

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

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Nancy Staggers, PhD, RN, FAAN
Associate Chief Information Officer, Information Technology Services
and Associate Professor, Clinical Informatics
University of Utah
421 Wakara Way, Suite 204
Salt Lake City, UT 84108
nancy.staggers@hsc.utah.edu
801.581.6702

Carole A. Gassert, PhD, RN, FAAN, FACMI*
Associate Professor, College of Nursing
University of Utah
Carole.gassert@nurs.utah.edu
801.581.3559

Christine Curran, PhD, RN, CNA
Associate Professor, Clinical
College of Nursing
The Ohio State University and
Director, Nursing Informatics and Research
The Ohio State University Medical Center
Columbus, Ohio
Curran.68@osu.edu
614-292-6217

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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.

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.
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- 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.