

Appendix A
Data Extraction Table

Authors and year	Purpose	Research Design	Sample	Instruments and Methodology	Findings	Limitations
Collins, S., Yen, P. Y., Phillips, A., Kennedy, M. (2017)	To identify informatics competencies which are relevant and required from the perspective of nurse leaders	Mixed Methods Environmental scan Delphi Survey method	Delphi method using snowball sampling Round 1: n= 34 Round 2: n= 26 Round 1: n= 41	<ul style="list-style-type: none"> • Environmental scan: <ol style="list-style-type: none"> 1. PubMed and CINAHL for validated competency scales and assessments 2. Google and Google Scholar for related reports and educational resources • Delphi Survey Method <ol style="list-style-type: none"> 1. Survey developed using REDCap software in 3 rounds 2. Survey distributed using snowball sampling method 3. Rounds 1 & 2 were data collection of quantitative and qualitative survey answers. 4. Rounds 2 & 3 included providing anonymized data from previous rounds back to participants 5. Content validity score was calculated to evaluate the relevance rankings assigned by participants and variance analysis was completed using Kruskal-Wallis analysis. 	<ul style="list-style-type: none"> • Identification of job specific informatics competencies continues to be a need in nursing. • Most nurse leaders report the development of informatics competencies is a result of “on-the-job” training. • Delphi study identified 108 competency items which reduced to 74 by the end of the Delphi rounds. These were then mapped to 15 informatics categories. The top 15 competencies were then ranked by the assigned priority. • Identified a shifting focus to new competencies that focus on outcomes, cost and quality • On the job informatics training/education is inadequate to meet the skill development needs of leaders. • Recommendation of the development of a validated self-assessment tool for nurse leaders to identify areas of competency development and support planning for attainment of the required skillset. • HIT knowledge should no longer be delegated to others, but an expected core competency in nursing practice at all levels. 	Possible selection bias given the snowball sampling method as it may have limited respondents to those with an interest or an existing identified need. Unable to report a response rate due to the choice of a snowball sampling method.

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Hartley, L. A. (2014)	To describe the development, implementation and outcomes of a shared governance to advance the informatics competencies of nurses and leaders within an organization	Summary report	Not provided	<ul style="list-style-type: none"> • Creation of a professional development council created which determined the baseline competency requirement for informatics nurses within the organization. • Subsequent creation of a professional practice council that guided continuing education and professional development of nursing informatics competencies across the organization. 	<ul style="list-style-type: none"> • Both councils were part of the shared governance model which provided the Chief Nursing Informatics Officer a framework for shared decision making within informatics practice. • Participation in the councils provided further development of informatics competencies. • Shared governance is an effective model for nursing leadership involved in health care informatics projects as it promotes competency development and supports informatics decision making for leaders 	<p>Not provided</p> <p>Noted that this was a summary article of a shared governance model implemented in a non-patient care environment (Vendor) so there may be reporter bias.</p>
Honey, M., & Westbrooke, L. (2016)	To provide a summary report of the work towards an update health strategy in New Zealand with a focus on the drivers related to nursing informatics and leadership	Summary report	Not applicable	<ul style="list-style-type: none"> • This is a review of the New Zealand Health Strategy. • Background information, context, development process, result and thematic implications for nursing were summarized and presented 	<ul style="list-style-type: none"> • The increasing use of ICTs and drive to incorporate “best use of technology” across the health care sector highlight the need for development of informatics competencies in nurse leaders. • Nurse leaders with informatics competencies will be need at higher levels to inform policy and decision making related to ICT implementation 	<p>No limitations by author identified as this was a summary report of a national health strategy.</p>

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Hussey, P., & Kennedy, M. A. (2015)	To present a discussion on how nursing and nurse leaders can use informatics knowledge and competencies to “instantiate transition into integrated models of care”	Discussion Paper	Not applicable	<ul style="list-style-type: none"> Literature search of PubMed and CINAHL using a purposive sampling method focused on relevance and overall contribution to the discussion topic 	<ul style="list-style-type: none"> Focus was on developing integrated care models with technology and how nursing/nurse leaders are perfectly positioned to provide the holistic perspective. Findings organized into three categories: <ol style="list-style-type: none"> Nursing informatics and engagement in change process <ol style="list-style-type: none"> Identified 5 strategic enablers Identified 3 additional sub-themes of mapping care delivery, data quality and education Instantiating informatics in nursing practice Implications for nursing 	No identified limitations
Hussey, P., Adams, E., & Shaffer, F. A. (2015)	To present an approach to advocate for the development of nursing leader informatics competencies to advance the global eHealth agenda	Discussion Paper	Not applicable	Not applicable	<ul style="list-style-type: none"> Presented a discussion on the use of existing theoretical frameworks to guide the implementation of eHealth initiatives and shape the future model of care. Highlighted the important role of nursing leaders in eHealth initiatives, including the importance of informatics competency development. Argument presented for the prioritization of informatics within strategic nursing leadership roles to progress uptake of “technology-enabled solutions for patient-centered care” 	Not applicable
Kerfoot, K. M. (2015)	To highlight the importance and need for the development of informatics competencies in nursing leaders to allow nursing to become a full participant in the	Executive Summary	Not applicable	Not applicable	<ul style="list-style-type: none"> Identifies the lack of formal training and education in informatics for nursing leaders and calls for continued work to embed informatics into both undergraduate and graduate programs. Argues that the “digital revolution” which has resulted in the integration of technology in every arena of nursing practice now requires all nurses and leaders to develop informatics skills and competencies to ensure 	Not applicable

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	technology-enabled initiatives				<p>“successful selection, development, and competent use of devices and clinical systems”</p> <ul style="list-style-type: none"> • There is a need for clinicians who have developed informatics competencies to support the development of frameworks to drive and interpret HIT analytics. 	
Lloyd, J., Ferguson S. (2017)	<p>To make a case for the inclusion of formal informatics education for nurse leaders.</p> <p>Primary focus is on the use of technology to address workforce planning, policy development & decision-making</p>	Executive Summary	Not applicable	Not applicable	<ul style="list-style-type: none"> • To ensure technology-based systems provide a maximum return on investment requires the employment of qualified nursing informaticists. • Chief Nursing Informatics Officer (CNIO) role can help bridge the gap between clinical practice and IMIT. • Nursing informatics leaders should be prepared/receive education at the graduate level. • Emerging technologies such real-time dashboards, predictive staffing algorithms and “acuity-based staffing tools” are being used now to aid in safe staffing across organizations. 	Not applicable
Phillips, A., Yen, P., Kennedy, M., & Collins, S. (2017)	<p>To provide an overview of one approach to implement the Nursing Informatics Competencies for Nurse Leaders self-assessment</p>	Book chapter	Not applicable	<p>The RE-AIM framework</p> <ul style="list-style-type: none"> • R- Reach • E- Efficacy • A- Adoption • I- Implementation • M- Maintenance 	<ul style="list-style-type: none"> • Incorporating the NIC-NL validated competency self-assessment tool into orientation for nurse leaders can provide a sustainable path to improve informatics competencies over time 	Not reported
Remus, S. (2016)	To apply transformational nursing leadership theory to the	Literature review	Not applicable	<ul style="list-style-type: none"> • Literature review that spanned three years and included peer reviewed and grey, English only literature from 1995 on. 	<ul style="list-style-type: none"> • Transformational leadership (TL) has four dimensions: <ol style="list-style-type: none"> 1. Idealized influence 2. Inspirational motivation 	None identified by authors but the restriction to English only

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	development and adoption of informatics competencies in chief nursing executives			<ul style="list-style-type: none"> Only published works related to digital health setting accountabilities, informatics competency, CNE transformational nurse leaders and EPR implementations 	<ul style="list-style-type: none"> 3. Intellectual stimulation 4. Idealized consideration Concept of E-Leadership in conjunction with TL results in leadership behaviours that transform digital environments. CNE that can adopt informatics competencies and operationalize a TL style can better advocate for ICT solutions that meet patient needs and align with frontline nursing practice at the strategic level. 	may have inadvertently excluded articles of relevance to the topic explored.
Simpson, R. L. (2013)	To identify gaps between chief nursing executives “lived-experience” with informatics competencies and the AONE competencies	Qualitative Ethnographic	N= 7	<ul style="list-style-type: none"> Purposive sampling strategy focused on members of the Health Management Academy Ethnographic interview approach that employed iterative interview process. Interviews were audio-recorded and then transcribed for coded data analysis for common and disparate themes 	<ul style="list-style-type: none"> AONE competencies provide a baseline for leaders to start enhancing informatics competencies AONE competencies do not address key aspects of HIT related decision-making such as evidence-based workflow and architecture creation. Nursing leaders need a deeper understanding of nursing informatics to effectively inform, influence or lead technology related initiatives. 	None identified by authors’, but the small sample size derived from a specific context may limit generalizability of the thematic results presented.
Staggers, N., Elias, B. L., Makar, E., & Alexander, G. L. (2018)	To develop a better understanding of the usability issues faced by nurses who interact with ICTs	Qualitative	N= 27	<ul style="list-style-type: none"> Semi-structured interviews 	<ul style="list-style-type: none"> Nurses continue to have usability issues related to ICTs in practice. For key themes identified: <ol style="list-style-type: none"> User experience pain points Importance of the issues Responsibility gap Acting on usability issues Recommendations for nurse leaders: 	None identified by authors’, but the small sample size derived from a specific context may limit

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					<ol style="list-style-type: none"> 1. Create a digital strategy 2. Identify organizational ownership 3. Use existing tools (i.e. HIMSS Usability Maturity Model) to develop usability as a strategic asset 	generalizability of the thematic results presented.
Strudwick, G. (2016)	To present an expert opinion piece on an international perspective on nursing informatics	Expert Opinion	Not applicable	<ul style="list-style-type: none"> • Interview 	<ul style="list-style-type: none"> • Policy implications for nursing if we as a professional enable ourselves to access and utilize “big data”. • Nursing informatics needs to become embedded across nursing, from the front lines through nurse leader positions. “Nurses at all levels stand to gain from the widespread implementation, use and exploitation of informatics” 	Potential bias as article presents an opinion which may not be shared by others
Technology Informatics Guiding Education Reform (2014)	To provide recommendations for integrating technology from a leadership perspective to help transform informatics education and practice.	Summary Report	Not applicable	<ul style="list-style-type: none"> • Summary Report 	<ul style="list-style-type: none"> • Provided background of the TIGER Synthesis Project • Outlined rationale for competency development: <ul style="list-style-type: none"> ○ Concept of inter-dependent polarities- argues that technology and practice are intertwined. Project synergy is created when both are leveraged to yield safe and sustainable quality patient outcomes ○ Presented the polarity map which highlights the positive and negative elements within technology and practice related to a change initiative; action steps included to balance the tensions ○ Allows leaders to leverage technology to trend and track data for quality improvement on the front lines ○ Data analytics to identify patterns and correlate with financial and clinical data to identify areas for improvement ○ Identify potential for new technologies to transform care delivery, such as telehealth 	None identified

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					<ul style="list-style-type: none"> ○ Concept of professional interoperability- sharing expertise and knowledge across disciplines in a meaningful and transparent way ● Competencies <ul style="list-style-type: none"> ○ Generate discussions on the motives for technology implementations from a nursing lens ○ Participate in the modeling, analyzing and formalizing of nursing knowledge for clinical practice, research, education and management ○ Review existing nursing practice to inform design, testing and implementation of ICT's ○ Study the effects of technology on nursing practice 	
Troseth, M. R. (2014)	To provide an update on the TIGER Leadership Imperative Report and the launch of TIGER internationally	Summary Report	Not applicable	<ul style="list-style-type: none"> ● Summary of project outcomes 	<ul style="list-style-type: none"> ● To highlight the key elements of “The Leadership Imperative: TIGER’s Recommendations for Integrating Technology to Transform Practice and Education” which built on the previous report “Revolutionary Leadership Driving Healthcare Innovation”. ● Leadership Imperative Report contained six recommendations: <ol style="list-style-type: none"> 1. Accelerate development, adoption and integration of innovations into practice by supporting ideas that promote best practice 2. Transform interdisciplinary models of care and relationships to support innovation 3. Lead nursing engagement in public policy development at all levels 4. Apply knowledge Funding and resources in the areas of IT, operations, policy, clinical informatics to improve patient outcomes 	None identified

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Weaver, C., & O'Brien, A. (2016)	To provide a report out on the recommendations from the University of Minnesota's Big Data Conference Working Group	Summary Report	Not applicable	<ul style="list-style-type: none"> Summary of a report generated by nursing leaders that comprised a working group charged with transforming EHR documentation for nursing and allied health providers 	<ul style="list-style-type: none"> Despite being the largest number of HIT users, nurses receive a "negligible" amount of information back that can be used to inform practice. Current state provided on nursing satisfaction and documentation practices post EHR implementation. Data input by nurses is not currently linked to other real-time knowledge/context limiting interpretation or ability to quantify nursing care in a meaningful way. Recommendation for nursing leaders to be knowledgeable in and promote the use of standardized data sets (i.e. SNOMED CT) in nursing data 	None identified

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Westra, B. L., Clancy, T. R., Sensmeier, J., Warren, J. J., Weaver, C., & Delaney, C. W. (2015)	To report out on the implications of big data science and the opportunities to us them in generating actionable predictive models aimed at improving patient outcomes	Summary report	Not applicable	<ul style="list-style-type: none"> • None- summary report 	<ul style="list-style-type: none"> • Nursing leaders need to be aware of and skilled at using big data to advance practice. • Nursing leaders need to understand “structured data and processes that support analytic methods to control costs and improve quality and safety”. • “The collection and analysis of data is foundational to the creation of information, knowledge and wisdom, as well as understanding the impact of nursing care”. • “DRIP” phenomenon (data rich, information poor) • Recommendations: <ol style="list-style-type: none"> 1. for nurse leaders to advocate for the use of standardized clinical data sets (LOINC, SNOMED CT) for capturing data in nursing. 2. for nurse leaders to support the use of nursing informaticists in building clinical systems so those data sets can be integrated and mapped appropriately. 3. For nurse leaders to use “The Big Data Checklist” to create a data culture 4. For nurse leaders to develop their own competencies in informatics to enhance their decision making at the strategic level. 	None identified