging their participation. The project site's instance of REDCap served as the enrollment platform for study participants. Each enrollee was assigned a respondent identification (ID) number. The respondent IDs were stored in a secure data file within the study site's instance of the REDCap platform. The participant identification data was only accessible by the project director.

Subsequently, an invitation to participate in the survey was generated using the REDCap platform. The invitation was sent to the nursing leaders' work email addresses. The email (Appendix E) contained an electronic hyperlink to complete the NICA-NL tool via the study site's instance of REDCap. The REDCap generated an invitation message detailed for the participants that completion of the survey conveyed consent. Survey participants were allowed to end their participation at any time before completing the survey. The survey, including all demographic and survey related questions, can be found in Appendix F. The survey remained open for two weeks. A reminder email was sent one week and 48 hours before the close of the survey.

### **Data Analysis**

Data analysis was completed using the Statistical Package for Social Sciences (SPSS) version 26.0. Statistical analysis was completed by the study site clinical data analyst. The de-identified data was stored on a secure server at the study site. Descriptive statistics were generated from the response data. Correlations between the item level responses and respondent demographic data were determined using the Clopper-Pearson (exact) method. Upper and lower confidence intervals and relative standard error (RSE) were calculated. The respondent sample sizes were reported for each response. The survey documentation was reviewed for missing value coding and skip patterns. The proper denominator was defined for each survey item. Additionally, the questions were checked for consistency in measurement and language within the survey, including skip patterns.

### **Results**

This project aimed to assess the informatics competency of nurse leaders within a 3-hospital academic health system. The inquiry was completed using the NICA-NL tool, which

consists of 26 informatics competencies relevant to the professional practice of the nurse leader. The leaders provided their self-assessment on each item using a 5-point Likert scale, with 0 being "not competent" to five being "very competent." Each survey item included the option to select "do not understand" in the event the question was unclear, or the subject matter was unfamiliar to the respondent. Responses of 1, 2, or 3 represent limited competency. Additionally, responses of "do not understand" were assigned a value of null and classified as low competence for data analysis.

### Respondent Demographics

Of the 90 invited participants, 24 surveys were returned (26.7%). The median age of the respondents was 45.50 (SD = 10.5). The median total years in their current position was 3.0 (SD = 6.56). However, their median total years of leadership experience were 12.0 (SD = 9.70). The majority of respondents (n = 15, 62.5%) held the position of nurse manager. The remaining respondents held various senior leadership positions (n = 9, 37.5%). Nineteen respondents (79.17%) reported having a master's or terminal degrees (Table 2).

Table 2

#### *Respondent Demographics*

N=24	
Education, n (%)	Professional Position
Diploma 1 (4.2%)	Clinical Supervisor 0 (0%)
AD 3 (12.5%)	Clinical Nurse Specialist 0 (0%)
BS, Non-Nursing 3 (12.5%)	Assistant Nurse Manager 0 (0%)
BSN 17 (70.8%)	Nurse Manager 15 (62.5%)
MS or MSN 11 (45.8%)	Assistant Director 1 (4.2%)
MBA 0 (0%)	Director 2 (8.3%)
MPH 2 (8.3%)	Senior Director 1 (4.2%)
Masters, Other 4 (16.7%)	Chief Nursing Officer 3 (12.5%)
DNP 0 (0%)	Other 2 (8.3%)
PhD 2 (8.3%)	

	Range	Mean ( <i>M</i> )	Median ( <i>Md</i> )	Standard Deviation ( <i>SD</i> )
Age	30-66	46.75	45.5	10.50
Years in Current Position	0.5-30	5.35	3.0	6.56
Total Years of Leadership Experience	3-40	14.06	12.00	9.70
Total Years of RN Experience	8-44	21.65	20.00	9.89

The majority of respondents reported obtaining informatics instruction through on-the-job training ( $n = 15, 62.5\%$ ) and in-service education ( $n = 10, 41.7\%$ ). Twenty-eight percent ( $n = 5$ ) reported having received informatics education within their academic nursing program. Twenty-five percent ( $n = 6$ ) indicated having received no informatics education. Fifty-four percent ( $n = 13$ ) of the respondents reported having received informatics training or education through two or more venues (Appendix G).

### Survey Results Overall

Responses were received on all 26 items, including four where the respondents selected "do not understand" (See Appendix H). Combined median scores by factor category are reported in Table 3. The respondents rated themselves highest on ethical and legal concepts (Median score 4.0 on both questions) followed by strategic implementation management (Median 3.55), and requirements and system selection (Median 3.25). Respondents reported limited competencies in two factors – information systems concepts (Median 2.67) and executive planning (Median 2.13) (Appendix I, item-level median scores).

Table 3

#### *Aggregate Median Score by Factor Grouping*

Factor	Median Score
--------	--------------

Executive Planning	2.13
Information Systems Concepts	2.67
Advanced Information Management and Education	3.00
Requirements and System Selection	3.25
Strategic Implementation Management	3.55
Ethical and Legal Concepts	4.00

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### **Responses by Nursing Informatics Education**

Seventy-five percent (n = 18) of the survey participants reported having attended some form of nursing informatics education. Those who reported having attended two types (venues) of nursing informatics education had higher median competency scores (Appendix J). However, those who attended more than two venues had overall lower median scores; most notably, they scored the lowest on the ability to define the total cost of ownership containment strategies and hidden costs of HIT implementation. Respondents who reported having had informatic concepts integrated within their nursing education reported the highest levels of competence, followed closely by those who had received in-service education. Conversely, those who had no informatics education reported low median scores in all but three competencies (Appendix K).

### **Responses by Professional Position**

The Senior Director respondent demonstrated the highest degree of self-reported competence. Their responses reflected median scores of 4 on all questions except understanding the methods of IT education (Median 3) and the ability to standardize the nursing process and automate workflow related to HIT (null) (Appendix L). The Assistant Chief Nursing Officer and Assistant Director respondents demonstrated a high degree of self-reported competence but with

more variability between item responses (Median scores ranging from 2-5). The Chief Nursing Officers reported low to moderate competencies (Median 2-4), while the remaining positions demonstrated a lower level of perceived competence overall.

### **Responses by Years of Experience**

Survey participants were asked to provide their total years of nursing experience, their total years of leadership experience, as well as their total years in their current role. Median scores for each item were evaluated for possible relationships between experience and their reported competency.

#### **Total Years of Nursing Experience**

The respondents were grouped into four cohorts based on their total years of nursing experience: 5-10 years, 10-15 years, 15-20 years, and greater than 20 years (Appendix L). A small negative correlation was observed in four areas: 1) searching information retrieval systems ( $r = -.29$ ), 2) conceptual understanding of data quality ( $r = -.30$ ), 3) the ability to conceptually understand how to define, design, and implement solutions to achieve overarching workflows, and ( $r = -.23$ ) 4) the ability to standardize nursing process and automate workflow related to HIT ( $r = -.25$ ) (Appendix M).

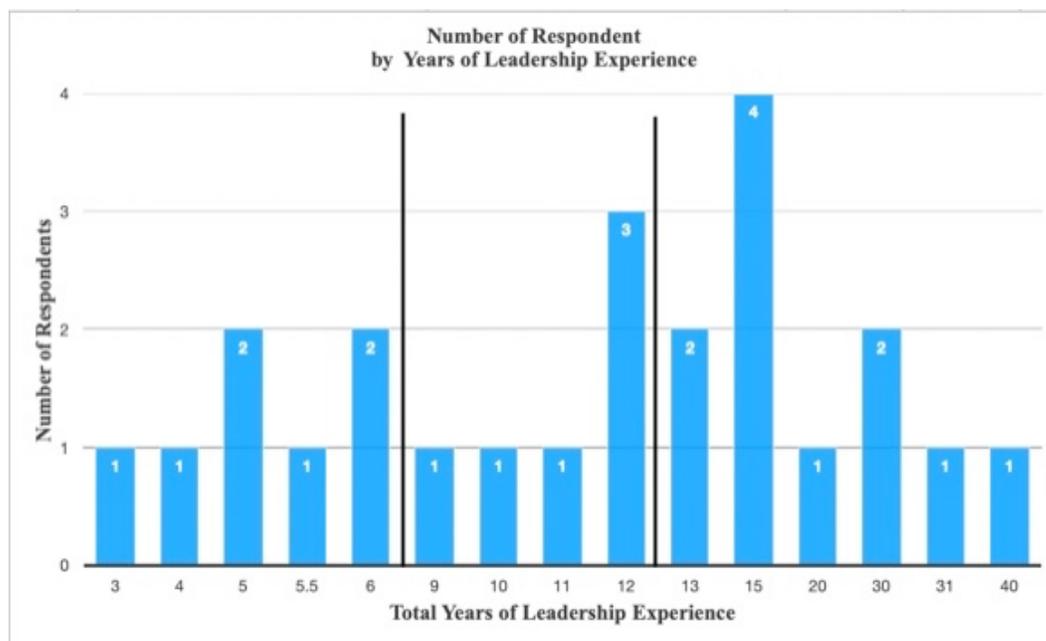
#### **Total Years of Leadership Experience**

The respondents were then grouped into three cohorts based on the distribution of their total years of leadership experience: 0-6 years, 6-12 years, and greater than 12 years (Table 4). Overall a small to moderate correlation ( $r > .20$  and  $< .50$ ) was found between the years of leadership experience and their perceived competence. The strongest correlation with years of leadership experience was related to the ability to champion nursing data in non-nursing

dominated HIT discussions ( $r = .45$ ) and the ability to understand HIT workarounds and consequences ( $r = .44$ ) (Appendix N).

Table 4

*Number of Respondents Grouped by Total Years of Leadership Experience*



### **Total Years of Experience in Current Position**

Next, the respondents were grouped based on their total years of experience in their current role: 0-3 years ( $n = 13$ ) and greater than three years ( $n = 11$ ). A small positive correlation was found between the respondents' total years of experience in their current role and their perceived competence on the majority of items (14 of 26, 53.85%). The strongest correlation was observed in their ability to function in a strategic capacity ( $r = .34$ ), champion the collection and analysis of nursing data in non-nursing dominated discussions ( $r = .25$ ), as well as to understand HIT workarounds and their consequences ( $r = .26$ ). However, a small negative correlation was found in their ability to define the total cost ownership containment strategies and hidden costs of HIT implementation ( $r = -.29$ ) (see Appendix N).

## Responses by Cohort

Finally, the survey participants were grouped into two cohorts – nurse managers (n = 15, 62.5%) and all other senior leaders (n = 9, 37.5%). The two groups were assessed for differences in median scores for each item. There was no difference in scores between the two groups for 14 of the 26 items (53.85%). The Other Senior Leaders scored higher than the nurse managers on 9 of the remaining items (34.62%). Of those nine items, there was a statistically significant difference in the median score for the Other Senior Leaders (Md 2) and nurse managers (Md 1) regarding their ability to define the total cost of ownership containment strategies and hidden costs of HIT implementation (p 0.005). Though the difference is statistically significant, both groups reported low scores (Md 3 or less) on all items within the executive planning category. The Nurse Managers reported higher median scores as compared to the Other Senior Leaders on three items: 1) ability to manage the impact of change due to the HIT implementation, 2) understanding of methods for evaluation of HIT implementation and use, and 3) ability to standardize nursing process and automate workflow related to HIT. However, their scores demonstrate lower levels of competency (Md  $\leq$  3) in all areas except the ability to manage the impact of change due to HIT implementation (See Appendix O).

## Discussion

This inquiry revealed there is little empirical data within the published literature regarding the current state of nurse leader informatics competencies. However, the descriptive literature reflects a high degree of variability in nurse leader informatics preparation and competency (Jensen, Casteli, Kobayashi, & Leite, 2015; Simpson, 2013; Huston, 2008; and Strudwick et al., 2019a). Nurse leaders with limited informatics knowledge may not be adequately skilled to actively participate in meaningful technology and workflow decisions

(Hussey & Kennedy, 2016), potentially sidelining them when critical organizational decisions are made.

Despite the nearly ubiquitous use of information technology within healthcare, the nurse leaders in this study report significant gaps in their perceived informatics competencies. Overall, the respondents identified the following as their least competent areas (aggregate median score of 2.5 or less):

- Functioning in a strategic capacity for HIT selection
- Defining (in collaboration with the IT department) the Total Cost of Ownership of HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements, and physical plant changes)
- Championing the collection, analysis, and trending of nursing data in non-nursing dominated discussions
- Defining and designing systems to support nursing workflow redesign to improve patient care delivery

This project also revealed a median score of three or less for 12 additional items, spanning five of the six-factor categories. These results reflect a general lack of nurse leaders' confidence in their knowledge of role-relevant informatics competencies.

A contributing factor to low self-perception of informatics competency is the variability in informatics education for nurses and nurse leaders. This may, in part, be due to a lack of understanding by nurses and nurse educators regarding the role of nursing informatics in contemporary healthcare delivery (Strudwick et al., 2019a). Despite the requirements for informatics competency integration within nursing training (AACN, 2006; AACN, 2008; AACN, 2011; Monsen et al., 2019), inconsistencies in program design and content delivery

persist. These inconsistencies include a lack of understanding of informatics competencies in the context of curriculum design, the ever-present challenge of curriculum compression (i.e., managing growing content needs within available credit hours), the integration of competencies within other content to the point that it is no longer identifiable, and the lack of informatics trained faculty (Fulton, Meek, & Walker, 2014; Vottero, 2017). The results of this project are not surprising, considering the inconsistencies in nursing education and the probability that some participants in this survey completed their academic training prior to the implementation of the current curriculum guidelines.

The sample size for this project was small and from a single health system, which limits the generalizability of the findings to other organizations. However, there was a notable difference between those who reported having received informatics education during nursing training and those who either had no formal informatics education or received informatics training in a non-academic setting. A related finding was the negative correlation between years of experience and critical informatics competencies. Both of these findings may reflect the impact of the nursing education curriculum changes over time (AACN, 2006; AACN 2008; AACN, 2011). These findings warrant further investigation but offer some confirmation of the value of informatics education integrated within formal nursing programs.

The application of a standardized assessment tool (NICA-NL) within this population offered insights into both the needed content (topical areas) and potential educational cohorts. The data reflect that early management careerists (e.g., nurse managers) would benefit from informatics training couched within their leadership responsibilities. Their results reflect comfort with the use of technology within the practice of nursing. However, the data reflected significant gaps in their strategic skills such as executive planning, systems requirements and

design, as well as the critical leadership roles of championing the needs of nursing, standardizing workflows, and managing change. Additionally, those who reported being in their leadership roles between six and twelve years demonstrated the greatest need for legal and ethical concepts, executive planning, and general HIT system management. Finally, though there was a material difference in the perceived competence based on role, with the nurse managers having the lowest median scores, all respondents demonstrated generally low median scores. These findings highlight the significant professional knowledge gap for practicing nurse leaders and underscores the need for continued education.

Unfortunately, due to the many demands on nursing leaders, seeking formal informatics education may not be a feasible solution for bridging the competency gap identified in this study. Thus, creative solutions focused on narrowing this knowledge gap are needed. The findings of this study support the value of in-service education as a viable means of increasing self-perceived competency. The study site is scheduled to implement a new EHR within the next six months. All nurse managers will be required to attend EHR training. Consistent with socio-technical systems theory, the insights gained from this project support the need for both role-based (role identity) and informatics competency training that fosters their leadership role development (value, meaning). Additional nurse manager curriculum topics include such things as the use of data in the management of care (e.g., dashboard, reporting), cognitive disruption and patient safety (e.g., impact of implementation on clinical environment, cognitive load changes due to new EHR), ongoing participation in system evaluation and use (e.g., informatics professional practice council, system evaluation, and change management), leading through change, and the impact of standardization on system design and clinical care.

Additionally, these findings will inform the development of a nursing leadership informatics academy. The academy will allow for a deeper exploration of critical and evolving informatics competencies that impact the practice of nursing and nursing leadership. The content modules align with the core competencies identified in the NICA-NL assessment tool:

- Ethical and legal concepts
- Executive Planning
- Advanced Information Management and Education
- System Requirements and Selection
- Strategic Implementation Management
- Information Systems Concepts

Each topic area will include a series of learning opportunities using a variety of delivery mechanisms (in-person, online, individual, group). The academy will also include experiential learning opportunities with a focus on industry partnership opportunities (e.g., partnership with a technology company to understand the role of cloud computing and predictive modeling in healthcare). The academy structure fosters entry at any point in the curriculum. The dynamic content will allow the user to engage with the material in a manner that promotes learning, is immediately applicable, and encourages further exploration.

### **Conclusion**

Nurses are uniquely positioned to influence healthcare decision making within and outside of traditional healthcare organizations. Concurrently, technology advancements are occurring at a rapid rate and have materially changed how and where care is delivered. Contemporary nurse leaders must have the requisite informatics competencies to not only effectively use technology within the workplace, but to lead the evaluation and selection of

clinical tools. Though significant gaps exist in the nurse leaders' informatics knowledge, these gaps can be bridged through engaging, relevant educational offerings.

These survey results set the stage for the development of tailored nurse leader education to fill the academic-practice gap. This project affirms the need for informatics skill-building within the nurse leader community of an academic medical system. The results will guide the development of learning opportunities designed to arm nurse leaders with the requisite informatics knowledge necessary to lead confidently within a dynamic healthcare environment and remain abreast of the ever-changing technology landscape. Though this project offers insights for the study site, further inquiry on a larger scale is warranted. If the findings of such an inquiry remain consistent among organizations, a national strategy for bridging the academic-practice gap for nursing leaders is warranted.

In conclusion, this clinical quality improvement project measured the baseline informatics competency of nurse leaders using the sole available validated instrument for measuring nurse leader informatics competencies. The survey participants reported a general lack of informatics competency, and a slight negative correlation was found between the total years of nursing experience and self-reported informatics competency. Respondents who had formal informatics training demonstrated higher levels of competence on the 26-item instrument. However, in-service education was demonstrated as a viable option to assist in bridging the knowledge gap. A lack of informatics knowledge limits the nurse leader's ability to be a full partner in clinical and business decision making. However, this deficit can be remedied with competency-based educational content designed especially for the nurse leader.

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## Appendix A

### Comparison of Essential Nurse Leader Competencies and Nursing Informatics Competencies of Nurse Leaders

<b>Essential Nurse Leader Competencies for 2020</b>	<b>Informatics Competencies for Nurse Leaders</b>
A global perspective or mindset regarding healthcare and professional nursing issues	Use technology to support the improvement of clinical and financial performance
Technology skills which facilitate mobility and portability of relationships, interactions, and operational processes	Collaborate to prioritize for the establishment of information technology resources
Expert decision-making skills rooted in empirical science	Participate in the evaluation of enabling technology in practice settings
The ability to create organizational cultures that permeate quality healthcare and patient/worker safety	Use data management systems for decision making
Understanding and appropriately intervening in political processes	Identify technological trends, issues, and new developments as they apply to patient care
Highly developed collaborative and team-building skills	Demonstrate skills in assessing data integrity and quality
The ability to balance authenticity and performance expectations	Provide leadership for the adoption and implementation of information systems
Being able to envision and proactively adapt to a healthcare system characterized by rapid change and chaos	Actively challenge boundaries within, across and outside the traditional care setting, to enable personalized, coordinated, and connected healthcare
	Foster nursing practice that maintains client advocacy in connected healthcare and empowers clients to effectively use the tools of connected health for supported self-management to achieve desired health outcomes
	Identify data sources and data types that inform data-driven clinical decisions that leverage clinical intelligence and practice-based evidence
	Demonstrate the ability to identify, filter, and use the information to support strategic organizational and profession-specific decision making

	Balance the use of technology with the humanistic perspective of nursing practice
	Demonstrate effective change management skills to resolve resistance to change and further support digital enablement and clinical practice alike

Note. Comparison of nurse leader competencies identified in *Preparing Nurse Leaders for 2020* (Houston, 2008) and the informatics competencies identified in *Nurse Leadership and Informatics Competencies: Shaping Transformation of Professional Practice* (Kennedy & Moen, 2017).

## Appendix B

### Literature Review Matrix

Article	Methods/Design	Informatics Competency Categories	Validated Competency Assessment Tool
<p>Towards the TIGER international framework for recommendations of core competencies in health informatics 2.0: Extending the scope and the roles</p> <p>(Hübner et al., 2019)</p>	<p>Descriptive</p>	<p>Competencies grouped by role Specified for the executive (clinical and administrative)</p> <p>Leadership</p> <p>Communication</p> <p>Quality &amp; safety management</p> <p>Information and knowledge management</p> <p>Strategic management</p> <p>Principles of management</p> <p>Legal issues in health information technology (IT)</p> <p>Process management</p> <p>Change and stakeholder management</p> <p>Ethics in health IT</p> <p>Resource planning &amp; management</p>	<p>No</p>
<p>Competencies related to informatics and information management for proacting nurses and nurse leaders in Brazil and South America</p> <p>(Barbosa, 2017)</p>	<p>Discussion</p>	<p>Referenced competencies published by others as integral to general nursing practice, thus nursing leadership</p> <p>Classified according to the level of practice:</p> <ul style="list-style-type: none"> <li>- Novice</li> <li>- Expert</li> <li>- Specialist</li> </ul> <p>Innovator</p>	<p>No</p>

<p>Nurse leadership and informatics competencies: Shaping transformation of professional practice (Kennedy &amp; Moen, 2017)</p>	<p>Descriptive</p>	<p>Technology use</p> <p>Technology adoption and implementation</p> <p>Technology evaluation</p> <p>Technology trend identification</p> <p>Data management in decision making</p> <p>Data integrity and quality</p> <p>Resource prioritization</p> <p>Change management skills</p> <p>Connected healthcare</p> <p>Practice that foster client advocacy</p> <p>Technology-human interaction balance</p> <p>Information management and use in strategic decision making</p>	<p>No</p>
<p>International evolution of TIGER informatics competencies</p> <p>(Sensmeier, Anderson, &amp; Shaw, 2017)</p>	<p>Descriptive</p>	<p>Basic computer competencies</p> <p>Information literacy</p> <p>Information management (including use of EHR)</p>	<p>No</p>
<p>Nursing informatics competency assessment for the nurse leader: Instrument refinement, validation, and psychometric analysis</p> <p>(Yen et al., 2017)</p>	<p>Item reduction and psychometric analysis</p>	<p>1) Strategic implementation</p> <p>2) Advanced information management</p> <p>3) Executive planning</p> <p>4) Ethical and legal concepts</p> <p>5) Information systems concepts</p> <p>6) Requirements and system selection</p>	<p>Yes</p>
<p>Towards an international framework</p>	<p>Descriptive</p>	<p>Competencies grouped by role</p>	<p>No</p>

<p>for recommendations of core competencies in nursing and inter-professional informatics: The TIGER competency synthesis project</p> <p>(Hübner et al., 2016)</p>		<p>Specified for nursing management</p> <p>Nursing documentation</p> <p>Principles of management</p> <p>Strategic management and leadership</p> <p>Quality management</p> <p>Human resource management</p> <p>Change management and stakeholder management</p>	
<p>Instantiating informatics in nursing practice for integrated patient-centered holistic models of care: a discussion paper</p> <p>(Hussey &amp; Kennedy, 2015)</p>	<p>Discussion paper</p>	<p>Empowering and engaging people: development of communities of practice</p> <p>Strengthening governance and accountability: adoption of new roles; emerging legislative and governance frameworks</p> <p>Reorientation of models of care and care co-ordination: standardize concepts and terms for care transition</p> <p>Creating an enabling environment: Training and education strategies to support transition and change (e.g., The Tiger Initiative)</p>	<p>No</p>
<p>Informatics competencies for nursing management</p> <p>(Jensen, Casteli, Kobayashi, &amp; Leite, 2015)</p>	<p>Scoping review</p>	<p>Basic computer competencies</p> <p>Information literacy</p> <p>Information Management</p>	<p>No</p>

## Appendix C

### Nursing Informatics Competency Assessment - Nurse Leader (NICA-NL)

#### **Factors:**

1. Strategic Implementation Management
2. Advanced Information Management and Education
3. Executive Planning
4. Ethical and Legal Concepts
5. Information Systems Concepts
6. Requirements and System Selection

#### **Factors and Items:**

Item	Factor	Item Description
1	Ethical and Legal Concepts	Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT
2	Ethical and Legal Concepts	Understanding of patients' rights related to HIT and computerized patient data
3	Executive Planning	Ability to function in a strategic capacity for HIT and not at a functional or recommender role
4	Executive Planning	Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians
5	Executive Planning	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs on HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements and physical plant changes)
6	Executive Planning	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover
7	Advanced Information Management and Education	Searching information retrieval systems
8	Advanced Information Management and Education	Conceptual understanding of data quality issues for HIT
9	Advanced Information Management and Education	Avoidance of potential negative impacts of HIT
10	Advanced Information Management and Education	Ability to understand technological trends, issues and new HIT developments as they apply to nursing

Item	Factor	Item Description
11	Advanced Information Management and Education	Understanding of methods for HIT education
12	Requirements and System Selection	Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation
13	Requirements and System Selection	Ability to integrate patient care processes and nursing administrative functions in HIT system requirements
14	Strategic Implementation Management	A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information
15	Strategic Implementation Management	The ability to understand regulations and transitions in policies as they relate to HIT
16	Strategic Implementation Management	Conceptual understanding of the importance of integrating nursing data elements in HIT systems
17	Strategic Implementation Management	Communicating a system and nursing vision about the benefits of HIT
18	Strategic Implementation Management	Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions
19	Strategic Implementation Management	Ability to manage the impact of change due to HIT implementation
20	Strategic Implementation Management	Recognition of value of clinicians' involvement in all appropriate phases of HIT
21	Strategic Implementation Management	Change management for HIT
22	Strategic Implementation Management	Ability to evaluate, contribute and revise project scope, objectives, and resources
23	Strategic Implementation Management	Understanding of methods for evaluation of HIT implementation and use
24	Information Systems Concepts	Ability to understand HIT 'workarounds' and the consequences of Human-computer interface interactions
25	Information Systems Concepts	Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows
26	Information Systems Concepts	Ability to standardize nursing process and automate workflow related to HIT

## Appendix D

### Study Information Flyer

IRB: QA/QI waiver [UW & KUMC] | Date approved: 12/30/2019

## Are you a nursing leader?

All UW nurse leaders are invited to participate in a survey to assess their comfort with nursing informatic skills needed for their role.

### Survey to assess nursing leader's self-perception of role-specific informatics competencies.

#### Aim

The objective of this project is to assess the self-reported level of informatics competency of nurse leaders.

The results of this study will be used to foster collaboration and inform the development of informatics focused nurse leader education materials.

#### Situation & Background

The proliferation of healthcare technology has fundamentally changed the manner and locations of care delivery. Concurrently, the role of the nurse leader has expanded to include strategic and operational responsibilities such as health information technology adoption, clinical outcomes improvement, and care delivery innovation.

Many practicing nurse leaders have expressed frustration with the role technology plays in their practice and that they feel ill equipped to meet the changing technology demands within their practice setting. Opportunities to participate in informatics education have been limited and variable, leaving some leaders with gaps in their knowledge.

#### Significance to Practice

Nursing leaders are uniquely positioned foster the adoption of enabling technology and leverage those capabilities to transform the delivery of care, improve patient outcomes, and enhance staff satisfaction.

To do so, nurse leaders need to be skilled in essential leadership capabilities including the application of informatics principles in their daily practice:

- Strategic implementation management
- Information management and education
- Ethical & legal concepts
- Executive planning
- Information systems concepts
- Requirements & system selection

#### How can you participate?

You can participate by completing the on-line, confidential survey sent to your UW medicine email account.

The email will provide further information about your participation and a link to the REDCap survey.

The invitation to participate will be from the principal investigator's email account: [krescosummers@kumc.edu](mailto:krescosummers@kumc.edu).

#### Principal Investigator

Kelly Resco-Summers, MS, Madm, BSN, RN | Doctor of Nursing Practice Student  
University of Kansas  
[krescosummers@kumc.edu](mailto:krescosummers@kumc.edu)  
602-312-3662

## Appendix E

### Study Information Electronic Mail Memo

My name is Kelly Resco-Summers, and I am a Doctor of Nursing Practice (DNP) student at the University of Kansas School of Nursing studying Informatics Leadership. My scholarly project is to assess practicing nurse leaders' self-perception of their informatics competencies.

I am inviting you, as a nurse leader, to participate in a confidential online survey using the Nursing Informatics Competency Assessment for the Nurse Leader (NICA-NL). The aim of this project is to assess your knowledge of informatics skills as it relates to your daily practice as a nurse leader. This information will inform future education offerings for nurse leaders.

The self-assessment is available via an online questionnaire that addresses 26 informatics competencies. The assessment will take approximately 15 minutes to complete. You may change your mind about participating in the study at any time and stop the survey. There is no penalty for stopping the survey early. There may be no direct benefit from participating in this study. There is no cost or payment associated with participation in this survey other than your time. Your answers will be kept confidential and secure.

Dr. E. LaVerne Manos, my project chair, will be assisting me with this project. We consider the completion of the demographics (age, gender, race, etc.) and survey questions as consent to participate in the project.

Only aggregate (combined) data will be included when disseminating the findings of this study. Dissemination may be in the form of public presentations, publications, or other professional communication media.

If you have questions you may contact us at the following e-mail address:

Kelly Resco-Summers, MS MAdm, BSN, RN  
DNP Student  
KUMC School of Nursing  
krescosummers@kumc.edu

LaVerne Manos DNP RN-BC FAMIA  
Clinical Associate Professor  
KU School of Nursing  
lmanos@kumc.edu

<Link to the online questionnaire>

## Appendix F

### Nursing Informatics Competency Assessment Survey Instrument

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Page 1

#### Nurse Leader Informatics Competency Assessment

Nursing Informatics Competency Assessment for Nurse Leaders (NICA-NL ©)

Directions for completion:

The questionnaire will take approximately 10-15 minutes to complete.

The questionnaire asks you to self-rank your current level of competency on a scale of 0 to 5, where 0 = Not Competent and 5 = Very Competent for a series of items. You may also answer "Don't Understand" for any item.

Thank you!

#### Demographic Information

Age \_\_\_\_\_

Highest Licensure

- Registered Nurse  
 Registered Advanced Nurse Practitioner

Education (check all that apply)

- Nursing Diploma  
 Associate Degree (AD/AS)  
 Baccalaureate Degree (BS/BA), non-nursing  
 Bachelor of Nursing (BSN)  
 Master of Nursing (MS or MSN)  
 Master of Business (MBA)  
 Master of Public Health (MPH)  
 Master, Other  
 Doctor of Nursing Practice (DN)  
 Doctor of Philosophy (PhD)

Professional Position

- Clinical Nurse Supervisor  
 Clinical Nurse Specialist  
 Assistant Nurse Manager  
 Nurse Manager  
 Assistant Director  
 Director  
 Senior Director  
 Chief Nursing Officer  
 Other (please specify)

Other (Specify) \_\_\_\_\_

Years in current position \_\_\_\_\_

Years of leadership experience (total) \_\_\_\_\_

Years of RN working experience (total) \_\_\_\_\_

Nursing informatics education  
(beyond EHR end-user training)

- None
- Self-study
- On-the-job training
- Inservice education
- Vendor sponsored training
- Professional organization training
- Integrated within nursing education (BS, MS, DNP/PHD)
- BS in informatics / bioinformatics (non-nursing)
- Master degree in informatics / bioinformatics (non-nursing)
- Master of Nursing, Informatics
- Doctor of Nursing Practice, Informatics
- Doctoral degree in informatics/bioinformatics (non-nursing)

### Nursing Leadership Competencies

**For each statement, indicate your current level of competency on the scale of 0 to 5, where 0 = Not Competent and 5 = Very Competent. You may also indicate that you do not understand the statement.**

Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to Health Information Technology (HIT)

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

Understanding of patients' rights related to HIT and computerized patient data

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

Ability to function in a strategic capacity for HIT and not at a functional or recommender role

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

Ability to collaborate with Chief Medical Officer peers related to HIT and needs of nurses and physicians

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs on HIT implementation (i.e. education, system maintenance, upgrade support staffing requirements and physical plant changes)

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

### Nursing Leadership Competencies

**For each statement, indicate your current level of competency on the scale of 0 to 5, where 0 = Not Competent and 5 = Expert**

---

Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Searching information retrieval systems

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Conceptual understanding of data quality issues for HIT

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Avoidance of potential negative impacts of HIT

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

### **Nursing Leadership Competencies**

**For each statement, indicate your current level of competency on the scale of 0 to 5, where 0 = Not Competent and 5 = Expert**

Ability to understand technological trends, issues and new HIT developments as they apply to nursing

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Understanding of methods for HIT education

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Ability to integrate patient care processes and nursing administrative functions in HIT system requirements

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

The ability to understand regulations and transitions in policies as they relate to HIT

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Conceptual understanding of the importance of integrating nursing data elements in HIT systems

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

### **Nursing Leadership Competencies**

**For each statement, indicate your current level of competency on the scale of 0 to 5, where 0 = Not Competent and 5 = Expert**

Communicating a system and nursing vision about the benefits of HIT

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Ability to manage the impact of change due to HIT implementation

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Recognition of value of clinicians' involvement in all appropriate phases of HIT

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Change management for HIT

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Ability to evaluate, contribute and revise project scope, objectives, and resources

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

---

Understanding of methods for evaluation of HIT implementation and use

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

### **Nursing Leadership Competencies**

**For each statement, indicate your current level of competency on the scale of 0 to 5, where 0 = Not Competent and 5 = Expert**

Ability to understand HIT 'work arounds' and the consequences of Human - computer interface interactions

0 Not competent    1    2    3    4    5 Very Competent    Don't Understand

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Page 5

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Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows

0 Not competent  1  2  3  4  5 Very Competent  Don't Understand

---

Ability to standardize nursing process and automate workflow related to HIT

0 Not competent  1  2  3  4  5 Very Competent  Don't Understand

**Please provide any feedback on this survey - confusing statements, missing information, or any suggestions.**

Comments

---

## Appendix G

### Respondent Self-reported Informatics Education by Venue and Frequency

<b>Nursing Informatics Education N=24</b>					
<b>Venue</b>	<b>n</b>	<b>(%)</b>	<b># Venues</b>	<b>Frequency</b>	<b>Percent</b>
None	6	25%			
Self-Study	5	20.8%	0	6	25.0%
On-the-job Training	15	62.5%	1	5	20.8%
In-service Education	10	41.7%	2	5	20.8%
Vendor Sponsored Training	4	16.7%	2+	8	33.3%
Professional Organization Training	4	16.7%			
Integrated within Nursing Education	5	20.8%			
BS, Informatics/Bioinformatics	0	0%			
MS, Informatics/Bioinformatics	0	0%			
MS, Nursing Informatics	0	0%			
DNP, Informatics	0	0%			
Doctoral degree informatics/Bioinformatics	0	0%			

## Appendix H

### Item Response Volume by Score

N=24							
n (%)	0	1	2	3	4	5	DNU*
Understand ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT	1 (4.2%)	1 (4.2%)	1 (4.2%)	7 (29.2%)	11 (25.8%)	3 (12.5%)	0 (0%)
Understand patient's rights related to HIT and computerized patient data	1 (4.2%)	1 (4.2%)	3 (12.5%)	4 (16.7%)	10 (41.7%)	5 (20.8%)	0 (0%)
Ability to function in a strategic capacity for HIT, not at a functional/recommender role	2 (8.3%)	4 (16.7%)	7 (29.2%)	5 (20.8%)	3 (12.5%)	1 (4.2%)	2 (8.3%)
Ability to collaborate with CMIO peers related to HIT and needs of nurses and physicians	1 (4.2%)	2 (8.3%)	5 (20.8%)	7 (29.2%)	6 (25%)	2 (8.3%)	1 (4.2%)
Define TCO** containment strategies and hidden costs of HIT implementation	7 (29.2%)	5 (20.8%)	6 (25%)	3 (12.5%)	2 (8.3%)	1 (4.2%)	0 (0%)
Define TCO specifically when it relates to HIT related costs of staff education, and re-education related to upgrades and staff turnover	2 (8.3%)	5 (20.8%)	9 (37.5%)	3 (12.5%)	4 (16.7%)	1 (4.2%)	0 (0%)
Search information retrieval systems	3 (12.5%)	1 (4.2%)	3 (12.5%)	5 (20.8%)	9 (37.5%)	2 (8.3%)	1 (4.2%)
Conceptual understanding of data quality issues for HIT	3 (12.5%)	2 (8.3%)	6 (25%)	6 (25%)	6 (25%)	1 (4.2%)	0 (0%)
Avoidance of potential negative impact of HIT	4 (16.7%)	1 (4.2%)	6 (25%)	8 (33.3%)	4 (16.7%)	1 (4.2%)	0 (0%)
Ability to understand technology trends, issues, and new HIT developments as it applies to nursing	1 (4.2%)	3 (12.5%)	7 (29.2%)	6 (25%)	6 (25%)	1 (4.2%)	0 (0%)

Understanding methods of HIT education	1 (4.2%)	1 (4.2%)	8 (33.3%)	9 (37.5%)	4 (16.7%)	1 (4.2%)	0 (0%)
Ability to assure nursing values/requirements are represented in HIT selection and evaluation	1 (4.2%)	2 (8.3%)	2 (8.3%)	7 (29.2%)	9 (37.5%)	3 (12.5%)	0 (0%)
Ability to integrate patient care processes and nursing administrative functions in HIT systems requirements	1 (4.2%)	2 (8.3%)	2 (8.3%)	6 (25%)	9 (37.5%)	2 (8.3%)	0 (0%)
Conceptual understanding of nursing intervention documentation using HIT, its impact on care delivery, productivity, and secondary use of information	1 (4.2%)	2 (8.3%)	1 (4.2%)	6 (25%)	11 (45.8%)	3 (12.5%)	0 (0%)
Understand regulation and transitions in policies as they relate to HIT	1 (4.2%)	2 (8.3%)	3 (12.5%)	11 (45.8%)	5 (20.8%)	2 (8.3%)	0 (0%)
Conceptual understanding of the importance of integrating nursing data elements in HIT systems	1 (4.2%)	2 (8.3%)	1 (4.2%)	6 (25%)	9 (37.5%)	5 (20.8%)	0 (0%)
Communicating a system and nursing vision about the benefits of HIT	2 (8.3%)	1 (4.2%)	3 (12.5%)	4 (16.7%)	11 (45.8%)	3 (12.5%)	0 (0%)
Ability to champion the collection, analysis, and trending of nursing data in non-nursing dominated HIT discussions	2 (8.3%)	2 (8.3%)	8 (33.3%)	4 (16.7%)	7 (29.2%)	1 (4.2%)	0 (0%)
Ability to manage the impact of change due to HIT implementation	2 (8.3%)	1 (4.2%)	3 (12.5%)	6 (25%)	8 (33.3%)	4 (16.7%)	0 (0%)
Recognition of value of clinicians' involvement in all appropriate phases of HIT	2 (8.3%)	1 (4.2%)	1 (4.2%)	5 (20.8%)	10 (41.7%)	5 (20.8%)	0 (0%)
Change management for HIT	1 (4.2%)	1 (4.2%)	5 (20.8%)	4 (16.7%)	10 (41.7%)	2 (8.3%)	1 (4.2%)

Ability to evaluate, contribute, and revise project scope, objectives, and resources	2 (8.3%)	0 (0%)	3 (12.5%)	11 (45.8%)	6 (25%)	2 (8.3%)	0 (0%)
Understanding of methods for evaluation of HIT implementation and use	2 (8.3%)	3 (12.5%)	5 (20.8%)	8 (33.3%)	5 (20.8%)	1 (4.2%)	0 (0%)
Understand HIT workarounds and consequences of human-computer interface interactions	2 (8.3%)	2 (8.3%)	5 (20.8%)	7 (29.2%)	5 (20.8%)	3 (12.5%)	0 (0%)
Conceptual understanding of how to define, design, and implement HIT solutions to achieve overarching nursing workflows	5 (20.8%)	2 (8.3%)	8 (33.3%)	6 (25%)	2 (8.3%)	1 (4.2%)	0 (0%)
Ability to standardize nursing process and automate workflow related to HIT	3 (12.5%)	1 (4.2%)	7 (29.2%)	7 (29.2%)	4 (16.7%)	1 (4.2%)	0 (0%)

## Appendix I

### Item Level Results (Median Score), Grouped by Factor

Factor	Competency Item	Median Score
<b>Ethical and Legal Concepts</b>	Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT	4.0
	Understanding of patients' rights related to HIT and computerized patient data	4.0
<b>Executive Planning</b>	Ability to function in a strategic capacity for HIT and not at a functional or recommender role	2.0
	Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians	3.0
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs of HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements and physical plant changes)	1.5
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover	2.0
<b>Advanced Information Management and Education</b>	Searching information retrieval systems	3.0
	Conceptual understanding of data quality issues for HIT	3.0
	Avoidance of potential negative impacts of HIT	3.0
	Ability to understand technological trends, issues and new HIT developments as they apply to nursing	3.0
	Understanding of methods for HIT education	3.0
<b>Requirements and System Selection</b>	Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation	3.5
	Ability to integrate patient care processes and nursing administrative functions in HIT system requirements	3.0
<b>Strategic Implementation Management</b>	A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information	4.0
	The ability to understand regulations and transitions in policies as they relate to HIT	3.0
	Conceptual understanding of the importance of integrating nursing data elements in HIT systems	4.0
	Communicating a system and nursing vision about the benefits of HIT	4.0
	Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions	2.5

	Ability to manage the impact of change due to HIT implementation	3.5
	Recognition of value of clinicians' involvement in all appropriate phases of HIT	4.0
	Change management for HIT	4.0
	Ability to evaluate, contribute and revise project scope, objectives, and resources	3.0
	Understanding of methods for evaluation of HIT implementation and use	3.0
<b>Information Systems Concepts</b>	Ability to understand HIT 'workarounds' and the consequences of Human - computer interface interactions	3.0
	Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows	2.0
	Ability to standardize nursing process and automate workflow related to HIT	3.0

### Appendix J

#### Item-level Responses (Median Score) by Number of Nursing Informatics Education Venues

Item	Nursing Informatics Education Venues			
	0	1	2	2+
Q1	3.5	4	4	4
Q2	3.5	3	4	4
Q3	2	2	3	2.5
Q4	2.5	3	3.5	3
Q5	1	2	2	0.5
Q6	2	2	2	2
Q7	3	3	4	3.5
Q8	2.5	2	3	2.5
Q9	2	3	3	2.5
Q10	1.5	3	3	3
Q11	2	2	3	3
Q12	2.5	3	4	4
Q13	3	2	4	4
Q14	3	3	4	4
Q15	3	3	3	3.5
Q16	3	4	4	4
Q17	2.5	4	4	4
Q18	2	2	3	3.5
Q19	2.5	3	4	4
Q20	3	4	4	4
Q21	2	3	4	4
Q22	2	4	3	3
Q23	2	2	3	3
Q24	2	3	3	3.5
Q25	2	2	2	2.5
Q26	2	2	3	3
<b>Aggregate Median</b>	<b>2.38</b>	<b>2.81</b>	<b>3.33</b>	<b>3.25</b>

## Appendix K

## Item-level Results (Median Score) by Nursing Informatics Education Venue

Nursing Informatics Education																											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	
None	4	4	2.5	3	2	2	4	3	3	3	3	4	4	4	3	4	4	3	4	4	4	4	3	3	3	2	3
Yes	3.5	3.5	2	2.5	1	2	3	2.5	2	1.5	2	2.5	3	3	3	3	2.5	2	2.5	3	2	2	2	2	2	2	
Self-study																											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26		
No	4	4	2	3	1	2	3.5	3	3	2	3	3	4	3	4	4	3	4	4	3	4	4	3	3	3	2	2
Yes	3	4	3	3	2	2	3	2	3	3	3	4	4	4	3	4	4	2	3	4	3	4	3	3	3	2	3
On-the-job training																											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26		
No	4	4	2	4	2	2	4	3	3	2	2	3	3	3	3	3	3	2	4	4	3	3	2	2	2	2	2
Yes	4	4	2	3	1	2	3	2	3	3	3	4	4	4	3	4	4	3	3	4	4	3	3	3	3	2	3
Inservice education																											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26		
No	4	4	2	3	2	2	3	2	2.5	2	2	3	3	3	3	3	3	2	3	3.5	3	3	2.5	2	2	2	
Yes	4	4	2	3	1	2	4	3	3	3	3	4	4	4	3	4	4	3.5	4	4	4	3	3	3.5	2.5	3	
Vendor sponsored training																											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26		
No	4	4	2	3	2	2	3	3	3	3	3.5	3	4	3	4	4	2	3	4	3	4	3	3	3	2	3	
Yes	3.5	3.5	3.5	2.5	0.5	3	3.5	2.5	2.5	2.5	2.5	3.5	3.5	4	3	4	4	4	4	4	4	4	3.5	3.5	4	1	
Professional organization training																											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26		
No	4	4	2	3	1.5	2	3	3	3	2.5	3	3	4	3	4	4	2.5	3.5	4	4	3	3	3	3	2	2.5	
Yes	4	4	2	3.5	2	1.5	3.5	2.5	3.5	3	4	4	4	4	4	4.5	4	3	3.5	4.5	3.5	3.5	3.5	3.5	1.5	4	
Integrated within nursing education																											
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26		
No	4	4	2	3	1	2	3	3	3	2	3	3	4	3	4	4	2	3	4	3	4	3	3	3	2	2	
Yes	4	5	2	3	2	2	4	3	3	4	3	4	4	4	3	4	4	3	4	4	4	4	3	3	3	3	

## Appendix L

## Mean and Median Scores by Professional Position

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
<b>Nurse Manager</b>	Mean	3.3	3.3	2.1	2.6	1	2	3	2.1	2	2.4	2.6	3	2.9
	Median	4	4	2	3	1	2	3	2	2	2	3	3	3
<b>Educator Trauma</b>	Mean	2	3	2	2	1	1	3	3	2	2	2	3	3
	Median	2	3	2	2	1	1	3	3	2	2	2	3	3
<b>Assistant Director</b>	Mean	4	5		3	3	4	4	4	3	3	3	4	4
	Median	4	5		3	3	4	4	4	3	3	3	4	4
<b>Director</b>	Mean	4	4	2	2.5	2	2	3	2	2.5	2.5	2	2.5	2.5
	Median	4	4	2	2.5	2	2	3	2	2.5	2.5	2	2.5	2.5
<b>Senior Director</b>	Mean	4	4	4	4	4	4	4	4	4	4	3	4	4
	Median	4	4	4	4	4	4	4	4	4	4	3	4	4
<b>Associate CNO</b>	Mean	4	4	2	4	3	2	5	4	4	4	4	5	4
	Median	4	4	2	4	3	2	5	4	4	4	4	5	4
<b>Chief Nursing Officer</b>	Mean	3.7	3.7	3	4	3	2.7	4	3.3	3.3	3.3	3.3	4	3.7
	Median	3	4	3	4	2	2	4	3	3	3	3	4	4
		Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26
<b>Nurse Manager</b>	Mean	3.2	2.7	3.3	2.9	2	3.1	3	3	2.9	2.5	2.7	1.7	2.3
	Median	4	3	4	4	2	4	4	3.5	3	3	3	2	3
<b>Educator Trauma</b>	Mean	3	3	3	3	2	2	4	2	2	1	1	3	2
	Median	3	3	3	3	2	2	4	2	2	1	1	3	2
<b>Assistant Director</b>	Mean	4	3	4	4	3	3	4	4	3	3	3	3	3
	Median	4	3	4	4	3	3	4	4	3	3	3	3	3
<b>Director</b>	Mean	3	2	3	3.5	2	2	3	2	3	2	2	2	2
	Median	3	2	3	3.5	2	2	3	2	3	2	2	2	2
<b>Senior Director</b>	Mean	4	4	4	4	4	4	4	4	4	4	4	4	
	Median	4	4	4	4	4	4	4	4	4	4	4	4	
<b>Associate CNO</b>	Mean	5	5	5	5	4	5	5	5	4	4	5	2	4
	Median	5	5	5	5	4	5	5	5	4	4	5	2	4
<b>Chief Nursing Officer</b>	Mean	3.7	3.7	4	3.7	4	4	4	4	3.7	3	3.7	2.7	3.3
	Median	4	3	4	4	4	4	4	4	3	2	3	2	3

## Appendix M

### *Item-level Results (Median Score), by Total Years of Nursing Experience*

<b>Item-Level Results</b>		<b>5-10</b>	<b>10-15</b>	<b>15-20</b>	<b>&gt;20</b>	<b>Corr.</b>
<b>Nursing Experience in Years - Median score</b>		<b>Years</b>	<b>Years</b>	<b>Years</b>	<b>Years</b>	<b>Coef.</b>
<b>Ethical and Legal Concepts</b>	Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT	3.00	4.00	4.00	4.00	-0.099
	Understanding of patients' rights related to HIT and computerized patient data	1.00	4.00	4.00	4.00	-0.066
<b>Executive Planning</b>	Ability to function in a strategic capacity for HIT and not at a functional or recommender role	1.00	2.00	2.00	3.00	0.032
	Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians	1.00	4.00	3.00	3.00	-0.098
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs of HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements and physical plant changes)	1.00	1.00	1.50	2.00	-0.191
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover	1.00	2.00	2.00	2.00	0.071
<b>Advanced Information Management and Education</b>	Searching information retrieval systems	3.00	3.00	4.00	3.00	-0.293
	Conceptual understanding of data quality issues for HIT	1.00	3.00	2.50	2.00	-0.304
	Avoidance of potential negative impacts of HIT	1.00	2.00	3.00	3.00	-0.123
	Ability to understand technological trends, issues and new HIT developments as they apply to nursing	1.00	2.50	2.50	3.00	0.087
	Understanding of methods for HIT education	1.00	3.00	3.00	3.00	0.041
<b>Requirements and System Selection</b>	Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation	1.00	3.50	4.00	3.00	-0.006

	Ability to integrate patient care processes and nursing administrative functions in HIT system requirements	1.00	3.00	4.00	4.00	-0.066
<b>Strategic Implementation Management</b>	A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information	1.00	3.50	4.00	4.00	-0.051
	The ability to understand regulations and transitions in policies as they relate to HIT	1.00	3.00	3.00	3.00	-0.078
	Conceptual understanding of the importance of integrating nursing data elements in HIT systems	1.00	3.50	4.00	4.00	0.058
	Communicating a system and nursing vision about the benefits of HIT	1.00	3.50	3.50	4.00	0.034
	Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions	1.00	2.50	2.50	4.00	0.112
	Ability to manage the impact of change due to HIT implementation	1.00	4.00	3.00	4.00	-0.054
	Recognition of value of clinicians' involvement in all appropriate phases of HIT	1.00	4.00	4.00	4.00	-0.005
	Change management for HIT	1.00	4.00	3.50	4.00	-0.016
	Ability to evaluate, contribute and revise project scope, objectives, and resources	3.00	3.00	3.00	4.00	-0.043
	Understanding of methods for evaluation of HIT implementation and use	1.00	2.50	3.00	3.00	0.092
	<b>Information Systems Concepts</b>	Ability to understand HIT 'workarounds' and the consequences of Human - computer interface interactions	1.00	2.50	3.00	4.00
Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows		1.00	2.50	2.00	2.00	-0.227
Ability to standardize nursing process and automate workflow related to HIT		1.00	2.50	3.00	3.00	-0.247

## Appendix N

## Item-level Results (Median Score), by Total Years of Leadership Experience

Item-Level Results		0-6	6-12	>12	Correlation Coefficient
Leader Experience	in Years - Median score				
<b>Ethical and Legal Concepts</b>	Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT	4	3	4	0.277
	Understanding of patients' rights related to HIT and computerized patient data	4	2.5	4	0.239
<b>Executive Planning</b>	Ability to function in a strategic capacity for HIT and not at a functional or recommender role	1.5	1.5	2.5	0.347
	Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians	2.5	2.5	3	0.252
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs of HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements and physical plant changes)	1	1.5	2	0.015
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover	1	2	2	0.252
<b>Advanced Information Management and Education</b>	Searching information retrieval systems	3	2.5	4	0.113
	Conceptual understanding of data quality issues for HIT	3	2	3	0.072
	Avoidance of potential negative impacts of HIT	2	2.5	3	0.204
	Ability to understand technological trends, issues and	2	3	3	0.250

	new HIT developments as they apply to nursing				
	Understanding of methods for HIT education	2	2.5	3	0.261
<b>Requirements and System Selection</b>	Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation	3	3	4	0.331
	Ability to integrate patient care processes and nursing administrative functions in HIT system requirements	3	2.5	4	0.206
<b>Strategic Implementation Management</b>	A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information	3	3	4	0.236
	The ability to understand regulations and transitions in policies as they relate to HIT	3	3	3	0.135
	Conceptual understanding of the importance of integrating nursing data elements in HIT systems	3	3	4	0.320
	Communicating a system and nursing vision about the benefits of HIT	3	3	4	0.390
	Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions	2	2	4	0.447
	Ability to manage the impact of change due to HIT implementation	3	3	4	0.264
	Recognition of value of clinicians' involvement in all appropriate phases of HIT	3	3.5	4	0.273
	Change management for HIT	2.5	3	4	0.228
	Ability to evaluate, contribute and revise project scope, objectives, and resources	3	3	3	0.267

	Understanding of methods for evaluation of HIT implementation and use	1	3	3	0.363
<b>Information Systems Concepts</b>	Ability to understand HIT 'workarounds' and the consequences of Human - computer interface interactions	2	3	4	0.441
	Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows	1	2	2	0.178
	Ability to standardize nursing process and automate workflow related to HIT	2	2.5	3	0.011

## Appendix O

## Item-Level Results (Median Score) by Total Years in Current Position

Item-Level Results Current Position in Years – Median score		0-3 Years	>3 Years	Correlation Coefficient
<b>Ethical and Legal Concepts</b>	Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT	4	4	-0.033
	Understanding of patients' rights related to HIT and computerized patient data	4	4	0.024
<b>Executive Planning</b>	Ability to function in a strategic capacity for HIT and not at a functional or recommender role	2	3	0.337
	Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians	3	3	-0.122
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs of HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements and physical plant changes)	1	2	-0.293
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover	2	2	0.261
<b>Advanced Information Management and Education</b>	Searching information retrieval systems	3	4	-0.033
	Conceptual understanding of data quality issues for HIT	3	3	-0.005
	Avoidance of potential negative impacts of HIT	2	3	0.116
	Ability to understand technological trends, issues and new HIT developments as they apply to nursing	3	3	-0.017
	Understanding of methods for HIT education	3	3	0.198
<b>Requirements and System Selection</b>	Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation	3	4	0.071

	Ability to integrate patient care processes and nursing administrative functions in HIT system requirements	3	4	0.192
<b>Strategic Implementation Management</b>	A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information	3	4	0.156
	The ability to understand regulations and transitions in policies as they relate to HIT	3	3	0.104
	Conceptual understanding of the importance of integrating nursing data elements in HIT systems	4	4	0.079
	Communicating a system and nursing vision about the benefits of HIT	4	4	0.104
	Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions	2	4	0.253
	Ability to manage the impact of change due to HIT implementation	3	4	0.097
	Recognition of value of clinicians' involvement in all appropriate phases of HIT	4	4	0.119
	Change management for HIT	3	4	0.187
	Ability to evaluate, contribute and revise project scope, objectives, and resources	3	3	-0.023
	Understanding of methods for evaluation of HIT implementation and use	2	3	0.241
<b>Information Systems Concepts</b>	Ability to understand HIT 'workarounds' and the consequences of Human - computer interface interactions	3	4	0.261
	Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows	2	2	0.050
	Ability to standardize nursing process and automate workflow related to HIT	2	3	0.089

## Appendix P

### Item-level Results (Median Score) by Professional Role Grouping

		Other Senior Leaders	Nurse Manager	% Diff.	p-Value
<b>Ethical and Legal Concepts</b>	Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT	4	4	0%	0.468
	Understanding of patients' rights related to HIT and computerized patient data	4	4	0%	0.273
<b>Executive Planning</b>	Ability to function in a strategic capacity for HIT and not at a functional or recommender role	2	2	0%	0.356
	Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians	3	3	0%	0.182
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) containment strategies and hidden costs of HIT implementation (i.e., education, system maintenance, upgrade support staffing requirements and physical plant changes)	2	1	-50%	0.005
	Ability to define (in collaboration with the IT department) Total Cost of Ownership (TCO) specifically when it relates to the HIT related cost of staff education, and re-education related to upgrades and staff turnover	2	2	0%	0.349
<b>Advanced Information</b>	Searching information retrieval systems	4	3	-25%	0.047

<b>Management and Education</b>	Conceptual understanding of data quality issues for HIT	3	2	-33%	0.05
	Avoidance of potential negative impacts of HIT	3	2	-33%	0.043
	Ability to understand technological trends, issues and new HIT developments as they apply to nursing	3	2	-33%	0.159
	Understanding of methods for HIT education	3	3	0%	0.534
<b>Requirements and System Selection</b>	Ability to assure that Nursing values/ requirements are represented in HIT selection and evaluation	4	3	-25%	0.192
	Ability to integrate patient care processes and nursing administrative functions in HIT system requirements	4	3	-25%	0.257
<b>Strategic Implementation Management</b>	A conceptual understanding of nursing intervention documentation using HIT, it's impact of care delivery, nursing productivity and secondary use of information	4	4	0%	0.358
	The ability to understand regulations and transitions in policies as they relate to HIT	3	3	0%	0.235
	Conceptual understanding of the importance of integrating nursing data elements in HIT systems	4	4	0%	0.329
	Communicating a system and nursing vision about the benefits of HIT	4	4	0%	0.119
	Ability to champion the collection, analysis and trending of Nursing data in non-nursing dominated HIT discussions	3	2	-33%	0.159
	Ability to manage the impact of change due to HIT implementation	3	4	33%	0.734
	Recognition of value of clinicians' involvement in all appropriate phases of HIT	4	4	0%	0.205
	Change management for HIT	4	3.5	-13%	0.421

	Ability to evaluate, contribute and revise project scope, objectives, and resources	3	3	0%	0.345
	Understanding of methods for evaluation of HIT implementation and use	2	3	50%	0.584
<b>Information Systems Concepts</b>	Ability to understand HIT 'workarounds' and the consequences of Human - computer interface interactions	3	3	0%	0.466
	Ability to conceptually understand how to define, design (create a schematic) and implement a HIT solution to achieve overarching nursing workflows	2	2	0%	0.082
	Ability to standardize nursing process and automate workflow related to HIT	2.5	3	20%	0.279