

Table 1: Data Extraction Table

Authors and year	Purpose	Research Design	Sample	Instruments and Methodology	Findings	Limitations
<p>Achampong, E. K. (2017). (Ghana)</p>	<p>To assess the current curriculum of the nursing and midwifery informatics course available at all nursing institutions across Ghana</p>	<p>Qualitative Focus Group</p>	<p>N=59</p>	<p>To separate workshops were held to ascertain:</p> <ol style="list-style-type: none"> 1. the preparedness of the tutors to teach nursing informatics 2. compare the curriculum of the nursing and midwifery informatics course to international recommendations 	<p>Timing of the informatics content is too early in the course, so a recommendation is made to move it to the subsequent year.</p> <p>Lack of skill and knowledge within the group of tutors on informatics. Recommendations to provide additional education and support to the tutors to build their informatics skill, which will positively influence their ability to instruct students.</p> <p>Linking to the internationally recommended competencies is lacking</p>	<p>The region-specific sample and nursing program design limits the generalizability of the results to nursing programs within Ghana</p>

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					<p>in some areas of the curriculum, this should be addressed in future curriculum revisions</p> <p>Long term recommendation to develop baccalaureate and masters level nursing informatics content in Ghana</p>	
Abdrbo, A. (2015). (Saudi Arabia)	To assess the relationship between nursing informatics competencies in undergraduate nursing education and patient safety competencies .	Quantitative Descriptive, cross-sectional correlational design	Convenience sample of n=154 Interns (Graduate) n=55 Nursing students (Undergrad) n=99	Self-administered questionnaire that consisted of: 1. Self-assessment of Nursing Informatics Competencies (SANICS) 2. Patient Safety Competencies Self-evaluation (PSCAE) 3. Demographic data sheet Descriptive statistics and tTests were used to describe participant characteristics and identify correlations. Reliability assessed using	<p>No significant difference in informatics competencies between interns and students.</p> <p>No significant difference in patient safety competencies between interns and students.</p> <p>Demonstrated a correlation between informatics competencies and patient safety</p>	<p>Subjective, self-reported data that may not reflect actual competencies</p> <p>Convenience sample limits the generalizability of the results</p>

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				Cronbach's alpha reliability coefficient.	competencies. Those who took the informatics course demonstrated higher patient safety competencies in knowledge and skill than those who did not. Cronbach's reliability 0.9	
Bryant, L. E., Whitehead, D. K., & Kleier, J. A. (2016). (United States)	To develop and test a new instrument to measure informatics competencies in nursing students Knowledge, Skills, and Attitudes towards Nursing Informatics (KSANI)	Quantitative	Convenience sample n=300	KSANI survey tool developed that consisted of 24 items and distributed to participants at the Florida Nursing Students Association conference. Completed tools were placed in a sealed box and were taken back to the university for statistical analysis. Principle component analysis conducted with Kaiser-Meyer Olkin measurement to verify sampling accuracy. Cronbach's test also	Tool demonstrated high internal consistency across the four factors of: 1. Educational opportunity to apply informatics 2. Knowledge of informatics 3. Informatics skills confidence 4. Attitude toward informatics Demonstrated appropriateness with both associate degree and	Subjective, self-reported data that may not reflect actual competencies Convenience sample captured students from across the state of Florida, however the results may not be

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				employed to demonstrate reliability.	baccalaureate nursing students Cronbach's reliability 0.9	generalizable to all nursing program within the states or elsewhere in North America
Choi, M., Park, J., Lee, H. (2016). (Korea)	To explore how faculty, clinical instructors and students perceive integration of an academic electronic medical record into an undergraduate nursing program	Qualitative Focus Group Interviews x4 Number of focus groups was based on data saturation	Purposive sample n=18 for each focus group (total n= 72) Participant breakdown per n=18: 1. 3 rd year students n=6 2. New nurses n=3 3. Clinical instructors n=6 4. Nursing faculty n=3	Semi-structured focus group interviews were conducted to elicit participant perspectives on electronic medical records and the incorporation of an academic electronic medical record in the undergraduate setting. Sessions were audio recorded and later transcribed verbatim. A research assistant took detailed field notes to capture non-verbal behaviors and interactions among the participants.	Major themes: 1. EMR as a Learning Tool for Clinical Practicum a. Adapting to EMR's at early stage in practicum b. Understanding pts condition & clinical practice c. Barriers to use 2. Essential functions of Academic EMR a. Practicing documentation b. recording and evaluating student activities 3. Expected outcomes of academic EMR use	The research context of a Korea nursing program may limit generalizability to nursing programs with a differing curriculum format of student demographic

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				Data was analyzed using qualitative content analysis.	<ul style="list-style-type: none"> a. Building capacity to complete nursing documentation b. Enhancing critical thinking and informatics competencies c. Integrating practice and theory 	
Egbert, N., et al. (2016). (International)	To propose a methodology for developing and implementing national recommendations for informatics competencies in nursing programs.	Mixed Methods	Purposive Sample n=120 (Germany n=64; Austria n=36; Switzerland n=20)	Triple Iterative methodology: <ul style="list-style-type: none"> 1. Step 1- Identified national health recommendations for informatics competencies based on expert opinion 2. Step 2- Matched and enriched with data from the literature 3. Step 3- Validated the identified 24 core competencies using on line survey in the three target countries; Two focus group workshops held at ENI conference to confirm relevance and completeness of the competencies; Follow-up 	<p>Survey #1- 72.5% response rate</p> <p>Focus Groups- identified two additional domains to be added</p> <p>Survey #2- 67.5% responses rate</p> <p>Study identified the feasibility of the triple iterative methodology in developing core competencies for nursing informatics.</p>	Study focused on the development of an iterative process to identify core informatics nursing competencies in the European context. As such, may not be generalizable

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				survey to same sample pool that included the two new domains		internationally
Hübner, U., et al. (2018). (International)	To empirically define and a globally accepted framework of core health informatics competencies	Mixed Methods	Survey n=43 Workshop n=28	<p>Survey developed based on 24 competencies derived from the existing international literature. (Reported response rate of approx. 60%)</p> <p>Five professional nursing roles targeted:</p> <ol style="list-style-type: none"> 1. Clinical nursing 2. Quality management 3. Coordination of inter-professional care 4. Nursing management 5. IT management in nursing <p>Workshop- audio recorded discussion on informatics competency issues summarized using inductive categorization. Domains identified were mapped to the 24 competencies and internal</p>	<p>Framework developed inclusive of 24 recommended core competencies defined for 5 major nursing roles.</p> <p>Ranked by relevance, the core competency areas were validated by experts and exemplar case studies were developed to expand on the identified competencies</p> <p>Provides a framework for international and interdisciplinary learning in health informatics for nursing that identifies high priority core competency areas to be considered in curriculum development</p>	<p>Does not distinguish between health informatics and nursing informatics</p> <p>Proposed framework will need to be updated regularly to keep up with the pace of technological advancements</p>

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				<p>consistency was 0.7 using Cronbach's alpha.</p> <p>Case Studies- exemplar case studies were selected from each country to purposefully mirror different professional cultures</p>		
<p>Hübner, U., et al. (2016). (International)</p>	<p>To empirically define and a globally accepted framework of core health informatics competencies</p> <p>To match the findings of the proposed framework to country</p>	<p>Mixed Methods</p>	<p>Survey n=43</p>	<p>Survey developed based on 24 competencies derived from the existing international literature. (Reported response rate of approx. 60%)</p> <p>Case Studies- 8 exemplar case studies were selected from each country to purposefully mirror different professional cultures</p>	<p>Review of the survey results and submitted case studies revealed that management competencies were require with IT competencies</p>	<p>Abstract nature of the core competencies mean they may be interpreted differently.</p> <p>Case studies could not be compared completely due to</p>

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	specific needs					different arrangements
Kleib, M., Nagle, L. (2018). (Canada)	To identify priority areas for informatics education for practising Alberta nurses	Quantitative Exploratory, descriptive, cross sectional	Convenience sample via electronic distribution list Survey n=2844	Descriptive electronic survey that incorporated the Canadian Nurse Informatics Competency Assessment Scale (C-NICAS) to explore the self-perceptions of Alberta nurses related to their informatics competencies. Descriptive statistical analysis was used to calculate mean scores for the C-NICAS. Reliability and internal consistency were assessed using Cronbach's alpha.	Self-perceived informatics competencies rate slightly above competent. The C-NICAS instrument face and content validity was supported by this study. Cronbach's alpha .926	Subjective, self-reported data that may not reflect actual competencies Results considered heterogenous to the Alberta nursing population however they may not be generalizable to context outside of Alberta
Kleib, M., Nagle, L. (2018).	To determine self-perceived competencies in informatics	Quantitative Exploratory, descriptive,	Convenience sample via electronic distribution list	Descriptive electronic survey that incorporated: 1. Demographics	Self-perceived informatics competencies rate slightly above competent.	Subjective, self-reported data that may not reflect

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(Canada)	and associated factors among practising nurses in Alberta	cross sectional	Survey n=2844	<p>2. General informatics factors derived from the literature</p> <p>3. Canadian Nurse Informatics Competency Assessment Scale (C-NICAS)</p> <p>Descriptive statistical analysis and ANOVA test using the Bonferroni adjustment method. This was followed by GLM variable and standard multiple regression analysis</p>	Overall scores varied with age, educational qualifications, work experience and work setting.	<p>actual competencies</p> <p>Results considered heterogenous to the Alberta nursing population however they may not be generalizable to context outside of Alberta</p>
Kleib, M., Nagle, L. (2018). (Canada)	To examine the factor structure and internal reliability and consistency of the Canadian Nurse Informatics Competency Assessment	Quantitative Cross sectional	Convenience sample via electronic distribution list Survey n=2844	<p>Exploratory principle component analysis with oblique promax rotation to determine factor structure and validity</p> <p>1. Assessment of sample size and strength of C-NICAS items to determine suitability and factorability</p>	<p>The component analysis process revealed a four-component structure for the 21 item C-NICAS</p> <p>Cronbach's alpha high across subscales as follows</p> <p>1. Foundational skills-.926</p>	The inclusion of ICT in item three may have affected the loading- future research recommended to assess indicators without ICT

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	Scales (C-NICAS)			<ol style="list-style-type: none"> 2. Evaluation of scree test, Kaiser's criterion, parallel analysis 3. Interpretation and impact of item loading 4. Calculation of internal reliability using Cronbach's alpha 5. Completion of statistical psychometric analysis 	<ol style="list-style-type: none"> 2. Knowledge and information management- .857 3. Professional and regulatory accountability- .806 4. ICT use- .864 	Results considered heterogenous to the Alberta nursing population however they may not be generalizable to context outside of Alberta
Nagle, L. M., et al. (2014). (Canada)	Aim to describe a process and outcome of development of CASN entry-to-practice informatics competencies	Mixed methods	Symposium n=50 Survey n=53	<p>Iterative framework for CASN competency development:</p> <ol style="list-style-type: none"> 1. Generation of preliminary competencies 2. Building Consensus 3. Refining the Competencies 	<p>Iterative process utilizing consensus-building was deemed effective for creating the CASN nursing informatics competencies</p> <p>83.3% of respondents indicated their agreement with the inclusion of the competencies in the framework</p>	Short timelines negatively impacted the number of responses to the survey questionnaire.

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Oh, J., Shin-Jeong Kim, Kim, S., & Vasuki, R. (2017). (Korea)	To evaluate the effects of “flipped” learning on a nursing informatics course	Quantitative Comparative Case Study	Flipped learning course University A n= 43 University B n= 46	Two phased research design using the Kirkpatrick evaluation model: 1. Phase 1- pre-test and post-test evaluation of satisfaction with course 2. Phase 2- follow-up survey 2.5 years after course completion Results between groups for phase 2 then compared and analyzed	Statistically significant difference reported in self-perceived nursing informatics competencies. Statistically significant difference in informatics competencies across domains of knowledge, skill application confidence and achievement attitudes. In all cases flipped learning group rated higher.	Sample limited to one region of Korea limits generalizability of the findings to other settings. Contrast group is needed to compare evaluations of Phase 1. Subjective, self-reported data that may not reflect actual competencies
Ronquillo, C., et al. (2017).	Presentation of international	Mixed Methods	Snowball sampling method for	Electronic international questionnaire developed based on contemporary	Five key themes identified:	Survey was translated into 18

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(International)	y survey results and recommendation for advancing nursing informatics		Survey n=272	nursing informatics literature to assess current trends. Survey was translated into 18 different languages with responses translated back into English for thematic analysis	<ol style="list-style-type: none"> 1. Education and Training 2. Research 3. Practice 4. Visibility 5. Collaboration and Integration <p>Recommendations:</p> <ol style="list-style-type: none"> 1. Nursing informatics education should span across all levels of nursing education 2. Development of competency requirements for advanced/specialty nursing informatics education levels 3. Development of faculty competencies in facilitating nursing informatics education 4. Further nursing informatics research through development of research skills in nursing informaticists 5. Inclusion of nursing practice perspectives 	different languages with responses translated back into English-potential for lost meaning that could influence the thematic analysis of the responses

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					<p>in the design and implementation of new technologies</p> <p>6. Increase nursing specific information systems beyond the acute care setting</p>	