Scope AND
Standards
OF PRACTICE

Nursing Informatics

2ND EDITION

NURSING STANDARDS

ANA Standards of Nursing Informatics Practice

The Standards of Practice for Nursing Informatics describe a competent level of nursing care as demonstrated by the critical thinking model known as the nursing process. The nursing process includes the components of assessment, diagnosis, outcomes identification, planning, implementation, and evaluation. Accordingly, the nursing process encompasses significant actions taken by nursing informatics nurses and forms the foundation of the nurse's decision-making.

Standards of Practice for Nursing Informatics Nursing

Standard 1. Assessment
The informatics nurse collects comprehensive data, information, and emerging evidence pertinent to the situation.

Standard 2. Diagnosis, Problems, and Issues Identification
The informatics nurse analyzes assessment data to identify diagnoses, problems, issues, and opportunities for improvement.

Standard 3. Outcomes Identification
The informatics nurse identifies expected outcomes for a plan individualized to the healthcare consumer or to the situation.

Standard 4. Planning
The informatics nurse develops a plan that prescribes strategies, alternatives, and recommendations to attain expected outcomes.

Standard 5. Implementation
The informatics nurse implements the individualized plan.

Standard 5A. Coordination of Activities
The informatics nurse coordinates planned activities.

Standard 5B. Health Teaching and Health Promotion
The informatics nurse employs informatics solutions and strategies for education and teaching to promote health and a safe environment.

Standard 5C. Consultation
The informatics nurse provides consultation to influence the identified plan, enhance the abilities of others, and effect change.

Standard 6. Evaluation
The informatics nurse evaluates progress toward attainment of outcomes.

ANA
AMERICAN NURSES ASSOCIATION

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Scope AND
Standards
OF PRACTICE

Nursing Informatics: Scope and Standards of Practice

Second Edition

American Nurses Association
Silver Spring, Maryland
2015

The American Nurses Association (ANA) is a national professional association. This publication, *Nursing Informatics: Scope and Standards of Practice, Second Edition,* reflects the thinking of the practice specialty of nursing informatics on various issues and should be reviewed in conjunction with state board of nursing policies and practices. State law, rules, and regulations govern the practice of nursing, while *Nursing Informatics: Scope and Standards of Practice, Second Edition,* guides informatics nurses in the application of their professional skills and responsibilities.

The American Nurses Association is the only full-service professional organization representing the interests of the nation's 3.1 million registered nurses through its constituent/state nurses associations and its organizational affiliates. The ANA advances the nursing profession by fostering high standards of nursing practice, promoting the rights of nurses in the workplace, projecting a positive and realistic view of nursing, and by lobbying the Congress and regulatory agencies on healthcare issues affecting nurses and the public.

American Nurses Association
8515 Georgia Avenue, Suite 400
Silver Spring, MD 20910-3492
1-800-274-4ANA
http://www.Nursingworld.org

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Contributors

Work Group Members

William Donovan, MA, RN, Chairperson

Linda Dietrich, MSN, RN-BC, PMP, CPHQ

Sandra Blair Ekimoto, MBA, BS, RN

Paulette Fraser, MS, RN-BC

Sharon Giarrizzo-Wilson, MS, RN-BC, CNOR

Linda Harrington, PhD, DNP, RN-BC, CNS, CPHQ, CENP, CPHIMS, FHIMSS

Luann Whittenburg, PhD, RN-BC, FNP-BC, CPHQ, CPHIMS

Kathleen "Katie" Hoy Johnson, DNP, RN-BC, NCSN

Mary Lynn McHugh, PhD, RN

Leigh Ann Chandler Poole, PhD, RN, FNP-BC, CRNP, CTCP, CTC

Cheryl D. Parker, PhD, RN-BC, FHIMSS

Troy Seagondollar, MSN-I, RN-BC

Nadia Sultana, DNP, MBA, RN-BC

Advisory Group Members

Theresa L. Calderone, EdD, Med, MSN, RN-BC

Lory J. Maddox, MSN, MBA, RN

Susan A. Matney, MSN, RN, FAAN

Darla Shehy, MSN, RN

Rhonda Struck, BSN, RN, MS

American Nurses Association Staff

Carol Bickford, PhD, RN-BC, CPHIMS, FAAN

Maureen Cones, Esq.

Eric Wurzbacher, BA

Yvonne Humes, MSA

About the American Nurses Association

The American Nurses Association (ANA) is the only full-service professional organization representing the interests of the nation's 3.1 million registered nurses through its constituent/state nurses associations and its organizational affiliates. The ANA advances the nursing profession by fostering high standards of nursing practice, promoting the rights of nurses in the workplace, projecting a positive and realistic view of nursing, and by lobbying the Congress and regulatory agencies on healthcare issues affecting nurses and the public.

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The Scope of Nursing Informatics Practice

Introduction

The American Nurses Association (ANA) identified nursing informatics as a nursing specialty in 1992. The first scope of practice statement for this specialty, *Scope of Practice for Nursing Informatics*, was published in 1994, followed by the 1995 release of an accompanying resource, *Standards of Practice for Nursing Informatics*. Those early publications were replaced in 2001 by the *Scope and Standards of Nursing Informatics Practice,* which combined both the scope and standards of practice into one document and created an enhanced and more robust definition of nursing informatics to reflect the contemporary healthcare informatics environment. The 2008 *Nursing Informatics: Scope and Standards of Practice* followed with a slightly revised specialty definition of nursing informatics and inclusion of an expanded presentation of competencies for the informatics nurse and informatics nurse specialist.

The publication of this second edition of *Nursing Informatics: Scope and Standards of Practice* is the culmination of an 18-month-long intensive professional review and revision initiative hosted by ANA. Dedicated workgroup members with more than 280 person-years of nursing and informatics expertise met at least twice a month via telephone conference calls from April 2013 until the final draft was completed in July 2014. Weekly meetings became the norm as the workgroup members evaluated every response received from the 30-day public comment period. The final draft completed a two-step ANA review process with examination by the ANA Committee on Nursing Practice Standards and final approval by the Board of Directors.

Definition of Nursing Informatics

Nursing informatics (NI) is the specialty that integrates nursing science with multiple information and analytical sciences* to identify, define, manage, and

* A listing of sciences that integrate with nursing informatics includes, but is not limited to: computer science, cognitive science, the science of terminologies and taxonomies (including naming and coding conventions), information management, library science, heuristics, archival science, and mathematics.

communicate data, information, knowledge, and wisdom in nursing practice. NI supports nurses, consumers, patients, the interprofessional healthcare team, and other stakeholders in their decision-making in all roles and settings to achieve desired outcomes. This support is accomplished through the use of information structures, information processes, and information technology.

The nursing informatics specialty and its constituent members contribute to achieving the goal of improving the health of populations, communities, groups, families, and individuals. Supporting activities include, but are not limited to, the identification of issues and the design, development, and implementation of effective informatics solutions and technologies within the clinical, administrative, educational, and research domains of practice.

Metastructures, Concepts, and Tools of Nursing Informatics

Metastructures: Data, Information, Knowledge, and Wisdom

In the mid-1980s, Blum (1986) introduced the concepts of data, information, and knowledge as a framework for understanding clinical information systems and their impact on health care. Blum classified clinical information systems according to the three types of objects that these systems processed: data, information, and knowledge. Blum noted that the classification was artificial, with no clear boundaries, although the categories did represent a scale of increasing complexity.

In 1989, Graves and Corcoran built on these ideas in their seminal study of nursing informatics using the concepts of data, information, and knowledge. They contributed two general principles to NI: a definition of nursing informatics that has been widely accepted in the field, and an information management model that identified data, information, and knowledge as key components of NI practice (Figure 1).

Drawing from Blum's 1986 work, Graves and Corcoran defined the three concepts as follows:

- *Data* are discrete entities that are described objectively without interpretation.
- *Information* is data that have been interpreted, organized, or structured.
- *Knowledge* is information that is synthesized so that relationships are identified and formalized.

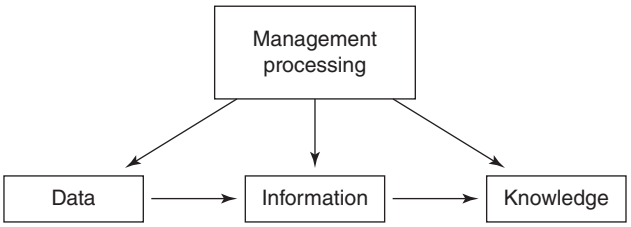

Figure 1. Conceptual Framework for the Study of Nursing Knowledge
Source: Graves & Corcoran (1989). Reprinted with permission of the publisher.

Data, information, and knowledge are of value to nurses in all areas of practice. Data may be obtained from multiple sources; the data are processed into information and then into knowledge. For example, data derived from direct care of an individual can be compiled across disease states and then aggregated for decision-making by nurses, nurse administrators, or other health professionals. Further aggregation can encompass geographical populations. Nurse educators can create case studies using these data, and nurse researchers can access the aggregated data for systematic study.

The appropriate use of knowledge involves the integration of empirical, ethical, personal, and aesthetic knowledge into actions. The individual must apply a high level of empirical knowledge in understanding the current situation, apply a professional value system in considering possible actions, be able to predict the potential outcome of these actions with a high level of accuracy, and then have the means to carry out the selected action in the given environment.

Wisdom is defined as the appropriate use of knowledge to manage and solve human problems. It consists of knowing when and how to apply knowledge to deal with complex problems or specific human needs (Nelson & Joos, 1989; Nelson, 2002; Nelson & Staggers, 2014). Whereas knowledge focuses on what is known, wisdom focuses on the appropriate application of that knowledge and an appreciation of the consequences of selected actions. For example, a knowledge base may include several options for managing an anxious family; wisdom involves nursing judgment about which of these options is most appropriate for a specific family, and use of that option in the care of that family.

An example can help distinguish data, information, knowledge, and wisdom. If a nurse receives the list of numbers, 28, 68, 94, 98, and 110, those raw numbers are certainly data, but they are meaningless. If, however, the numbers are ordered, structured, and identified as follows: T 98°, P 94, R 28, and BP 110/68, the nurse recognizes this series as measurements of vital signs and will regard those numbers as information. Nevertheless, the nurse

must be able to place these measures in the context of a particular patient's situation in order to interpret the meaning of those values. If these vital signs were obtained from a newborn, they mean one thing; if they were obtained from an adult, they have a very different meaning. The nurse's knowledge of normal vital sign values for different types of patients, and the condition of the patient from whom the numbers were obtained, provide a context within which the nurse can interpret the information. Then the nurse will know if the numbers represent a normal, expected result or an abnormal, even pathological result. The numbers must be placed in a particular context so that the nurse can take appropriate clinical action, thereby demonstrating "knowledge-in-use" or wisdom.

Figure 2 builds on the work of Graves and Corcoran by depicting the relationship of data, information, knowledge, and wisdom. As data are

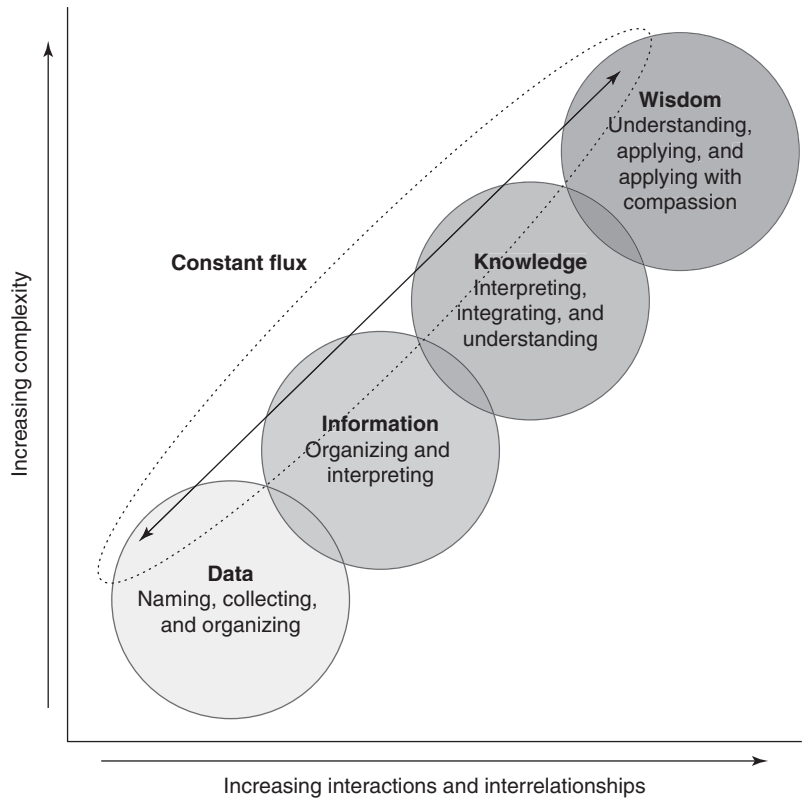

Figure 2. The Relationship of Data, Information, Knowledge, and Wisdom

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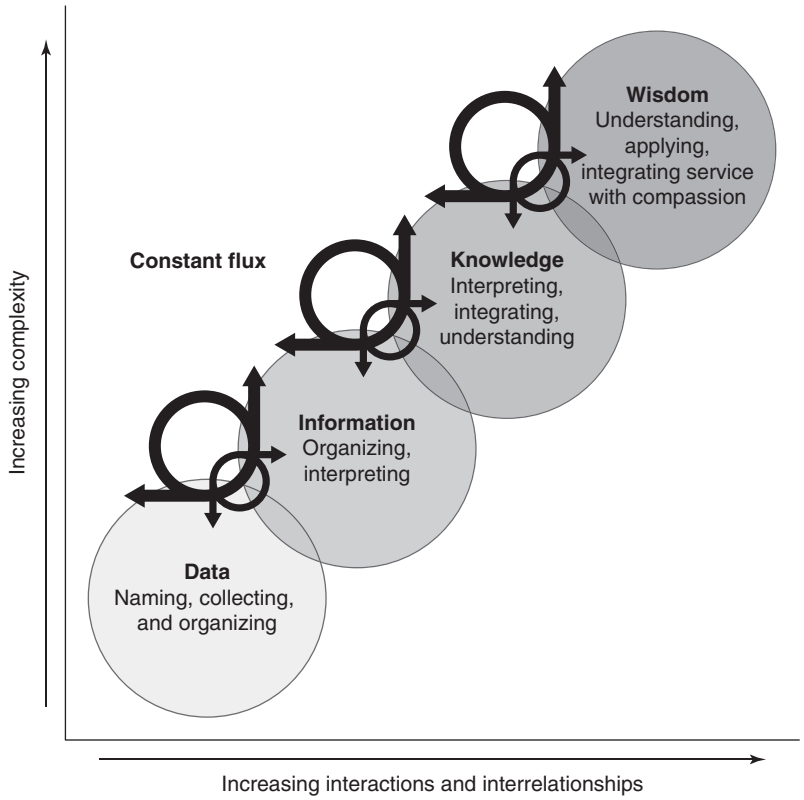

Figure 3. Revised Data Information Knowledge Wisdom (DIKW) Model—2013 Version

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transformed into information and information into knowledge, each level increases in complexity and requires greater application of human intellect. The x-axis represents interactions within and the interrelationships between the concepts as one moves from data to wisdom; the y-axis represents the increasing complexity of the concepts.

Figure 3 reflects Nelson's recent evolution of her 2002 model depicting the dynamic interactivity of the inter- and intra-environmental factors that influence the movement across and within the data-to-wisdom continuum.

In a newly published model, Nelson identifies how information, decision support, and expert systems represent and enable the evolution of data to information to knowledge to wisdom (Figure 4). For some additional details on an emerging wisdom model, see Appendix A.

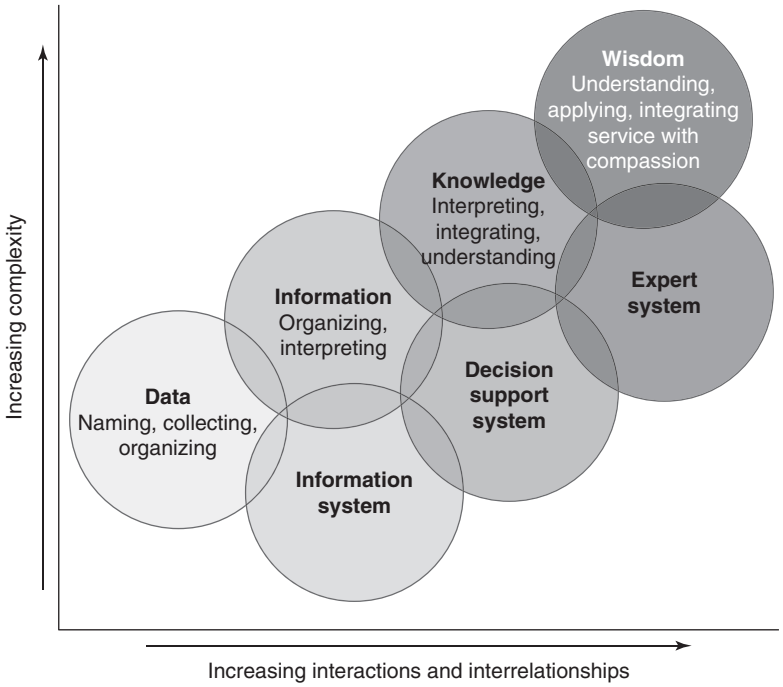

Figure 4. Moving from Data to Expert Systems Version
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Benner (1984) defined the experiential stages of the nursing professional in *Novice to Expert: Excellence and Power in Clinical Nursing Practice.* Englebardt and Nelson (2002) also integrated wisdom into their model. Benner, Hooper-Kyriakidis, and Stannard (2011) have contributed Thinking-in-Action as an approach to administration of care. The addition of wisdom raises new and important research questions, challenging the profession to develop tools and processes for classifying, measuring, and encoding wisdom as it relates to nursing and informatics education. Research in these directions will help clarify the relationship between wisdom and the intuitive thinking of expert nurses. Such research will also be invaluable in building information systems to better support healthcare practitioners in decision-making.

Integration of Nursing Informatics into Practice

Data, information, knowledge, and wisdom are central to effective healthcare delivery. Nurses are skilled in managing and communicating information and

are always concerned with content quality. Nursing informatics is also concerned with the creation, structure, storage, delivery, exchange, interoperability, and reuse of nursing and clinical information along the continuum of care. As electronic health information systems are integrated into every nursing role and setting, the use of technology at the point of care delivery; the external use of clinical information for quality, legal, and regulatory activities; and the use of analytics of data and metadata contribute to the creation of new nursing knowledge. Such an evolution in the healthcare environment and ubiquitous use of data, information, and knowledge resources contribute to the blurring of the boundaries between the roles of nurses, informatics nurses, and informatics nurse specialists.

The *informatics nurse (IN)* is a registered nurse with an interest or experience in an informatics field, most often identified as nursing informatics. The informatics nurse specialist (INS) is a registered nurse with formal graduate-level education in informatics or an informatics-related field. The informatics nurse specialist is often responsible for implementing or coordinating projects involving multiple professions and specialties. Both INs and INSs employ their unique informatics knowledge, experience, and skills to support and enable other registered nurses to best use data, information, knowledge, and technology in their practice domain. They interact with healthcare consumers and other diverse stakeholders across all care settings and throughout the entire system life cycle.

Nursing Informatics Practice

As previously presented, *nursing informatics (NI)* is the specialty that integrates nursing science with multiple information and analytical sciences to identify, define, manage, and communicate data, information, knowledge, and wisdom in nursing practice. NI supports nurses, consumers, patients, the interprofessional healthcare team, and other stakeholders in their decision-making in all roles and settings to achieve desired outcomes. This support is accomplished through the use of information structures, information processes, and information technology.

Note that information technology does not define NI. The synthesis of data and information into knowledge and wisdom is a core principle of NI, while information technology supports a system lifecycle process. Both the IN and the INS strive to master information management and information technology in the design, structure, retrieval, presentation, storage, exchange, and use of data, information, and knowledge. The IN and INS consider the

impact of information and applied computer science on healthcare delivery and the nursing process. Table 1 illustrates the connection between the different foci of nursing and NI. These occur along a continuum without distinct boundaries.

Table 1. Nursing and Nursing Informatics Foci

Nursing Focus	Nursing Informatics Focus
Nurses, patients, health, environment	Information user, information recipients, exchange of data, information, knowledge, and wisdom
Content of information, support for evidence-based practice	Design, structure, interpretation, and representation of data, information, knowledge, and wisdom
Using information applications and technology	Design, develop, implement, and evaluate applications and technologies, ensuring their safety, quality, effectiveness, efficiency, and usability

Tenets of Nursing Informatics

The following tenets of nursing informatics form a framework that characterizes the thinking and actions of informatics nurses in all aspects of practice and in every setting. Nursing informatics

- Has a unique body of knowledge, preparation, and experience that aligns with the nursing profession. NI incorporates informatics concepts in specific application to the role of nursing and nurses in the healthcare continuum.
- Involves the synthesis of data and information into knowledge and wisdom.
- Supports the decision-making of healthcare consumers, nurses, and other professionals in all roles and settings to achieve healthcare consumer safety and advocacy.
- Supports data analytics, including quality-of-care measures, to improve population health outcomes and global health. The IN and INS understand that the real-time application of accurate information by nurses and other clinicians is a mechanism to change healthcare delivery and affect patient outcomes.

- Promotes data integrity and the access and exchange of health data for all consumers of health information.
- Supports national and international agendas on interoperability and the efficient and effective transfer and delivery of data, information, and knowledge.
- Ensures that collaboration is an integral characteristic of practice.
- Interleaves user experience and computer–human interaction concepts throughout practice.
- Incorporates key ethical concerns of NI such as advocacy, privacy, and assurance of the confidentiality and security of data and information.
- Considers the impact of technological changes on patient safety, healthcare delivery, quality reporting, and the nursing process.
- Leads in the design and promotion of useful, innovative information technologies that advance practice and achieve desired outcomes.

Nursing, the Nursing Process, and Vocabularies

"Nursing is the protection, promotion, and optimization of health and abilities, prevention of illness and injury, alleviation of suffering through the diagnosis and treatment of human response, and advocacy in the care of individuals, families, communities, and populations" (ANA, 2010). Further explication of nursing practice and its complexity is found in the established standards of professional nursing practice that incorporate the nursing process of assessment, diagnosis, outcomes identification, planning, implementation, and evaluation. Delineated competencies accompany each standard.

The importance of languages, vocabularies, and terminologies cannot be overstated when describing nursing practice. Nursing leaders have identified many different vocabularies and ways of organizing data, information, and knowledge pertinent to nursing through numerous established research initiatives that have spanned decades. In the early 1990s, ANA began to formally recognize these languages, vocabularies, and terminologies (listed in Table 2) as valuable representations of nursing practice and to promote the integration of standardized terminologies into information technology solutions. To date, none has emerged as the leading standardized resource able to represent all nursing practice concepts.

Table 2. ANA Recognized Terminologies and Data Element Sets		
ANA-Recognized Informatics Systems	**Setting Where Developed**	**Content**
Data Element Sets		
NMDS Nursing Minimum Data Set	All nursing	Clinical data elements
NMMDS Nursing Management Minimum Data Set	All settings	Nursing administrative data elements
Nursing-Developed Terminologies		
CCC System Clinical Care Classification System	All nursing care + other health professionals	Diagnoses, interventions, and outcomes
ICNP® International Classification for Nursing Practice	All nursing	Diagnoses, interventions, and outcomes
NANDA NANDA International	All nursing	Diagnoses
NIC Nursing Interventions Classification	All nursing	Interventions
NOC Nursing Outcomes Classification	All nursing	Outcomes
Omaha System	Home care, public health, and community	Diagnoses, interventions, and outcomes
PNDS Perioperative Nursing Data Set	Perioperative care settings	Diagnoses, interventions, and outcomes
Multidisciplinary Terminologies		
ABC ABC Codes	Nursing and other health professionals	Interventions
LOINC® Logical Observation Identifiers, Names, and Codes	Nursing and other health professionals	Outcomes and assessments
SNOMED CT Systematic Nomenclature of Medicine Clinical Terms	Nursing and other health professionals	Diagnoses, interventions, and outcomes

Adapted from ANA, 2012.

Standardized terminologies have become a significant vehicle for facilitating interoperability between different concepts, nomenclatures, and information systems. Continued evolution, mapping, and integration of concepts, as well as research efforts, characterize today's terminology environment in light of passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009. HITECH's accompanying funding resources continue to stimulate more rapid movement toward electronic data capture and health information exchanges (HIEs) (HealthIT.gov, 2009). Two examples follow.

> *The International Classification for Nursing Practice (ICNP®), developed and maintained by the International Council of Nurses (ICN), provides a global cross-map of nursing terminologies to unite nursing practice through comparison, new research generation, and to inform and influence health policy. ICNP® has been harmonized with SNOMED CT® and offers more than 18 different translations (ICN, 2013).*

> *The Systematized Nomenclature of Medicine, or SNOMED CT® (http://www.ihtsdo.org/snomed-ct/), is a comprehensive universal healthcare reference terminology and messaging structure. SNOMED CT® enables multiple nursing terminology systems to be mapped to one another through harmonized concepts. Released in 2011, the Nursing Problem List Subset of SNOMED CT® is the primary coding terminology for nursing problems used in clinical documentation and based on nursing concepts found within the National Library of Medicine's Unified Medical Language System (UMLS) Metathesaurus. The UMLS Metathesaurus includes more than 100 source vocabularies and is responsible for managing the nursing terminologies mapped to SNOMED CT®. Other mapping initiatives are underway.*

The U.S. federal government formalized its interest in standardized terms to describe healthcare practice when the Office of the National Coordinator for Health Information Technology (ONC) established the HIT Standards Committee with its role to recommend the clinical vocabularies to be used in the electronic specification process (Table 3). Clinical vocabularies define the concepts used to measure clinical processes and patient outcomes. Harmonization between the different vocabularies is necessary to ensure appropriate implementation of the electronic measures across all electronic health record (EHR) systems. This table does not

Table 3. ONC HIT Standards Committee Recommended Clinical Vocabulary Standards

Vocabulary	Setting Application	Content
CVX Codes for Vaccines Administered	Nursing and other	Vaccines (administered)
CPT Current Procedural Terminology	Other	Medical, surgical, and diagnostic services rendered for claims
CDC-PHIN/VADS CDC-Public Health Information Network/Vocabulary Access and Distribution System	Nursing and other	Patient characteristic (administrative gender, date of birth)
HCPCS Healthcare Common Procedure Coding System	Other	Medical, surgical, and diagnostic services rendered for claims
ICD-9 CM International Statistical Classification of Diseases and Related Health Problems—Clinical Modification (9th ed.)	Nursing and other	Diagnoses and assessments
ICD-9 PCS International Statistical Classification of Diseases and Related Health Problems—Procedural Coding System (9th ed.)	Nursing and other	Diagnoses and assessments
ICD-10 CM International Statistical Classification of Diseases and Related Health Problems—Clinical Modification (10th ed.)	Nursing and other	Diagnoses and assessments
ICD-10 PCS International Statistical Classification of Diseases and Related Health Problems—Procedural Coding System (10th ed.)	Nursing and other	Diagnoses and assessments
ICF International Classification of Functioning, Disability, and Health	Nursing and other	Functional status

ISO-639 International Organization for Standardization Standard 639	Nursing and other	Representation of languages and language groups
LOINC® Logical Observation Identifiers, Names, and Codes	Nursing and other	Outcomes and assessments
RxNORM	Nursing and other	Normalized clinical drug names
SNOMED CT® Systematic Nomenclature of Medicine Clinical Terms	Nursing and other	Diagnoses, interventions, and outcomes
UCUM Unified Code for Units of Measure	Nursing and other	Units of measure for results

Adapted from CMS Measures Management System Blueprint v. 11.0, July 2014 (http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/MMS/MeasuresManagementSystemBlueprint.html).

include recognition of the important codes reflected in the *Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5)* released in 2013.

Such diversity and disparity confirm that informatics nurses must seek a broader picture of the implications of their work and the uses of languages and vocabularies for documentation by end users and in outcomes analysis. For instance, nurses mapping a home care vocabulary to an intervention vocabulary must see beyond the technical aspect of the work to understand how a case manager for a multisystem health organization or a home care agency may be basing knowledge of nursing acuity and case mix on the differing vocabularies. By envisioning the varied uses of the terminologies, the IN and INS promote continuity in the patient care process by harmonizing concepts across disparate organizations and EHR systems. Success in this area mandates active informatics nurse participation in associated standards initiatives, such as the work being done by Health Level Seven International (HL7) and the International Health Terminology Standards Development Organisation (IHTSDO).

Concepts and Tools from Information Science and Computer Science

Tools and methods from information and computer sciences are fundamental to NI, including:

- Information management—An elemental process by which one files, stores, manipulates, and reports data for various uses.
- Information communication—Enables systems to send data and to present information in formats that improve understanding.
- Information structures—Organize data, information, and knowledge for processing by computers.
- Information technology—Includes computer hardware, software, communication, and network technologies, derived primarily from computer science. Its use distinguishes informatics from more traditional methods of information management.

User Experience and Related Concepts

Usability, human–computer interaction (HCI), ergonomics, and human factors have long been overlapping concepts of fundamental interest to the informatics nurse. Contemporary thinking has identified *user experience* as the overarching descriptive term.

Although the 2001 Institute of Medicine (IOM) report, *Crossing the Quality Chasm: A New Health System for the 21st Century,* publicized the importance of human factors in health care, the emphasis for attention and action related to usability goes much further. Many researchers (including Ash, Berg, & Coiera, 2004; Ash, Sittig, Dykstra, Campbell, & Guappone, 2009; Koppel et al., 2005; Staggers, Jennings, & Lasome, 2010; and Guo, Irdbarren, Kapsandoy, Perri, & Staggers, 2011) have reported usability issues. Stead and Lin (2009) concluded from their evaluation of top U.S. electronic health records that the major impediment to their effectiveness was usability.

ISO 9241-11 defines *usability* as the extent to which a product can be used by specific users in a specific context to achieve specific goals with effectiveness, efficiency, and satisfaction. Usability in healthcare is fundamentally about patient safety and human performance with tools and systems. Several resources provide more details about usability:

- Health Information and Management Systems Society (HIMSS), *Promoting Usability in Health Organizations: Initial Steps and*

Progress Toward a Healthcare Usability Maturity Model (2011), available at http://www.himss.org/files/HIMSSorg/content/files/HIMSS_Promoting_Usability_in_Health_Org.pdf

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HCI examines how people, software applications, and computer technology interact and influence each other. Elements of HCI are rooted in psychology, cognitive science, sociology, computer science, and information science. HCI addresses the design, development, procurement, implementation, and evaluation of applications as well as other components associated with the system life cycle. For example, an informatics nurse would assess a bar-code medication administration system before purchase to determine whether the design and operation complement the way nurses cognitively process medication administration and document that action.

The IOM's 2012 report, *Health IT and Patient Safety: Building Safer Systems for Better Care,* identifies the importance of HCI in the integration of applications and technology with healthcare delivery. Such integration into everyday life has contributed to the empowerment of patients, now often designated as *e-patients*, and the promotion of interprofessional collaboration through mobile technology (m-health). This requires the IN and INS to address all environments and all levels of user ability to assure accommodation of the various devices being developed.

The IN and INS will also have to consider a variety of sociotechnical issues and their effect on HCI (Sittig & Singh, 2010). These include clinical experience level (Cho, Staggers, & Park, 2010), user literacy and user physical limitations

(Huang, Chen, & Chung, 2005), and aging (Sibley, 2008). In the future, the convenience of technologies available in commercial products can be expected to drive similar functionality in healthcare technology and will increase the scope of HCI factors. Finally, the effect of natural language processing (Zhou, 2007) and implantable monitoring devices (Topol, 2011) on HCI is yet to be determined.

The term *ergonomics* refers to attributes of physical equipment or to principles of arrangement of equipment in the work environment. For instance, an informatics nurse may have a role in ensuring that sound ergonomics principles are used in clinical settings to guide the selection and arrangement of various devices to support workflow for interprofessional providers, patients and their families, and other end users.

In the past, HCI, usability, and ergonomics have typically been subsumed under the rubric of *human factors*, or how humans interact with tools, including technology. The Human Factors and Ergonomics Society (HFES) identifies *ergonomics* (or human factors) as "the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance" (https://www.hfes.org/web/educationalresources/hfedefinitionsmain.html#profsoc). The concepts of efficiency, effectiveness, and safety are integral and apply to the client, consumer, and others.

The term *user experience* encompasses all aspects of users' interactions. The International Organization for Standardization (ISO) 9241-11 defines the term as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service." (ISO, 2009) describes it as a range of experiences, from walking into a healthcare facility to designs that fit into complex ecosystems with many users interacting. Development of high-quality user experiences requires the diverse expertise of many professions, such as engineering, graphic and industrial design, interface design, and psychology. Staggers (2014) identified the interrelationship of the user experience as encompassing human factors, HCI, ergonomics, and usability, as displayed in Figure 5.

Phenomenon of Nursing

The metaparadigm of nursing comprises four key concepts: nurse, person, health, and environment. The phenomenon of nursing, both art and science, is supported by the tenets of nursing informatics. The nurse continuously collects data about persons, their health, and the environmental factors that

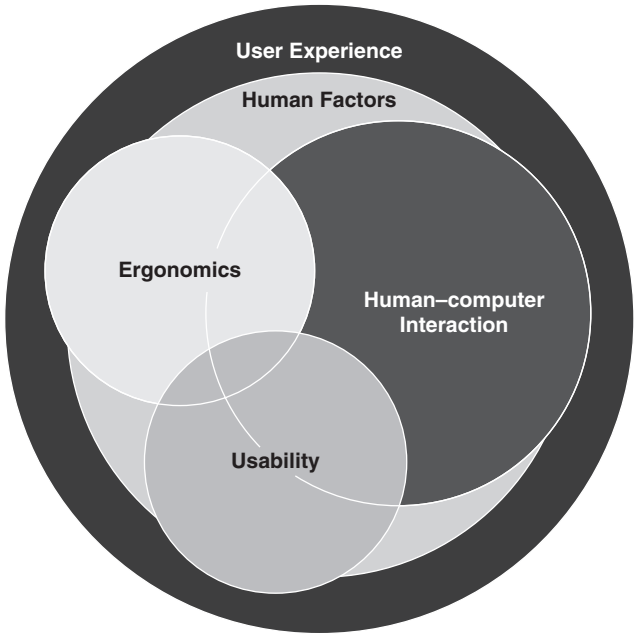

Figure 5. Relationship of User Experience to Other Concepts
Reference: Staggers, 2014, p. 337.

influence health maintenance and the healing process. Nurses, using their education, intellect, and experiential knowledge, place these data into categories to create information. Finally, using critical thinking and wisdom, the nurse is able to formulate a plan and prioritize interventions or actions that effect the most positive outcome possible for the situation.

Nurses make decisions from their unique perspectives based on their education, experience, and specialty. *Decision-making* is the process of choosing among alternatives. The decisions that nurses make can be characterized both by the quality of decisions and by the impact of the actions resulting from those decisions. As knowledge workers, nurses make numerous decisions that affect the lives and well-being of individuals, families, groups, communities, and populations. The process of decision-making in nursing is guided by the concept of critical thinking. *Critical thinking* is the intellectually disciplined process of actively and skillfully searching out the best evidence and using that knowledge to conceptualize, apply, analyze, synthesize, and/or evaluate data and information as a guide to belief and action (adapted from Scriven & Paul, 1987).

The nursing process of assessment, diagnosis, outcomes identification, planning, implementation, and evaluation can be enhanced through the utilization of technology. Technology, when properly developed and applied, has been shown to enhance the healthcare team's ability to collect, categorize, interpret, manage, evaluate, and share relevant information. This also enhances the team's ability to manage client care in a more efficient and productive manner. In most cases, the utilization of technology has decreased the nurse's workload associated with collecting and categorizing data, while enabling and enhancing the sharing of relevant information with other members of the healthcare team. When the complexity of information sharing is decreased, enhanced sharing of relevant information within the healthcare team theoretically improves quality and safety and results in improved patient outcomes. The informatics nurse is ideally suited to evaluate how technology can assist the nurse and other members of the care delivery team to manage data and share information to achieve desired outcomes.

In addition to enhancing the nursing process, data collection, information sharing, intervention implementation, and resultant patient outcomes can be tracked via database queries and processed through research methods. Evidence-based practice models can be developed through this research. Models of practice that generate positive patient outcomes can then be replicated and supported by systems optimized to allow seamless data capture, intuitive data display, and expert system processing.

Nursing is focused on optimizing the health status of individuals, families, groups, communities, and populations. Each of these entities is affected by the environment in which it resides. Technology, when properly designed and implemented, enhances the ability to track and trend data to help determine what, where, when, how, and why resources could be allocated to achieve the greatest good. Informatics nurses are uniquely qualified to assist in the development and optimization of systems that capture, categorize, share, and evaluate data and information while keeping the nursing process as the foundation of practice.

Functional Areas of Nursing Informatics

Informatics nurses, informatics nurse specialists, and other stakeholders are helping transform health care through the use of informatics processes, tools, and structures. Across all healthcare environments, INs and INSs most commonly practice in interprofessional healthcare environments and interact with information technology (IT) professionals during all phases of the system