

**Results of a Delphi Study to Determine Informatics Competencies for Nurses
at Four Levels of Practice**

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**Results of a Delphi Study to Determine Informatics Competencies for
Nurses
at Four Levels of Practice**

The final master list of valid competencies for the four levels of nursing practice is as follows:

Level 1 Beginning Nurse

Computer Skills - Administration

- Uses administrative applications for practice management (e.g., searches for patient, retrieves demographics, billing data)
- Uses applications for structured data entry (e.g., patient acuity or classification applications)

Computer Skills – Communication (email, internet, telecommunications)

- Uses telecommunication devices (e.g., modems or other devices) to communicate with other systems (e.g., access data, upload, download)
- Use e-mail (e.g., create, send, respond, use attachments)
- Uses the Internet to locate, download items of interest (e.g., patient, nursing resources)

Computer Skills – Data access

- Uses sources of data that relate to practice and care
- Accesses, enters, and retrieves data used locally for patient care (e.g., uses HIS, CIS for plans of care, assessments, interventions, notes, discharge planning)
- Uses database applications to enter and retrieve information
- Conducts on-line literature searches

Computer Skills - Documentation

- Uses an application to document patient care
- Uses an application to plan care for patients to include discharge planning
- Uses an application to enter patient data (e.g., vital signs)

Computer Skills – Education

- Uses information management technologies for patient education (e.g., identifies areas for instruction, conducts education, evaluates outcomes, resources)

Computer Skills-Monitoring

- Uses computerized patient monitoring systems

Computer Skills – Basic Desktop Software

- Uses multimedia presentations
- Uses word processing
- Demonstrates keyboarding (typing) skills

Computer Skills - Systems

- Uses networks to navigate systems (e.g., file servers, www)
- Operates peripheral devices (e.g., bedside terminals, hand-helds)
- Uses operating systems (e.g., copy, delete, change directories)
- Uses existing external peripheral devices (e.g., CD-ROMs, zip drives)
- Uses computer technology safely

Level 1 Beginning Nurse, cont.

- Is able to navigate Windows (e.g., manipulate files using file manager, determine active printer, access installed applications, create & delete directories)
- Identifies the appropriate technology to capture the required patient data (e.g., fetal monitoring device)
- Demonstrates basic technology skills (e.g., turn computer off & on, load paper, change toner, remove paper jams, print documents)

Informatics Knowledge – Data

- Recognizes the use and/or importance of nursing data for improving practice

Informatics Knowledge - Impact

- Recognizes that a computer program has limitations due to its design and capacity of the computer
- Recognizes that it takes time, persistent effort, and skill for computers to become an effective tool
- Recognizes that health computing will become more common
- 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
- Recognizes that one does not have to be a computer programmer to make effective use of the computer in nursing

Informatics Knowledge – Privacy/security

- Seeks available resources to help formulate ethical decisions in computing
- Describes patients' rights as they pertain to computerized information management

Informatics Knowledge - Systems

- Recognizes the value of clinicians' involvement in the design, selection, implementation, and evaluation of applications, systems in health care
- Describes the computerized or manual paper system that is present
- Explains the use of networks for electronic communication (e.g., Internet)
- Identifies the basic components of the current computer system (e.g., features of a PC, workstation)

Level 2 Experienced Nurse

Computer Skills - Administration

- Uses administrative applications for forecasting
- Uses administrative applications for budget
- Uses applications to manage aggregated data
- Uses administrative applications for staff scheduling
- Uses administrative applications for maintaining employee records

Computer Skills – Education

- Uses applications to develop testing materials
- Uses applications for curriculum planning
- Evaluates CAI as a teaching tool

Computer Skills-data access

- Accesses shared data sets
- Extracts data from clinical data sets
- Extracts selected literature resources and integrates them to a personally usable file

Computer Skills-Monitoring

- Applies monitoring system appropriately according to the data needed

Computer Skills-Quality improvement

- Uses data and statistical analyses to evaluate practice and perform quality improvement

Computer Skills-Research

- Uses computer applications for statistical analysis and nursing research

Informatics Knowledge – Data

- Supports efforts toward development and use of a unified nursing language
- Promotes the integrity of nursing information and access necessary for patient care within an integrated computer-based patient record
- Provides for efficient data collection

Informatics Knowledge - Research

- Describes general applications available for research

Informatics Knowledge - Impact

- Defines the impact of computerized information management on the role of the nurse

Informatics Knowledge – Privacy/security

- Discusses the principles of data integrity, professional ethics and legal requirements
- Describes ways to protect data

Informatics Knowledge -Systems

- Describes general applications to support administration (e.g., staffing, budget)
- Describes general applications, systems to support clinical care
- Describes general applications to support nursing education
- Discusses CAI as a teaching and learning tool

Level 2 Experienced Nurse, cont.**Informatics Skills - Evaluation**

- Assesses the accuracy of health information on the Internet
- Assists patients to use databases to make informed decisions

Informatics Skills - Role

- Participates in influencing the attitudes of other nurses toward computer use for nursing practice
- As a clinician (nurse), participates in the selection process, design, implementation, and evaluation of systems
- Acts as an advocate of system users including patients or clients
- Markets self, system or application to others

Informatics Skills – Systems Maintenance

- Performs basic trouble-shooting in applications

Level 3 Informatics Specialist

Computer Skills-Basic Desktop Software

- Develops or modifies spreadsheets used for complex problems
- Writes macros, shortcuts for spreadsheets

Computer Skills-Project Management

- Manages projects with project management software

Computer Skills-Quality Improvement

- Determines data indicators used to monitor quality and effectiveness of nursing informatics practice
- Collects data to monitor quality and effectiveness of nursing informatics practice
- Determines aspects of nursing informatics practice important for quality monitoring

Computer Skills - Systems

- Has the ability to integrate different applications or programs
- Uses utility programs for data recovery and system performance indices

Informatics Knowledge-Data

- Demonstrates fluency in informatics and nursing terminologies
- Supports integration of a unified nursing language with the standardized language developed in collaboration with other health care disciplines
- Recognizes the capacity for data aggregation and integration

Informatics Knowledge-Education

- Implements and evaluates application/system training programs for users and clients
- Plans and develops application/system training programs for users, clients
- Constructs guidelines for the purchase of software and hardware
- Participates with practicing nurses, nurse administrators, and nurse researchers to define and develop new computer competencies
- Teaches users/clients about effective and ethical uses of applications and systems
- Serves as an informational resource person for applications/system

Informatics Knowledge-Impact

- Determines the impact of computerized information management on managers and executive roles
- Interprets current legislation, research, and economics affecting computerized information management in health care
- Assesses current capabilities and limitations of technology (e.g., data transfer rates, chip capacity)
- Determines projected impacts to users and organizations when changing to computerized information management
- Determines the reasons for slow response time (e.g., heavy demands on computer system at time of shift change)
- Discusses new careers available to informaticists
- Determines the social, legal, and ethical impacts of changing to computerized information management
- Discusses the interdependencies computerized information management creates (e.g., changes when MD enters own orders)
- Determines the limitations, reliability of computerized patient monitoring systems

Level 3 Informatics Specialist, cont.

- Applies strategies for change management to produce satisfied and productive users
- Determines the impact of information management technologies on therapeutic outcomes and quality of care
- Discusses the computer's effect on cost of health care
- Interprets the benefits and risks of computerized information management
- Interprets research findings about the impact of computerized information management on clinical practice, educational, administration &/or research
- Analyzes the impacts of information management technologies on time allocation and tasks of care
- Interprets the impact of computerized information management on nursing education

Informatics Knowledge –Privacy/security

- Interprets copyright issues in computing
- Discusses features, capabilities and scope of user passwords
- Devises strategies to protect the confidentiality of computerized information
- Differentiates issues surrounding confidentiality in computerized information management

Informatics Knowledge -Regulations

- Incorporates relevant law and regulations into informatics practice

Informatics Knowledge -Systems

- Explains various input and output devices
- Applies theories that influence computerization in health care
- Discusses computer fundamentals (hardware, software, networks, data communications)
- Projects health care computing trends in nursing
- Evaluates applications/systems available in health care
- Differentiates significant highlights in the evolution of computer technology
- Interprets capabilities and limitations of hardware, interfaces and their relationship to the outcomes of health computing
- Demonstrates extensive knowledge of the applications/systems currently in use
- Constructs resources to support users
- Discusses general knowledge of computer theory and terminology
- Recognizes viruses and other system risks
- Discusses broad knowledge of other available hardware and software
- Devises strategies to involve clinicians in the design, selection, implementation, and evaluation of applications and systems in health care
- Discusses current applications available to support clinical care
- Discusses concepts of telemedicine and Internet and their relationship to nursing
- Discusses bedside terminals and associated issues such as use in sterile environments
- Conducts site visits of health information systems in actual use
- Recommends who generates, owns, and uses nursing and other data
- Interprets the current and projected future state of physiological monitoring

Informatics Knowledge-Usability

- Analyzes the health and safety aspects of the work station and its location
- Applies human factors and ergonomics to the design of the computer screen, location and design of devices, and design of software

Level 3 Informatics Specialist, cont.
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Informatics Skills-Analysis

- Develops and implements work plans during application development and implementation
- Constructs data elements appropriate to a given practice context
- Applies principles and techniques of systems analysis
- Discusses functional areas and how their information flow interacts with an area being evaluated
- Analyzes current computerized information and recommends enhancements
- Analyzes business practices to determine need for reengineering the information flow
- Applies principles of computing (e.g., reading an algorithm)
- Analyzes user areas to determine procedural errors versus hardware and software problems
- Interprets information flow within the organization
- Modifies existing applications, devices to meet changing requirements
- Conducts feasibility assessments throughout the information systems life cycle
- Prepares process flow charts to describe current and proposed information flows for all aspects of clinical systems
- Analyzes organizations to determine policies affecting information flow
- Determines problems and impediments in installing computerized information management

Informatics Skills -Data / Data Structures

- Constructs data structures and maintains data sets
- Applies data structure concepts in designing a database system
- Determines relationships among tables in databases and performs tasks such as database normalization
- Integrates nursing taxonomies, unified nomenclatures, and other data needed by nurses within database design
- Develops procedures to establish and maintain the validity and integrity of data and databases
- Modifies available software programs to support data aggregation and analyses
- Alters a defined data structure to interface with another data structure

Informatics Skills-Design, Development

- Develops screen layouts, report formats and custom views of clinical data working directly with clinical departments and individual users
- Consults in the design or enhancements to integrated patient information, management, educational or research systems
- Participates in the development of new methods or in making modifications to improve the efficiency and/or effectiveness of data storage and its communication
- Coordinates the development of integrated computer-based patient record technologies
- Maintains database (e.g., adding, deleting fields, structuring input for others, relational database)
- Incorporates established data and database management standards into database design
Participates in the development of new tools for management purposes
- Develops methods of data communication, hardware and software integration, and data transformation
- Develops database structures to support clinical care, education, administration or research
- Applies concepts of nursing theory and research to the design of health information applications and systems
- Develops databases to facilitate clinical care, education, administration or research
- Develops new ways to interact with information technology and access data
- Assists in the development of computer applications to meet clinical, education, administration and research requirements

Level 3 Informatics Specialist, cont.

- Applies skills in the systems life cycle to support all computer-enabled patient care activities.

Informatics Skills - Evaluation

- Evaluates existing technologies for cost-effectiveness
- Evaluates data storage capacities of the system in use
- Assures that information systems used in the organization comply with standards set forth by external licensing, accreditation & regulatory agencies
- Evaluates hardware, software, and vendor support
- Participates on interdisciplinary teams that evaluate nursing informatics practice or health informatics services
- Analyzes the system in use

Informatics Skills – Fiscal Management

- Develops strategies to obtain funding for information systems
- Uses strategies to optimize application use after implementation (benefits realization)
- Participates in budget activities for the procurement and maintenance of the system
- Determines the cost-benefit of computer technology used in practice, education, administration and/or research

Informatics Skills –Implementation

- Leads or participates in user groups during all phases of the systems life cycle
- Devises strategies for installing applications/systems
- Develops implementation plans
- Distinguishes implementation phases (i.e., pre-implementation, implementation, post-implementation)
- Applies installation tools during implementation
- Develops information management plans and/or work plans to support the systems life cycle
- Applies appropriate implementation strategies
- Manages the installation process
- Recognizes opportunities for applying information management technologies to clinical practice, education, administration and/or research situations
- Devises strategies to encourage interdisciplinary use of computerized information management

Informatics Skills –Management

- Manages terms and conditions of a contract with an information systems vendor
- Develops a plan for limited resources (e.g., costs, staffing, equipment)
- Determines project scope, objectives, and resources for each proposed application, system or enhancement
- Develops system testing, implementation, conversion, and backup plans
- Develops a strategic or long-range plan for the management of applications and systems
- Develops policies, procedures and guidelines based on research
- Develops policies and procedures related to information systems implementation, use, and maintenance
- Escalates client issues and problems to the next available level of management when appropriate
- Communicates progress of project to appropriate personnel
- Applies principles and concepts of project management
- Functions as a project manager

Level 3 Informatics Specialist, cont.
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Informatics Skills – Privacy/security

- Develops policies related to privacy, confidentiality and security of patient and client data
- Recommends procedures for achieving data integrity and security
- Analyzes the capability of information technology to support programs of data integrity and security

Informatics Skills -Programming

- Determines the characteristics of a good computer program
- Applies principles of computer programming in order to communicate with software developers
- Differentiates between machine and high-level programming languages

Informatics Skills -Requirements

- Determines priorities for new requirements within budget constraints
- Modifies information technologies to meet changing data requirements/needs
- Determines new requirements according to the needs of the organization
- Demonstrates skills in the systems life cycle to support policies, procedures and knowledge bases in organizations
- Includes client needs in requirements development
- Develops requirements for an integrated clinical, education, administration and/or research applications
- Communicates informatics' needs to a systems analyst
- Performs needs assessment for future requirements

Informatics Skills-Role

- Influences change to improve the impact of informatics on the system of care
- Designs strategies to manage the impact of change to information systems implementation ...
- Consults about informatics with clinical, managerial, educational, and/or research entities
- Develops collegial relationships with information system technical support personnel
- Serves as a liaison among agency departments and vendors
- Collaborates with nursing personnel and interdisciplinary teams to accomplish information management work
- Promotes understanding and effective use of information technology
- Makes formal presentations of project findings, recommendations, and specifications to user department managers, supervisors, and/or administrators
- Recommends changes in health informatics practice based upon evaluation data from nursing informatics (e.g., a validated severity of illness instrument)
- Recommends policies and procedures to improve the quality of nursing informatics practice
- Implements activities to enhance the quality of nursing informatics practice
- Develops recommendations to improve nursing informatics practice or outcomes
- Acts as a liaison to support communication among providers, patient, and technical communities
- Uses software tools as appropriate during the systems life cycle
- Provides backup support to installation personnel as required
- Applies knowledge of patient care processes to systems and their life cycle
- Maintains a system perspective that encompasses the entire organization
- Integrates knowledge from other informatics disciplines with nursing to improve patient care, administration, education and/or research

- Participates in top level decisions and policy design which impact clinical information management

Level 3 Informatics Specialist, cont.

- Conducts research to examine impacts of computer technology in nursing
- Conducts research to determine application needs in clinical care, education, administration and research
- Conducts research in informatics
- Disseminates new knowledge by informing colleagues of new developments and applications in nursing or healthcare informatics
- Contributes to informatics education of students, peers and colleagues

Informatics Skills -Systems Maintenance

- Assists in the resolution of basic software problems
- Performs complex trouble-shooting in applications
- Recommends solutions to application-specific problems
- Maintains the data dictionary and other technical support elements

Informatics Skills – System Selection

- Designs evaluation criteria and strategies for selecting applications and systems
- Applies ergonomics principles in the selection and use of information management technologies
- Participates with others in selecting applications or systems (e.g., users, vendors, system designers)

Informatics Skills-Testing

- Develops procedures and scenarios for acceptance testing, conversions, and interface testing
- Conducts tests of information management applications, systems

Informatics Skills-Training

- Produces short-term and long-term training plans
- Produces training materials and operating manuals tailored to the organization
- Delivers user training programs
- Evaluates user training programs

Level 4 Informatics Innovator

Computer Skills-Simulation

- Develops models for simulation purposes

Informatics Knowledge - Education

- Evaluates informatics competencies required for specific role functions for the practicing nurse, nurse administrator and others

Informatics Knowledge - Impact

- Evaluates the changing role of educator when computerized information management is introduced

Informatics Skills – Analysis

- Designs innovative analytic techniques

Informatics Skills – Design, Development

- Designs unique technology or system alternatives for clinical care, education, administration and/or research
- Develops the conceptual model for a database

Informatics Skills - Evaluation

- Evaluates the performance and impact of information management technologies on organizational efficiency
- Evaluates factors related to safety, effectiveness, cost and social impact when developing and implementing information management technologies
- Based upon information management technologies evaluation data, recommends and/or modifies clinical practice enhancements
- Evaluates the performance and impact of information management technologies on clinical practice, education, administration &/or research
- Develops a framework(s) for evaluating applications and system performance in clinical care, education, research, and/or administration

Informatics Skills –Fiscal Management

- Develops strategies to obtain research funding

Informatics Skills – Management

- Designs innovative methods for project management

Research

- Develops innovative and analytic techniques for scientific inquiry in nursing informatics
- Develops new methods of organizing data to enhance research capacities
- Develops research designs to examine impacts of computer technology in nursing.
- Conducts basic science research to support the theoretical development of the informatics specialty (e.g., decision-making, human-computer interaction, taxonomy development, etc.)
- Designs evaluation techniques to assess the quality of data and information in information systems (e.g., the validity of Internet-based patient educational content).
- Applies advanced methodological and statistical techniques to the design and evaluation of computerized clinical information systems

Level 4 Informatics Innovator, cont.

- Publishes findings from informatics-focused research to support the development of the specialty's theoretical knowledge base
- Sustains an informatics-focused program of research
- Applies multivariate statistical concepts to the evaluation of complex data sets to forecast quality management trends
- Develops psychometrically sound instruments for use in informatics-focused research.
- Develops new framework(s) for use in informatics

Practice

- Applies advanced analysis and design concepts to the system life cycle process
- Integrates domain knowledge within computerized decision support systems
- Analyzes complex issues (e.g., confidentiality, privacy, and data security)
- Recommends policies based upon analytical findings
- Designs and/or evaluates enterprise-wide strategies for managing the impact of information systems implementation
- Designs the structure for complex data sets
- Develops new methods of organizing data to enhance research capabilities
- Develops innovative methods of data communication, hardware and software integration, and data transformation
- Designs unique system alternatives for clinical care, education, administration or research
- Exerts leadership of interdisciplinary teams to provide strategic IS direction
- Influences top-level decisions and policy design which impact clinical information management

Education

- Applies sophisticated educational design and research evaluation concepts to the use of innovative computer-based education techniques (e.g., distance education)
- Develops theoretically-based curricular models for nursing informatics

Other Results

Overall, 24 competencies were not approved. The following 5 competencies were rejected:

Experienced Nurse

- Uses applications for diagnostic coding
- Uses desktop publishing

Nurse Informatics Specialist

- Applies computer-assisted software engineering (CASE) tools
- Manages central facilities to enable data sharing
- Writes an original computer program and modifies it

The competency “writes an original computer program and modifies it” was rejected early during round 1. The other 4 competencies did not reach consensus (an 80% agreement) to discard them until round 3.

Six competencies were valid competencies, but no agreement on a practice level was reached. One of these 6 competencies achieved the 80% threshold of agreement that it was at the wrong level, but still did not reach agreement on a correct level. This competency was “uses authoring tools to develop CAI for students, nurses and/or patients.” It was originally at the experienced nurse level; 77% of the respondents placed this competency at the informatics specialist level. The other five valid competencies not reaching consensus about a level were:

- Recognizes computerized diagnosis equipment (e.g., CAT scan, MRI, digital imaging) (originally at the informatics specialist level)
- Conducts research to examine impacts of computer technology in nursing (originally at the informatics specialist level)
- Conducts research in informatics (originally at the informatics specialist level)
- Teaches informatics competencies required for specific role functions for the practicing nurse, the nurse administrator (originally at the nurse innovator level)
- Evaluates applications supporting clinical care (including decision support), education, administration and/or research (originally at the nurse innovator level)

There were no competencies that changed levels of practice as a result of the Delphi study.

The following 13 items did not reach agreement as valid competencies:

Level 1: Beginning Nurse

- Locates and evaluates patient support groups or chat rooms on the Internet
- Uses a database management program to develop a simple database and/or table
- Uses decision support systems, expert systems, and aids for clinical decision-making or differential diagnosis
- Uses computer-assisted instruction (CAI)
- Uses presentation graphics (e.g., PowerPoint) to create slides, displays
- Uses spreadsheets

Level 3: Informatics Specialist

- Discusses the mathematical models underlying the fiscal management system or spreadsheet
- Applies simulation models
- Discusses concepts and uses of robotics
- Evaluates network capacity
- Modifies the available software programs to support data analysis
- Develops marketing materials
- Identifies the more common programming languages in use today

The results of this Delphi study created a master list of informatics competencies for nurses at four levels of practice. Please see the full length article in Nursing Research for the discussion and conclusions about this work.