**Supplemental Digital Content 3: Reported Competencies**

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| **Study:** An Examination of the Leadership Competency Requirements of Nurse Leaders in Healthcare Information Technology  **Authors:** Amendola (2008)  **Number of competencies identified:** 74 (not counting the existing competencies, and obvious duplicates) | | |
| **Categories** | **Competencies** | |
| Leadership | * Communication skills * Systems thinking * Managing change * Visioning * Shared values * Shared decision making * Motivation * Understanding nursing theory | * Assessment of Organizational climate and needs * Strategic influence * Spiritual leadership * Leadership Model Theories * Behaviour Modification * Strengthen Relationships * Motivate Staff * Belief System |
| Operations skills | * Financial management * Information technology * Resource allocation * Organizational assessment * Driving for Performance * Regulatory expertise | * Clinical credibility * Service management * Evidence based research * Driving for quality * Problem solving |
| Interpersonal or soft skills | * Cultural competence * Emotional intelligence * Political savvy * Management of nurse/physician relationships | * Diverse team leadership * Negotiation/ conflict management * Supporting the needs of professional staff |
| Industrial/ environmental issues | * Balance * Workforce development * Succession planning * Mentoring * Flexibility/ adaptability * Patient-centered care | * Situational preparedness * Routine progress * Integrational workforce * Leadership skills * Community outreach |
| Health information technology (health informatics) | * Knowledge transfer * Office automation tools * Disaster recovery plans * Conflict resolution * Impact of IT on Nursing culture * Emotional intelligence skills * Monitoring skills * Stewardship * Facilitator skills * Managing clinical, operational, and financial information * Application of technology * Electronic documentation * IT Systems skills * Accessing data * Managing information resources * Managing technology life cycles * Decision support * Developing strategic partnerships * Effective HIT practices * Developing HIT expertise | * Ethical use of HIT * Information Technology savvy * Understanding of integrated clinical software applications * Cultural competencies * Management of electronic information * Applying information technology tools & technologies * Managing the amount of information presented that is delivered through multiple technology media sources * Effectively manage and share large amounts of complex data * Understanding how information technology within specific clinical areas works in conjunction with other areas |

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| **Study:** Nursing Informatics Competency Assessment for the Nurse Leader: The Delphi Study  **Authors:** Collins, Yen, Phillips, Kennedy (2017)  **Number of competencies identified:** 74 | |
| **Categories** *(based on modified  Westra and Delaney 2008 categories)* | **Number of competencies in each category** *(with examples from top 15 competencies)* |
| Management concepts | 9   * Inclusion of nursing information within HIT system * Communicating a system and nursing vision about the benefits of HIT |
| Requirements and system selection | 9   * Ability to ensure that nursing values/requirements are represented in HIT selection and evaluation * Ability to collaborate with interprofessional team in HIT selection process * Ability to advocate for the development (or purchase) and use of integrated, cost-effective HIT systems within the organization * Ability to involve frontline staff in the development of HIT system requirements |
| Ethical/legal concepts | 8 |
| Information systems concepts | 7   * Recognition of value of clinicians’ involvement in all appropriate phases of HIT |
| Advanced software applications | 6   * Budgeting using technology * Data-based planning and decision making through the utilization and synthesis of HIT system data * Quality assurance using technology |
| Executive leadership | 5 |
| Financial | 5 |
| Implementation/management | 5   * Ability to see HIT as a top priority and strategic decision * Ability to involve frontline staff in appropriate aspects of HIT design, implementation, and testing related to their practice * Ability to collaborate with other departments regarding project management and resource allocation for HIT system implementation |
| Patient-related applications | 5 |
| Data issues | 4 |
| Technical knowledge | 4 |
| Collaboration | 2 |
| Electronic communications | 2 |
| HIT selection | 2   * Ability to collaborate with chief medical officer peers related to HIT and needs of nurses and physicians * Ability to involve frontline staff in the evaluation of HIT systems related to their practice |
| Standardization | 1 |

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| Study: A Delphi Study to Determine Baseline Informatics Competencies for Nurse Managers **Authors:** Hart (2010)  **Number of competencies identified:** 49 | | |
| **Categories** | **Subcategories** | **Competencies for Beginning & Experiences Nurses**  *(based on Staggers et al. 2002)* |
| Computer Skills | Administration | * Uses administrative applications for practice management (e.g., searches for patient, retrieves demographics, billing data)(I) * Uses applications for structured data entry (e.g., patient acuity or classification applications) (I) * Uses administrative applications for budget(II) * Uses applications to manage aggregated data (II) * Uses administrative applications for staff scheduling (II) * Uses administrative applications for maintaining employee records (II) |
| Communication (email, internet, telecommu-nications) | * Use e-mail (e.g., create, send, respond, use attachments)(I) * Uses the Internet to locate, download items of interest (e.g., patient, nursing resources) (I) |
| Data access | * Uses sources of data that relate to practice and care (I) * Accesses, enters, and retrieves data used locally for patient care (e.g., uses HIS, CIS for plans of care, assessments, interventions, notes, discharge planning) (I) * Conducts on-line literature searches (I) |
| Documentation | * Uses an application to document patient care (I) * Uses an application to plan care for patients to include discharge planning (I) * Uses an application to enter patient data (e.g., vital signs) (I) |
| Education | * Uses information management technologies for patient education (e.g., identifies areas for instruction, conducts education, evaluates outcomes, resources) (I) |
| Monitoring | * Uses computerized patient monitoring systems (I) |
| Basic Desktop Software | * Uses multimedia presentations(I) * Uses word processing(I) * Demonstrates keyboarding (typing) skills (I) |
| Systems | * Operates peripheral devices (e.g., bedside terminals, hand-helds) (I) * Uses existing external peripheral devices (e.g., CD-ROMs, zip drives) (I) * Uses computer technology safely (I) * Identifies the appropriate technology to capture the required patient data (e.g., fetal monitoring device) (I) * Demonstrates basic technology skills (e.g., turn computer off & on, load paper, change toner, remove paper jams, print documents) (I) |
| Quality improvement | * Uses data and statistical analyses to evaluate practice and perform quality improvement (II) |
| Informatics Knowledge | Data | * Recognizes the use and/or importance of nursing data for improving practice (I) * Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record (II) * Provides for efficient data collection (II) |
| Impact | * Recognizes that a computer program has limitations due to its design and capacity of the computer (I) * Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool (I) * Recognizes that health computing will become more common (I) * Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer (I) * Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing (I) * Defines the impact of computerized information management on the role of the nurse (II) |
| Privacy/ security | * Seeks available resources to help formulate ethical decisions in computing (I) * Describes patients' rights as they pertain to computerized information management (I) * Discusses the principles of data integrity, professional ethics and legal requirements (II) * Describes ways to protect data (II) |
| Systems | * Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care (I) * Describes the computerized or manual paper system that is present (I) * Explains the use of networks for electronic communication (e.g., Internet) (I) * Identifies the basic components of the current computer system (e.g., features of a PC, workstation (I) * Describes general applications to support administration (e.g., staffing, budget) (II) * Describes general applications, systems to support clinical care (II) * Describes general applications to support nursing education (II) |
| Informatics Skills | Role | * Participates in influencing the attitudes of other nurses toward computer use for nursing practice (II) * As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems (II) * Acts as an advocate of system users including patients or clients (II) |
| Systems Maintenance | * Performs basic trouble-shooting in applications |
| Levels of Practicing Nurses:   1. Level 1 – Beginning Nurse 2. Level 2 – Experienced Nurse | | |

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| **Study:** Towards an International Framework for Recommendations of Core Competencies in Nursing and Inter-Professional Informatics: The TIGER Competency Synthesis Project.  **Authors:** Hubner, Shaw, Thye, Egbert, Marin and Ball (2016)  **Number of competencies identified:** 24 (only reported top 14) | |
| **Competencies** | **Appropriate within the following nursing roles** |
| Nursing documentation | Nursing management, Clinical nursing, Quality management, Inter-professional coordination |
| Principles of management | Nursing management |
| Strategic management and leadership | Nursing management |
| Quality management | Nursing management, Quality management |
| Human resource management | Nursing management |
| Change management, stakeholder manager | Nursing management |
| Information knowledge management | Clinical nursing, Quality management, Inter-professional coordination, IT management |
| Principles of nursing informatics | Clinical nursing, Quality management, IT management |
| Data protection and security | Clinical nursing, Inter-professional coordination, IT management |
| Ethics and IT | Clinical nursing, Inter-professional coordination |
| Information communication systems | Clinical nursing, Quality management, Inter-professional coordination, IT management |
| Process management | Quality management, Inter-professional coordination, IT management |
| IT risk management | IT management |
| Project management | IT management |

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| **Study:** Informatics Competencies in Nursing Management | | |
| **Authors:** Jensen, Casteli, Kobayashi and Leite (2015) | | |
| **Number of competencies identified:** 13 abilities organized within 3 competencies *(based on TIGER)* | | |
| **Competencies** | **Abilities** | |
| Basic Computer Competencies | Skills to use:   * the internet * spreadsheets | * graphs * social networks * databases |
| Information Literacy | Skills to:   * use minimum data sets * use telemedicine | * use evidence-based practice in decision making * ensure the quality of information |
| Information Management | Skills to use:   * algorithms * decision support systems | * information systems * systems that can maximize clinical outcomes and reduce costs |

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| Study: Informatics Competencies Essential to Decision Making in Nursing Management **Authors:** Jensen, Guedes and Leite (2016)  **Number of competencies identified:** 56 abilities organized within 2 competencies *(based on TIGER)* | | |
| **Competencies** | **Categories** | **Abilities** |
| Information Literacy | Knowledge – Determine the nature and extent of the information needed | * Recognize a specific information need |
| Access – Access needed information effectively and efficiently | * Understand that the Internet may be a useful resource for locating, retrieving and transferring information electronically * Select types of information resources appropriate to a specific information need * Use online search techniques and tools to locate relevant citations and to further refine the search * Use search language appropriate to the source, such as a controlled vocabulary, key words, natural language, author and title searches to locate relevant items in print and electronic resources |
| Evaluate information and its sources critically and incorporates selected information into his or her knowledge base and value system | * Integrate the new information into existing body of knowledge * Understand that the Internet may be a useful resource for locating, retrieving and transferring information electronically * Use a variety of criteria, such as author's credentials, peer review, and reputation of the publisher, to assess the authority of the source * Assess the relevance of a source to an information need by examining publication date, purpose, and intended audience * Recognize omission in the coverage of a topic |
| Individually or as a member of a group, use information effectively to accomplish a specific purpose | * Create a logical argument based on information retrieved * Organize the information in a logical and useful manner * Recognize and evaluate documentation for the information source, such as research methodology, bibliography or footnotes * Recognize and accept the ambiguity of multiple points of view |
| Evaluate outcomes of the use of information | * Understand the ethics of information use, such as knowing how and when to give credit to information and ideas gleaned from others by appropriately citing sources in order to avoid plagiarism * Respect intellectual property rights by respecting copyright * Understand the social/political issues affecting information, such as:   a) privacy  b) privatization and access to government information  c) electronic access to information  d) the exponential growth of information  e) equal access to information   * Describe the criteria used to make decisions and choices at each step of the particular process used |
| Information Management | Demographic/patient info | * Identify and Maintain a Patient Record * Produce a Summary Record of Care * Manage Patient History * Manage Patient * Demographics |
| Consents and Authorizations | * Manage Consents and Authorizations |
| Medication Management | * Manage Problem Lists * Manage Medication Administration * Manage Medication Lists |
| Planning Care | * Manage Patient-Specific Care and Treatment Plans * Interact with Guidelines and Protocols for Planning Care * Interact with Clinical Workflow Tasking |
| Order/Results Management | * Manage Results * Manage Non-Medication Patient Care Orders * Manage Orders for Diagnostic Tests * Manage Orders for Blood Products and Other Biologics |
| Care Documentation | * Manage Patient Clinical Measurements * Manage Documentation of Clinician Response to Decision Support Prompts * Generate and Record Patient-Specific Instructions |
| Decision Support | * Manage Health Information to Provide Decision Support for Patient Context- Driven assessments * Interact with decision Support for Standard Care Plans, Guidelines, and Protocols * Manage Health Information to Provide Decision Support for Identification of Potential Problems and Trends * Manage Health Information to Provide Decision Support for Standard Assessments * Interact with decision Support for Safe Blood Administration * Interact with decision Support for Drug Interaction Checking * Manage Health Information to Provide Decision Support for Self-Care * Manage Health Information to Provide Decision Support for Patient and Family Preferences * Interact with decision Support for Medication and Immunization Administration * Interact with decision Support for Medication Recommendations * Interact with decision Support for Non-Medication Ordering * Interact with decision Support for Patient Specific Dosing and Warnings |
| Notifications | * Manage Health Information to Provide Decision Support for Monitoring Response * Manage Health Information to Provide Decision Support for Notification and Response regarding population health issues * Access Healthcare Guidance * Interact with decision Support for Notifications and Reminders for Preventive Services and Wellness |
| Facilitating Communications | * Facilitate Patient, Family and Care Giver Education * Facilitate Inter-Provider Communication * Facilitate Communications Between Provider and Patient and/or the Patient Representative * Facilitate Provider -Pharmacy Communication |

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| **Study:** Developing nurse educators’ computer skills towards proficiency in nursing informatics  **Authors:** Rajalahti, Heinonen and Saranto (2014)  **Number of competencies identified:** 100, reported 9 | | |
| **Competencies** | **Sub-competencies** | **Variables** |
| Basic Computer Competences (33 total variables) | Basic and safe computer use |  |
|  | Ability to use computers | * knowledge and skills on how to use applications, software and internet-related software applications |
|  | Use of computer to communicate |  |
| Advanced Nursing Informatics Competences (67 total variables) | Information literacy | * use of different applications:  1. eLearning environments (e.g. logging in, attaching files, sending messages) 2. media environments 3. visual environments  * mastering of applications * information retrieval |
| Information management | * electronic nursing documentation (describing a patient’s needs, interventions, outcomes with terminology) * ability to use evidence-based knowledge * using the nursing process model * information security – data protection and privacy |

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| **Study:** Nursing Informatics Core Competencies  **Authors:** Simpson (1994)  **Number of competencies identified:** 11 |
| **Competencies** |
| 1. Understand the basic tools and terminology of the trade and have some experience with computers and information technology 2. Understand how information technology can help with decision-making and strategic planning at the executive level 3. Understand how to actively and effectively participate in the evaluation, selection and maintenance of an information system that will support nursing practice 4. Understand that information technology is an interdepartmental process and what that means to the nursing department as a whole 5. Understand the important role nursing data must and should play in the development or selection of a hospital information system 6. Understand how computers and telecommunications technology can be used for staff development and clinical practice enhancement 7. Understand how decision support systems can be used and strategic planning 8. Understand the ethical issues regarding information technology, security and confidentiality 9. Know how to evaluate, select and manage the services of IS consultants 10. Understand how to use information technology for data collection for regulatory compliance 11. Understand market forces, vendor marketing techniques and emerging technologies for future decision making |

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| Study: Chief Nurse Executives Need Contemporary Informatics Competencies **Authors:** Simpson (2013)  **Number of competencies identified:** 14 | |
| **Broader themes identified from CNEs** | **AONE Technology Competencies** |
| * Technology Knowledge * Collaboration * HIT Selection * Executive Leadership * Standardization | * Demonstrate basic competency in email, common word processing, spreadsheet and Internet programs * Recognize the relevance of nursing data for improving practice * Recognize the limitations of computer applications * Use telecommunication devices * Utilize hospital database management, decision support and expert systems programs to access information and analyze data from disparate sources for use in planning patient care processes and systems * Participate in change management processes and utility analysis * Participate in the evaluation of information in practice settings * Evaluate and revise patient care processes and systems * Use computerized management systems to record administrative data (billing data, quality assurance data, workload data, etc) * Use applications for structured data entry (classification systems, acuity level, etc.) * Recognize the utility of nursing involvement in planning, design, choice and implementation of information systems in the practice environment * Demonstrate awareness of social and technological trends, issues, and developments as they relate to nursing * Demonstrate proficient awareness of legal and ethical issues related to client data, information and confidentiality * Read and interpret benchmarking, financial and occupancy data |

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| Study: Informatics Competencies for Nurses at Four Levels of Practice **Authors:** Staggers, Gassert and Curran (2001)  **Number of competencies identified:** 304 | | |
| **Categories** | **Subcategories** | **Competencies** |
| Computer Skills | Administration | * Uses administrative applications for practice management (e.g.. searches for patient, retrieves demographics, billing data) (I) * Uses applications for structured data entry (e.g., patient acuity, classification applications) (I) * Uses administrative applications for forecasting (II) * Uses administrative applications for budget (II) * Uses applications to manage aggregated data (II) * Uses administrative applications for staff scheduling (II) * Uses administrative applications for maintaining employee records (II) * Uses applications for diagnostic coding (II) * Develops models for simulation purposes (IV) |
| Communication | * Uses telecommunication devices (e.g., modems, other devices) to communicate with other systems (e.g., access data, upload, download) (I) * Uses e-mail (e.g., create, send, respond, use attachments) (I) * Locates and evaluates patient support groups or chat rooms on the Internet (I) * Uses the Internet to locate and download items of interest (e.g., patient or nursing resources) (I) |
| Data Access | * Uses sources of data that relate to practice and care (I) * Accesses, enters, and retrieves data used locally for patient care (e.g., uses Hospital Information System and Clinical Information System for plans of care, assessments, interventions, notes, discharge planning) (I) * Uses a database management program to develop a simple database and/or table (I) * Uses database applications to enter and retrieve information (I) * Conducts on-line literature searches (I) * Accesses shared data sets (II) * Extracts data from clinical data sets (II) * Extracts selected literature resources and integrates them to a personally usable file (II) |
| Decision Support | * Uses decision support systems, expert systems, and aids for clinical decision making or differential diagnosis (I) |
| Documentation | * Uses an application to document patient care (I) * Uses an application to plan care for patients to include discharge planning (I) * Uses an application to enter patient data (e.g., vital signs) (I) |
| Education | * Uses computer-assisted instruction (CAlI) (I) * Uses information management technologies for patient education (e.g., identifies areas for instruction, conducts education, evaluates outcomes, resources) (I) * Uses applications to develop testing materials (II) * Uses applications for curriculum planning (II) * Uses authoring tools to develop CAI for students, nurses, and/or patients (II) * Evaluates CAI as a teaching tool (II) * Teaches informatics competencies required for specific role functions for the practicing nurse and the nurse administrator (IV) * Evaluates informatics competencies required for specific role functions for the practicing nurse, the nurse administrator, and others (IV) |
| Monitoring | * Uses computerized patient monitoring systems (I) * Applies monitoring system appropriately according to the data needed (II) |
| Basic Desktop Software | * Uses presentation graphics (e.g., PowerPoint) to create slides, displays (I) * Uses multimedia presentations (I) * Uses word processing (I) * Demonstrates keyboarding (i.e., typing) skills (I) * Uses spreadsheets (I) * Uses desktop publishing (II) * Develops or modifies spreadsheets used for complex problems (III) * Discusses the mathematical models underlying the fiscal management system or spreadsheet (III) * Writes macros and shortcuts for spreadsheets (III) |
| Systems | * Uses networks to navigate systems (e.g., file servers, World Wide Web) (I) * Operates peripheral devices (e.g. bedside terminals. hand-helds) (I) * Uses operating systems (e.g., copy, delete, change directories) (I) * Uses existing external peripheral devices (e.g., CD-ROMs, zip drives) (I) * Uses computer technology safely (I) * Is able to navigate Windows (e.g.. manipulate files using file manager, determine active printer, access installed applications, create and delete directories) (I) * Identifies the appropriate technology to capture the required patient data (e.g., fetal monitoring device) (I) * Demonstrates basic technology skills (e.g., turn computer off and on, load paper. change toner, remove paper jams, print documents) (I) |
| Quality Improvement | * Uses data and statistical analyses to evaluate practice and perform quality improvement (II) * Determines indicators used to monitor quality and effectiveness of nursing informatics practice (III) * Collects data to monitor quality and effectiveness of nursing informatics practice (III) * Determines aspects of nursing informatics practice important for quality monitoring (III) |
| Research | * Uses computer applications for statistical analysis and nursing research (II) |
| Case Tools | * Applies computer-assisted software engineering (CASE) tools (III) |
| Project Management | * Manages projects with project management software (III) |
| Simulation | * Applies simulation models (III) |
| Systems | * Has the ability to integrate different applications or programs (III) * Uses utility programs for data recovery and system performance indices (III) |
| Informatics Knowledge | Data | * Recognizes the use and/or importance of nursing data for improving practice (I) * Supports efforts toward development and use of a unified nursing language (II) * Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record (II) * Provides for efficient data collection (II) * Demonstrates fluency in informatics and nursing terminologies (III) * Supports integration of a unified nursing language with the standardized language developed in collaboration with other health care disciplines (III) * Recognizes the capacity for data aggregation and integration (III) |
| Impact | * Recognizes that a computer program has limitations due to its design and capacity of the computer (I) * Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool (I) * Recognizes that health computing will become more common (I) * Recognizes that the computer is only a tool to provide better nursing care and that there are human functions that cannot be performed by computer (I) * Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing (I) * Describes the computerized or manual paper system that is present (I) * Explains the use of networks for electronic communication (e.g., Internet) (I) * Identifies the basic components of the current computer system (e.g., features of a personal computer, workstation) (I) * Defines the impact of computerized information management on the role of the nurse (II) * Determines the impact of computerized information management on managers and executive roles (III) * Interprets current legislation, research, and economics affecting computerized information management in health care (III) * Assesses current capabilities and limitations of technology (e.g., data transfer rates, chip capacity) (III) * Determines projected impacts to users and organizations when changing to computerized information management (III) * Determines the reasons for slow response time (e.g., heavy demands on computer system at time of shift change) (III) * Discusses new careers available to informaticists (III) * Determines the social, legal, and ethical impacts of changing to computerized information management (III) * Discusses the interdependencies computerized information management creates (e.g., changes when doctor enters own orders) (III) * Determines the limitations and reliability of computerized patient monitoring systems (III) * Applies strategies for change management to produce satisfied and productive users (III) * Determines the impact of information management technologies on therapeutic outcomes and quality of care (III) * Discusses the computer's effect on cost of health care (III) * Interprets the benefits and risks of computerized information management (III) * Interprets research findings about the impact of computerized information management on clinical practice, educational, administration, and research (III) * Analyzes the impacts of information management technologies on time allocation and tasks of care (III) * Interprets the impact of computerized information management on nursing education (III) * Evaluates the changing role of educator when computerized information management is introduced (IV) |
| Privacy/ Security | * Seeks available resources to help formulate ethical decisions in computing (I) * Describes patients' rights as they pertain to computerized information management (I) * Discusses the principles of data integrity, professional ethics and legal requirements (II) * Describes ways to protect data (II) * Interprets copyright issues in computing (III) * Discusses features, capabilities, and scope of user passwords (III) * Devises strategies to protect the confidentiality of computerized information (III) * Differentiates issues surrounding confidentiality in computerized information management (III) |
| Systems | * Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications and systems in health care (I) * Describes general applications to support administration (e.g., staffing, budget) (II) * Describes general applications and systems to support clinical care (II) * Describes general applications to support nursing education (II) * Discusses CAI as a teaching and learning tool (II) * Explains various input and output devices (III) * Applies theories that influence computerization in health care (III) * Discusses computer fundamentals (e.g., hardware, software, networks, data communications) (III) * Projects health care computing trends in nursing (III) * Evaluates applications/systems available in health care (III) * Differentiates significant highlights in the evolution of computer technology (III) * Interprets capabilities and limitations of hardware, interfaces and their relationship to the outcomes of health computing (III) * Demonstrates extensive knowledge of the applications/systems currently in use (III) * Discusses concepts and uses of robotics (III) * Constructs resources to support users (III) * Discusses general knowledge of computer theory and terminology (III) * Recognizes viruses and other system risks (III) * Discusses broad knowledge of other available hardware and software (III) * Devises strategies to involve clinicians in the design, selection, implementation, and evaluation of applications and systems in health care (III) * Discusses current applications available to support clinical care (III) * Recognizes computerized diagnosis equipment (e.g., computed tomography scan, magnetic resonance imaging, digital imaging) (III) * Discusses concepts of telemedicine and Internet and their relationship to nursing (III) * Discusses bedside terminals and associated issues. such as use in sterile environments (III) * Conducts site visits of health information systems in actual use (III) * Recommends who generates, owns, and uses nursing and other data (III) * Interprets the current and projected future state of physiological monitoring (III) |
| Research | * Describes general applications available for research (II) |
| Education | * Implements and evaluates application or system training programs for users and clients (III) * Plans and develops application/system training programs for users and clients (III) * Constructs guidelines for the purchase of software and hardware (III) * Participates with practicing nurses, nurse administrators, and nurse researchers to define and develop new computer competencies (III) * Teaches users and clients about effective and ethical uses of applications and systems (III) * Serves as an informational resource person for applications/system (III) |
| Regulations | * Incorporates relevant law and regulations into informatics practice (III) |
| Usability | * Analyzes the health and safety aspects of a workstation and its location (III) * Applies human factors and ergonomics to the design of the computer screen, location and design of devices, and design of software (III) |
| Analysis | * Analyzes and refines work plans and site methodologies (III) * Constructs data elements appropriate to a given practice context (III) * Applies principles and techniques of systems analysis (III) * Discusses functional areas and how they interact with the area of interest (III) * Analyzes current computerized information and recommends enhancements (III) * Analyzes business practices to determine need for reengineering (III) * Applies principles of computing (e.g., reading an algorithm) (III) * Analyzes user areas to determine procedural errors versus hardware and software problems (III) * Interprets information flow within the organization (III) * Modifies existing applications, devices to meet changing requirements (III) * Conducts feasibility assessments throughout the information systems life cycle (III) * Prepares process flow charts to describe current and proposed information flows for all aspects of clinical systems (III) * Analyzes organizations to determine policies affecting information flow (III) * Determines problems and impediments in installing computerized information management (III) |
| Informatics Skills | Evaluation | * Assesses the accuracy of health information on the Internet (III) * Assists patients to use databases to make informed decisions (III) |
| Role | * Participates in influencing the altitudes of other nurses toward computer use for nursing practice (II) * As a clinician (nurse) participates in the selection process, design, implementation, and evaluation of systems (II) * Acts as an advocate of system users including patients or clients (II) * Markets self, system, or application to others (II) * Influences change to improve the impact of informatics on the system of care (III) * Designs strategies to manage the impact of change to information systems implementation (III) * Consults about informatics with clinical, managerial, educational, and/or research entities (III) * Develops collegial relationships with information system technical support personnel (III) * Serves as a liaison among agency departments and vendors (III) * Collaborates with nursing personnel and interdisciplinary teams to accomplish information management work (III) * Promotes understanding and effective use of information technology (III) * Makes formal presentations of project findings, recommendations, and specifications to user department managers, supervisors, and/or administrators (III) * Recommends changes in health informatics practice based upon evaluation data from nursing informatics (e.g., a validated severity of illness instrument) (III) * Recommends policies and procedures to improve the quality of nursing informatics practice (III) * Implements activities to enhance the quality of nursing informatics practice (III) * Develops recommendations to improve nursing informatics practice or outcomes (III) * Acts as a liaison to support communication among providers, patient, and technical communities (III) * Uses software tools as appropriate during the systems life cycle (III) * Provides backup support to installation personnel as required (III) * Uses knowledge of patient care processes and nursing to plan, develop, purchase, implement, maintain, and evaluate applications/systems (III) * Maintains a system perspective that encompasses the entire organization (III) * Integrates knowledge from one area to another to improve patient care, administration, education, and/or research (III) * Participates in top level decisions and policy design which impact clinical information management (III) * Conducts research to examine impacts of computer technology in nursing (III) * Conducts research to determine application needs in clinical care, education, administration, and research (III) * Conducts research in informatics (III) * Disseminates new knowledge by informing colleagues of new developments and applications in nursing or health care informatics (III) * Contributes to informatics education of students, peers and colleagues (III) |
| Systems Maintenance | * Performs basic trouble-shooting in applications (II) * Assists in the resolution of basic software problems (III) * Performs complex troubleshooting in applications (III) * Recommends solutions to application-specific problems (III) * Maintains the data dictionary and other technical support elements (III) |
| Analysis | * Designs innovative analytic techniques (IV) |
| Data | * Constructs data structures and maintains data sets (III) * Applies data structure concepts in designing a database system (III) * Determines relationships among tables in databases and performs tasks such as database normalization (III) * Integrates nursing taxonomies, unified nomenclatures, and other data needed by nurses within database design (III) * Develops procedures to establish and maintain the validity and integrity of data and databases (III) * Modifies available software programs to support data aggregation and analyses (III) * Alters a defined data structure to interface with another data structure (III) * Manages central facilities to enable data sharing (III) |
| Design and Development | * Develops screen layouts, report formats, and custom views of clinical data working directly with clinical departments and individual users (III) * Consults in the design or enhancements to integrated patient information, management, educational, or research systems (III) * Modifies the available software programs to support data analysis (III) * Participates in the development of new methods or in making modifications to improve the efficiency and/or effectiveness of data storage and its communication (III) * Coordinates the development of integrated computer-based patient record technologies (III) * Maintains database (e.g.. adding. deleting fields, structuring input for others. relational database) (III) * In-corporates established data and database management standards into database design (III) * Participates in the development of new tools for management purposes (III) * Develops methods of data communication, hardware and software integration, and data transformation (III) * Develops database structures to support clinical care, education, administration, or research (III) * Applies concepts of nursing theory and research to the design of health information applications and systems (III) * Develops databases to facilitate clinical care, education, administration, or research (III) * Develops new ways to interact with information technology and access data (III) * Assists in the development of computer applications to meet clinical, education, administration, and research requirements (III) * Applies skills in the systems life cycle to support all computer-enabled patient care activities (III) * Designs unique technology or system alternatives for clinical care, education, administration. and/or research. * Develops the conceptual model for a database (IV) |
| Evaluation | * Evaluates network capacity (III) * Evaluates existing technologies for cost effectiveness (III) * Evaluates data storage capacities of the system in use (III) * Assures that information systems used in the organization comply with standards set forth by external licensing, accreditation, and regulatory agencies (III) * Evaluates hardware, software. and vendor support (III) * Participates on interdisciplinary teams that evaluate nursing informatics practice or health informatics services (III) * Analyzes the system in use (III) * Evaluates applications supporting clinical care (including decision support), education, and administration. and/or research (IV) * Evaluates the performance and impact of information management technologies on organizational efficiency (IV) * Evaluates factors related to safety, effectiveness, cost, and social impact when developing and implementing information management technologies (IV) * Based on information management technologies evaluation data, recommends and/or modifies clinical practice enhancements (IV) * Evaluates the performance and impact of information management technologies on clinical practice, education, administration, and/or research (IV) * Develops a framework(s) for evaluating applications and system performance in clinical care, education, administration, and or research (IV) |
| Fiscal Management | * Develops strategies to obtain funding for information systems (III) * Uses strategies to optimize application use after implementation (benefits realization) (III) * Participates in budget activities for the procurement and maintenance of the system (III) * Determines the costs and benefits of computer technology used in practice, education, administration, and/or research (III) * Develops strategies to obtain research funding (IV) |
| Implementation | * Leads or participates in user groups during all phases of the systems life cycle (III) * Devises strategies for installing applications/systems (III) * Develops implementation plans and marketing materials (III) * Distinguishes implementation phases (I.e., pre-implementation, implementation, post-implementation) (III) * Applies installation tools during implementation (III) * Develops information management plans and/or work plans to support the systems life cycle (III) * Applies appropriate implementation strategies (III) * Manages the installation process (III) * Recognizes opportunities for applying information management technologies to clinical practice, education, administration, and/or research situations (III) * Devises strategies to encourage interdisciplinary use of computerized information management (III) |
| Management | * Manages terms and conditions of a contract with an information systems vendor (III) * Develops a plan for limited resources (e.g., costs, staffing, equipment) (III) * Determines project scope, objectives, and resources for each proposed application, system or enhancement (III) * Develops system testing, implementation, conversion, and backup plans (III) * Develops a strategic or long-range plan for the management of applications and systems (III) * Develops policies, procedures, and guidelines based on research (III) * Develops policies and procedures related to information systems implementation, use, and maintenance (III) * Escalates client issues and problems to the next available level of management when appropriate (III) * Communicates progress of project to appropriate personnel (III) * Applies principles and concepts of project management (III) * Functions as a project manager (III) * Designs innovative methods for project management (IV) |
| Privacy/ Security | * Develops policies related to privacy, confidentiality, and security of patient and client data (III) * Recommends procedures for achieving data integrity and security (III) * Analyzes the capability of information technology to support programs of data integrity and security (III) |
| Programming | * Identifies the more common programming languages in use today (III) * Writes an original computer program and modifies it (III) * Determines the characteristics of a good computer program (III) * Applies principles of computer programming in order to communicate with software developers (III) * Differentiates between machine and high-level programming languages (III) |
| Requirements | * Determines priorities for new requirements within budget constraints (III) * Modifies information technologies to meet changing data requirements and needs (III) * Determines new requirements according to the needs of the organization (III) * Demonstrates skills in the systems life cycle to support policies, procedures and knowledge bases related to decision making (III) * Includes client needs in requirements development (III) * Develops requirements for an integrated clinical, education, administration and/or research applications (III) * Communicates informatics needs to a systems analyst (III) * Performs needs assessment for future requirements (III) |
| System Selection | * Designs evaluation criteria and strategies for selecting applications and systems (III) * Applies ergonomics principles in the selection and use of information management technologies (III) * Participates with others in selecting applications or systems (e.g., users, vendors, system designers) (III) |
| Testing | * Develops procedures and scenarios for acceptance testing, conversions, and interface testing (III) * Conducts tests of information management applications/systems (III) |
| Training | * Produces short-term and long-term training plans (III) * Produces training materials and operating manuals tailored to the organization (III) * Delivers user training programs (III) * Evaluates user training programs (III) |
| Research | * Develops innovative and analytic techniques for scientific inquiry in nursing informatics (IV) * Develops new methods of organizing data to enhance research capacities (IV) * Develops research designs to examine impacts of computer technology in nursing (IV) * Conducts basic science research to support the theoretical development of the informatics specialty (e.g., decision making, human-computer interaction, taxonomy development) (IV) * Designs evaluation techniques to assess the quality of data and information in information systems (e.g., the validity of Internet-based patient educational content) (IV) * Applies advanced methodological and statistical techniques to the design and evaluation of computerized clinical information systems (IV) * Publishes findings from informatics-focused research to support the development of the specialty's theoretical knowledge base (IV) * Sustains an informatics-focused program of research (IV) * Applies multivariate statistical concepts to the evaluation of complex data sets to forecast quality management trends (IV) * Develops psychometrically sound instruments for use in informatics-focused research (IV) * Develops new framework(s) for use in informatics (IV) |
| Practice | * Applies advanced analysis and design concepts to the system life cycle process (IV) * Integrates domain knowledge within computerized decision support systems (IV) * Analyzes complex issues (e.g., confidentiality, privacy, data security) (IV) * Recommends policies based on analytical findings (IV) * Designs and/or evaluates enterprise-wide strategies for managing the impact of information systems implementation (IV) * Designs the structure for complex data sets (IV) * Develops new methods of organizing data to enhance research capabilities (IV) * Develops innovative methods of data communication, hardware and software integration, and data transformation (IV) * Designs unique system alternatives for clinical care, education, administration or research (IV) * Exerts leadership of interdisciplinary teams to provide strategic Information System direction (IV) * Influences top-level decisions and policy design which impact clinical information management (IV) |
| Education | * Applies sophisticated educational design and research evaluation concepts to the use of innovative computer-based education techniques (e.g., distance education) (IV) * Develops theoretically-based curricular models for nursing informatics (IV) * Evaluates the effectiveness of curricular models in nursing informatics (IV) |
| Four levels of Practicing Nurses:   1. Level 1 – Beginning Nurse 2. Level 2 – Experienced Nurse 3. Level 3 – Informatics Nurse Specialist 4. Level 4 – Informatics Innovator | | |

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| Study: A Delphi Study to Determine Informatics Competencies for Nurses at Four Levels of Practice Informatics **Authors:** Staggers, Gassert and Curran (2002)  **Number of competencies identified:** 300  This study is based on Staggers, Gassert and Curran (2002). See above for the list of 304 competencies, with the ***following differences:*** | | |
| “Develops implementation and marketing plans” were split into: | | |
| **Categories** | **Subcategories** | **Competencies** |
| Informatics Skills | Implementation | * Develops implementation plans * Develops marketing materials |
| These 5 competencies were rejected: | | |
| **Categories** | **Subcategories** | **REJECTED Competencies** |
| Computer Skills | Administration | * Uses applications for diagnostic coding |
| Basic Desktop Software | * Uses desktop publishing |
| Case Tools | * Applies computer-assisted software engineering (CASE) tools. |
| Informatics Skills | Data | * Manages central facilities to enable data sharing. |
| Programming | * Writes an original computer program and modifies it |

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| Study: Informatics Competencies for Nursing and Healthcare Leaders **Authors:** Westra and Delaney (2008)  **Number of competencies identified:** 92 *(based on Staggers et al. 2001 categories)* | | |
| **Categories** | **Subcategories** | **Competencies** |
| Computer Skills | Basic Software Applications | * Word processing software * Spreadsheet software (e.g.. Excel) * Presentation software (e.g. PowerPoint) * Internet browsers |
| Advanced Software Applications | * Forecasting * Budgeting * Human resources * Quality assurance * Staffing/Determining patient acuity * Statistical analysis * Synthesizing the whole patient picture from a multidisciplinary perspective * Planning and making decisions |
| Electronic Communications | * Composing e-mails * Sending confidential documents * Participating in group communication |
| Access Data/ Information | * Navigating systems (e.g., file servers) * Searching information retrieval systems * Distance-learning |
| Patient Related Applications | * Documenting patient assessments * Creating care plans * Documenting nursing interventions * Documenting outcomes of care * Monitoring trends in patient outcomes * Supporting patient education |
| Informatics Knowledge | Management Concepts | * Management of system implementations * Avoidance of potential negative impacts * Allocating financial resources * Inclusion of nursing information within systems * Communicating a vision about the benefits * Anticipating changes in economic and business processes * Analysis of interprofessional workflow processes * Revising processes from workflow analysis * Decisions impacting clinical IS implementation, use, and maintenance * Change management |
| Data Issues | * Health care data standards * Importance of integrating nursing data elements in systems * Importance of integrating standardized nursing languages in systems * Data quality issues * Data reporting issues |
| Information Systems Concepts | * Value of clinicians' involvement in at all appropriate phases * Strengths and limitations of applications related to software programming language or design * Strengths and limitations of applications related to hardware/ networks * Technological trends, issues and new developments as they apply to nursing * “Work arounds” and the consequences of these * Human - computer interface interactions * Ergonomics of work station, bed side * Ergonomics of adjunct technologies * Ergonomics of portable technology * Application of IS technologies to clinical practice * Application of IS technologies to administration * Application of IS technologies to clinical research situations |
| Staff Education | * Levels of informatics knowledge by roles * Methods for education |
| Clinical Research | * Evaluating internet resources * Methods for evaluation of IS implementation and use * Reuse of patient/ administrative data for research * Application of informatics research for practice |
| Ethical/ Legal Concepts | * Patients' rights r/t computerized information management * Principles of data integrity * Ethical principles for collection, maintenance, use, and dissemination of data and information * Application of HIPAA to information systems * Compliance with IRB for research with data from information systems * Policies and procedures consistent with regulatory and accrediting requirements for IS * Intellectual property, copyright, and fair use of copyrighted material |
| Informatics skills | Requirements and System Selection | * Develop project scope, objectives, and resources * Integrate patient care processes and nursing administrative functions in system requirements * Involve front-line staff in the development of system requirements * Involve front-line staff in the development of system selection * Specify system requirements based on the needs of the organization * Collaborate with interprofessional team in system selection process * Evaluate information systems in practice settings * Advocate for the development (or purchase) and use of integrated, cost-effective health information systems within the organization * Advocate new applications meet standards for interoperability |
| Financial | * Priorities are within budget constraints and organizational priorities * Alternatives for funding information systems * Costs and benefits analysis applied for in practice, education, administration, and/or research * Financial and staffing implications of ongoing updates to information systems * Actual vs budgeted costs for implementing nursing-related information systems * Collaborate with interprofessional team around financial issues |
| Implementation/ Management | * Implementation of systems consistent with the vision, mission, strategic and tactical plans * Use project management for implementation of * IS * Manage the impact of change due to IS implementation * Front-line staff are involved in appropriate aspects of design, implementation, and testing related to their practice * Improve the use of informatics within nursing practice * Collaborate with interprofessional team to manage information systems |
| Ethical/ Legal Concepts | * Access to system information * Use of data (obtaining, storing, and disseminating text, data, images, or sounds) * Access to personal health information (PHI – * HIPAA language) |
| Analysis/ Evaluation | * Consistency with organizational policies, external licensing, accreditation, and regulatory agency requirements * Ensure testing plans are evaluated at every phase of system implementation * Ensure that front-line staff (users) are involved in the evaluation of information systems * Collaborate with interprofessional team to evaluate information systems |

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| Study: Perspectives from Nurse Managers on Informatics Competencies **Authors:** Yang, Cui, Zhu, Zhao, Xiao and Shen (2014)  **Number of competencies identified:** 49  *(all 49 competencies are identical to Hart 2010)* |

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| Study: Nursing Informatics Competency Assessment for the Nurse Leader **Authors:** Yen, Phillips, Kennedy and Collins (2017)  **Number of competencies identified:** 26 | |
| **Factor** | **Competencies** |
| Strategic implementation management | * Change management for HIT * Ability to manage the effect of change because of HIT implementation * Understanding of methods for evaluation of HIT implementation and use * Ability to champion the collection, analysis, and trending of nursing data in non-nursing-dominated HIT discussions * Communicating a system and nursing vision about the benefits of HIT * Ability to evaluate, contribute, and revise project scope, objectives, and resources * Recognition of value of clinicians’ involvement in all appropriate phases of HIT * Conceptual understanding of the importance of integrating nursing data elements in HIT systems * The ability to understand regulations and transitions in policies because they relate to HIT * A conceptual understanding of nursing intervention documentation using HIT, its effect of care delivery, nursing productivity, and secondary use of information |
| Advanced information management and education | * Conceptual understanding of data quality issues for HIT * Searching information retrieval systems * Avoidance of potential negative impacts of HIT   Understanding of methods for HIT education   * Ability to understand technological trends, issues, and new HIT developments because they apply to nursing |
| Executive planning | * Ability to define (in collaboration with the IT department) TCO containment strategies and hidden costs on HIT implementation (ie, education, system maintenance, upgrade, support staffing requirements, and physical plant change) * Ability to define (in collaboration with the IT department) TCO specifically when it relates to the * HIT-related cost of staff education and re-education related to upgrades and staff turnover * Ability to function in a strategic capacity for HIT and not at a functional or recommender role * Ability to collaborate with CMO peers related to HIT and needs of nurses and physicians |
| Ethical and legal concepts | * Understanding of patients’ rights related to HIT and computerized patient data * Understanding of ethical principles for collection, maintenance, use, and dissemination of data and information related to HIT |
| Information systems concepts | * Ability to conceptually understand how to define, design (create a schematic), and implement an * HIT solution to achieve overarching nursing workflows * Ability to standardize nursing process and automate workflow related to HIT * Ability to understand HIT Bwork – arounds [ and the consequences of human-computer interface interactions |
| Requirements and system selection | * Ability to integrate patient care processes and nursing administrative functions in HIT system requirements * Ability to assure that nursing values/requirements are represented in HIT selection and evaluation |

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| Study: Nursing Informatics Competencies | | |
| **Authors:** Grobe (1989) | | |
| **Number of competencies identified:** 24 | | |
| **Nursing Role** | **Major Function** | **Competencies** |
| Practicing nurse | Documents Nursing Practice | * Knows the type of system in use (I) * Analyzes the system in use (II) * Participates in designing and developing systems for nursing practice functions and serves as an innovator of applications for care and practice (III) |
| Accesses Information | * Understands the data structures and accesses data used locally for patient care (I) * Knows other sources of data that relate to practice and care; and, accesses and uses them as well (II) * Develops new ways to interact with computer systems and to access data (III) |
| Nurse administrator: | Directs the organization of information | * Can identify the requirements of an integrated patient care system and knows the steps of implementation (I) * Evaluates and analyzes the impact of an integrated patient care system on the organization and efficiency of service delivery (II) * Participates and consults in the design or enhancements of the integrated patient information systems (III) |
| Maintains ethical standards | * Is familiar with the principles of data integrity, professional ethics and legal requirements and understands ways to protect data (I) * Monitors and evaluates the capacity of the system to protect data and monitors ethical standards (II) * Participates in the development and integration of security and data protection protocols for systems and personnel files (III) |
| Nurse teacher | Teaches with the computer | * Prepares instructional materials with existing software (I) * Evaluates strengths and weaknesses of hardware and software available to assist teachers (II) * Deisgns, develops and implements hardware and software systems or instructional support activities (III) |
| Performs student assessments | * Uses software for student assessment (I) * Evaluates and modifies software to assist in assessing student performance (II) * Designs, develops and implements hardware and software systems for student assessment and evaluation (III) |
| Nurse researcher | Accesses, communicates and stores data | * Accesses shared data sets for multicenter research (I) * Transmits and receives research documents electronically (II) * Organizes and directs central facilities for shared data sets (III) |
| Manages and manipulates data | * Accesses and extracts data from clinical sets (I) * Uses clinical data sources and modifies data structures for clinical research (II) * Designs and/or develops data based structures to facilitate clinical research (III) |
| Competency levels within each function are as follows:   1. Level I: User (able to use the tool) 2. Level II: Modifier (able to participate knowledgably in development) 3. Level III: Innovator (able to direct computer system development and implementation, and/or serve as a knowledgeable consultant, evaluator or researcher) | | |