# SECTION I

# Building Blocks of Nursing Informatics


**Chapter 1** Nursing Science and the Foundation of Knowledge

**Chapter 2** Introduction to Information, Information Science, and Information Systems

**Chapter 3** Computer Science and the Foundation of Knowledge Model

**Chapter 4** Introduction to Cognitive Science and Cognitive Informatics

**Chapter 5** Ethical Applications of Informatics


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**Nursing professionals are information-dependent knowledge workers.** As health care continues to evolve in an increasingly competitive information marketplace, professionals—that is, the knowledge workers—must be well prepared to make significant contributions by harnessing appropriate and timely information. Nursing informatics (NI), a product of the scientific synthesis of information in nursing, encompasses concepts from computer science, cognitive science, information science, and nursing science. NI continues to evolve as more and more professionals access, use, and develop the information, computer, and cognitive sciences necessary to advance nursing science for the betterment of patients and the profession. Regardless of their future roles in the healthcare milieu, it is clear that nurses need to understand the ethical application of computer, information, and cognitive sciences to advance nursing science.

To implement NI, one must view it from the perspective of both the current healthcare delivery system and specific, individual organizational needs, while anticipating and creating future applications in both the healthcare system and the nursing profession. Nursing professionals should be expected to discover opportunities to use NI, participate in the design of solutions, and be challenged to identify, develop, evaluate, modify, and enhance applications to improve patient care. This text is designed to provide the reader with the information and knowledge needed to meet this expectation.

Section I presents an overview of the building blocks of NI: nursing, information, computer, and cognitive sciences. Also included in this section is a chapter on ethical applications of healthcare informatics. This section lays the foundation for the remainder of the book.

The *Nursing Science and the Foundation of Knowledge* chapter describes nursing science and introduces the Foundation of Knowledge model as the conceptual framework for the book. In this chapter, a clinical case scenario is used to illustrate the concepts central to nursing science. A definition of nursing science is also derived from the American Nurses Association's definition of nursing. Nursing science is the ethical application of knowledge acquired through education, research, and practice to provide services and interventions to patients to maintain, enhance, or restore their health, and to acquire, process, generate, and disseminate nursing knowledge to advance the nursing profession. Information is a central concept and health care's most valuable resource. Information science and systems, together with computers, are constantly changing the way healthcare organizations conduct their business. This will continue to evolve.

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To prepare for these innovations, the reader must understand fundamental information and computer concepts, covered in the *Introduction to Information, Information Science, and Information Systems* and *Computer Science and the Foundation of Knowledge Model* chapters, respectively. Information science deals with the interchange (or flow) and scaffolding (or structure) of information and involves the application of information tools for solutions to patient care and business problems in health care. To be able to use and synthesize information effectively, an individual must be able to obtain, perceive, process, synthesize, comprehend, convey, and manage the information. Computer science deals with understanding the development, design, structure, and relationship of computer hardware and software. This science offers extremely valuable tools that, if used skillfully, can facilitate the acquisition and manipulation of data and information by nurses, who can then synthesize these resources into an ever-evolving knowledge and wisdom base. This not only facilitates professional development and the ability to apply evidence-based practice decisions within nursing care, but, if the results are disseminated and shared, can also advance the profession's knowledge base. The development of knowledge tools, such as the automation of decision making and strides in artificial intelligence, has altered the understanding of knowledge and its representation. The ability to structure knowledge electronically facilitates the ability to share knowledge structures and enhance collective knowledge.

As discussed in the *Introduction to Cognitive Science and Cognitive Informatics* chapter, cognitive science deals with how the human mind functions. This science encompasses how people think, understand, remember, synthesize, and access stored information and knowledge. The nature of knowledge, including how it is developed, used, modified, and shared, provides the basis for continued learning and intellectual growth.

The *Ethical Applications of Informatics* chapter focuses on ethical issues associated with managing private information with technology and provides a framework for analyzing ethical issues and supporting ethical decision making.

The material within this book is placed within the context of the Foundation of Knowledge model (shown in **Figure I-1** and periodically throughout the book, but more fully introduced and explained in the *Nursing Science and the Foundation of Knowledge* chapter). The Foundation of Knowledge model is used throughout the text to illustrate how knowledge is used to meet the needs of healthcare delivery systems, organizations, patients, and nurses. It is through interaction with these building blocks—the theories, architecture, and tools—that one acquires the bits and pieces of

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data necessary, processes these into information, and generates and disseminates the resulting knowledge. Through this dynamic exchange, which includes feedback, individuals continue the interaction and use of these sciences to input or acquire, process, and output or disseminate generated knowledge. Humans experience their environment and learn by acquiring, processing, generating, and disseminating knowledge. When they then share (disseminate) this new knowledge and receive feedback on the knowledge they have shared, the feedback initiates the cycle of knowledge all over again. As individuals acquire, process, generate, and disseminate knowledge, they are motivated to share, rethink, and explore their own knowledge base. This complex process is captured in the Foundation of Knowledge model. Throughout the chapters in the *Building Blocks of Nursing Informatics* section, readers are challenged to think about how the model can help them to understand the ways in which they acquire, process, generate, disseminate, and then receive and process feedback on their new knowledge of the building blocks of NI.

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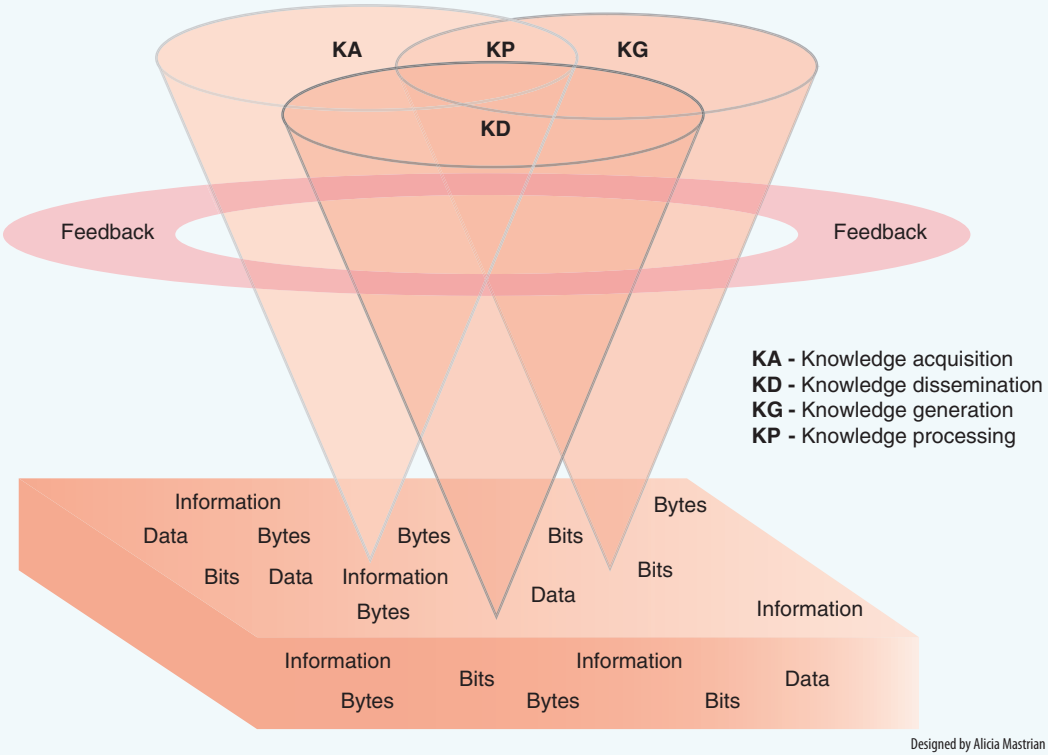


**Figure I-1** Foundation of Knowledge Model

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## Objectives

1. Define nursing science and its relationship to various nursing roles and nursing informatics.
2. Introduce the Foundation of Knowledge model as the organizing conceptual framework for the text.
3. Explain the relationships among knowledge acquisition, knowledge processing, knowledge generation, knowledge dissemination, and wisdom.

## Key Terms

- Borrowed theory
- Building blocks
- Clinical databases
- Clinical practice guidelines
- Conceptual framework
- Data
- Data mining
- Evidence
- Feedback
- Foundation of Knowledge model
- Information
- Knowledge
- Knowledge acquisition
- Knowledge dissemination
- Knowledge generation
- Knowledge processing
- Knowledge worker
- Nursing informatics
- Nursing science
- Nursing theory
- Relational database
- Transparent wisdom

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# CHAPTER 1

# Nursing Science and the Foundation of Knowledge

Dee McGonigle and Kathleen Mastrian

## Introduction

**Nursing informatics** has been traditionally defined as a specialty that integrates **nursing science**, computer science, and information science to manage and communicate data, information, knowledge, and wisdom in nursing practice. This chapter focuses on nursing science as one of the **building blocks** of nursing informatics. As depicted in **Figure 1-1**,

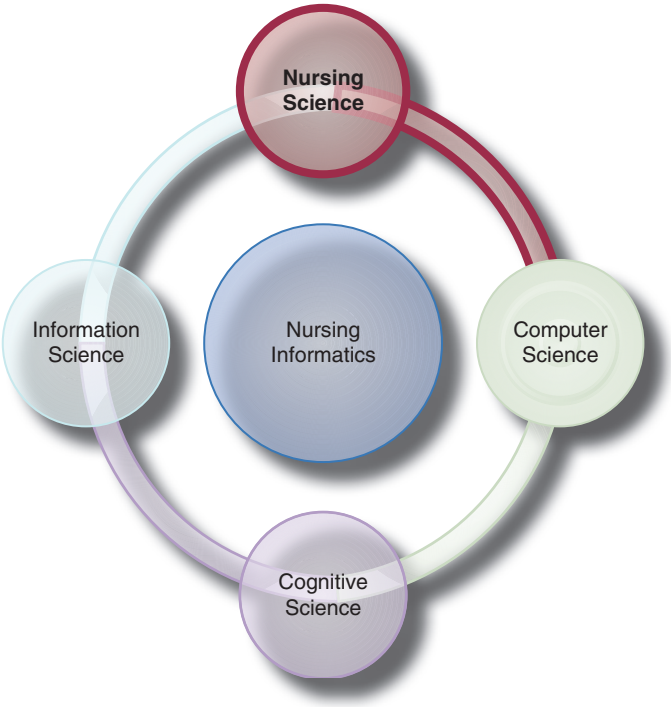


**Figure 1-1** Building Blocks of Nursing Informatics



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the traditional definition of nursing informatics is extended to include cognitive science.The **Foundation of Knowledge model** is also introduced as the organizing **conceptual framework** of this text, and the model is tied to nursing science and the practice of nursing informatics. To lay the groundwork for this discussion, consider the following patient scenario:

> *Tom H. is a registered nurse who works in a very busy metropolitan hospital emergency room. He has just admitted a 79-year-old man whose wife brought him to the hospital because he is having trouble breathing. Tom immediately clips a pulse oximeter to the patient's finger and performs a very quick assessment of the patient's other vital signs. He discovers a rapid pulse rate and a decreased oxygen saturation level in addition to the rapid and labored breathing. Tom determines that the patient is not in immediate danger and that he does not require intubation. Tom focuses his initial attention on easing the patient's labored breathing by elevating the head of the bed and initiating oxygen treatment; he then hooks the patient up to a heart monitor. Tom continues to assess the patient's breathing status as he performs a head-to-toe assessment of the patient that leads to the nursing diagnoses and additional interventions necessary to provide comprehensive care to this patient.*

Consider Tom's actions and how and why he intervened as he did. Tom relied on the immediate **data** and **information** that he acquired during his initial rapid assessment to deliver appropriate care to his patient. Tom also used technology (a pulse oximeter and a heart monitor) to assist with and support the delivery of care. What is not immediately apparent, and some would argue is transparent (done without conscious thought), is the fact that during the rapid assessment, Tom reached into his **knowledge** base of previous learning and experiences to direct his care, so that he could act with **transparent wisdom**. He used both **nursing theory** and **borrowed theory** to inform his practice. Tom certainly used nursing process theory, and he may have also used one of several other nursing theories, such as Rogers's science of unitary human beings, Orem's theory of self-care deficit, or Roy's adaptation theory. In addition, Tom may have applied his knowledge from some of the basic sciences, such as anatomy, physiology, psychology, and chemistry, as he determined the patient's immediate needs. Information from Maslow's hierarchy of needs, Lazarus's transaction model of stress and coping, and the health belief model may have also helped Tom practice professional nursing. He gathered data, and then analyzed and interpreted those data to form a conclusion—the essence of science. Tom has illustrated the practical aspects of nursing science.

The American Nurses Association (2016) defines nursing in this way: "Nursing is the protection, promotion, and optimization of health and abilities, prevention of illness and injury, facilitation of healing, alleviation of suffering through the diagnosis and treatment of human response, and advocacy in the care of individuals, families, groups, communities, and populations" (para. 1). Thus the focus of nursing is on human responses to actual or potential health problems and advocacy for various clients. These human responses are varied and may change over

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time in a single case. Nurses must possess the technical skills to manage equipment and perform procedures, the interpersonal skills to interact appropriately with people, and the cognitive skills to observe, recognize, and collect data; analyze and interpret data; and reach a reasonable conclusion that forms the basis of a decision. At the heart of all of these skills lies the management of data and information. This definition of nursing science focuses on the ethical application of knowledge acquired through education, research, and practice to provide services and interventions to patients to maintain, enhance, or restore their health and to acquire, process, generate, and disseminate nursing knowledge to advance the nursing profession.

Nursing is an information-intensive profession. The steps of using information, applying knowledge to a problem, and acting with wisdom form the basis of nursing practice science. Information is composed of data that were processed using knowledge. For information to be valuable, it must be accessible, accurate, timely, complete, cost-effective, flexible, reliable, relevant, simple, verifiable, and secure. Knowledge is the awareness and understanding of a set of information and ways that information can be made useful to support a specific task or arrive at a decision. In the case scenario, Tom used accessible, accurate, timely, relevant, and verifiable data and information. He compared that data and information to his knowledge base of previous experiences to determine which data and information were relevant to the current case. By applying his previous knowledge to data, he converted those data into information, and information into new knowledge—that is, an understanding of which nursing interventions were appropriate in this case. Thus information is data made functional through the application of knowledge.

Humans acquire data and information in bits and pieces and then transform the information into knowledge. The information-processing functions of the brain are frequently compared to those of a computer, and vice versa (see a discussion of cognitive informatics for more information). Humans can be thought of as organic information systems that are constantly acquiring, processing, and generating information or knowledge in their professional and personal lives. They have an amazing ability to manage knowledge. This ability is learned and honed from birth as individuals make their way through life interacting with the environment and being inundated with data and information. Each person experiences the environment and learns by acquiring, processing, generating, and disseminating knowledge.

Tom, for example, acquired knowledge in his basic nursing education program and continues to build his foundation of knowledge by engaging in such activities as reading nursing research and theory articles, attending continuing education programs, consulting with expert colleagues, and using **clinical databases** and **clinical practice guidelines**. As he interacts in the environment, he acquires knowledge that must be processed. This processing effort causes him to redefine and restructure his knowledge base and generate new knowledge. Tom can then share (disseminate) this new knowledge with colleagues, and he may receive **feedback** on the knowledge that he shares. This dissemination and feedback builds the knowledge foundation anew

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as Tom acquires, processes, generates, and disseminates new knowledge as a result of his interactions. As others respond to his **knowledge dissemination** and he acquires yet more knowledge, he is engaged to rethink, reflect on, and re-explore his **knowledge acquisition**, leading to further processing, generating, and then disseminating knowledge. This ongoing process is captured in the Foundation of Knowledge model, which is used as an organizing framework for this text.

At its base, the model contains bits, bytes (a computer term used to quantify data), data, and information in a random representation. Growing out of the base are separate cones of light that expand as they reflect upward; these cones represent knowledge acquisition, **knowledge generation**, and knowledge dissemination. At the intersection of the cones and forming a new cone is **knowledge processing**. Encircling and cutting through the knowledge cones is feedback that acts on and may transform any or all aspects of knowledge represented by the cones. One should imagine the model as a dynamic figure in which the cones of light and the feedback rotate and interact rather than remain static. Knowledge acquisition, knowledge generation, knowledge dissemination, knowledge processing, and feedback are constantly evolving for nurse scientists. The transparent effect of the cones is deliberate and is intended to suggest that as knowledge grows and expands, its use becomes more transparent—a person uses this knowledge during practice without even being consciously aware of which aspect of knowledge is being used at any given moment.

Experienced nurses, thinking back to their novice years, may recall feeling like their head was filled with bits of data and information that did not form any type of cohesive whole. As the model depicts, the processing of knowledge begins a bit later (imagine a timeline applied vertically) with early experiences on the bottom and expertise growing as the processing of knowledge ensues. Early on in nurses' education, conscious attention is focused mainly on knowledge acquisition, and beginning nurses depend on their instructors and others to process, generate, and disseminate knowledge. As nurses become more comfortable with the science of nursing, they begin to take over some of the other Foundation of Knowledge functions. However, to keep up with the explosion of information in nursing and health care, they must continue to rely on the knowledge generation of nursing theorists and researchers and the dissemination of their work. In this sense, nurses are committed to lifelong learning and the use of knowledge in the practice of nursing science.

The Foundation of Knowledge model (**Figure 1-2**) permeates this text, reflecting the understanding that knowledge is a powerful tool and that nurses focus on information as a key building block of knowledge. The application of the model is described to help the reader understand and appreciate the foundation of knowledge in nursing science and see how it applies to nursing informatics. All of the various nursing roles (practice, administration, education, research, and informatics) involve the science of nursing. Nurses are **knowledge workers**, working with information and generating information and knowledge as a product. They are knowledge acquirers, providing convenient and efficient means of capturing and storing knowledge. They are knowledge users, meaning individuals or groups who benefit from valuable, viable knowledge. Nurses are knowledge engineers, designing, developing, implementing, and maintaining knowledge. They are knowledge managers, capturing and processing collective expertise and distributing it where it can create the largest benefit. Finally,

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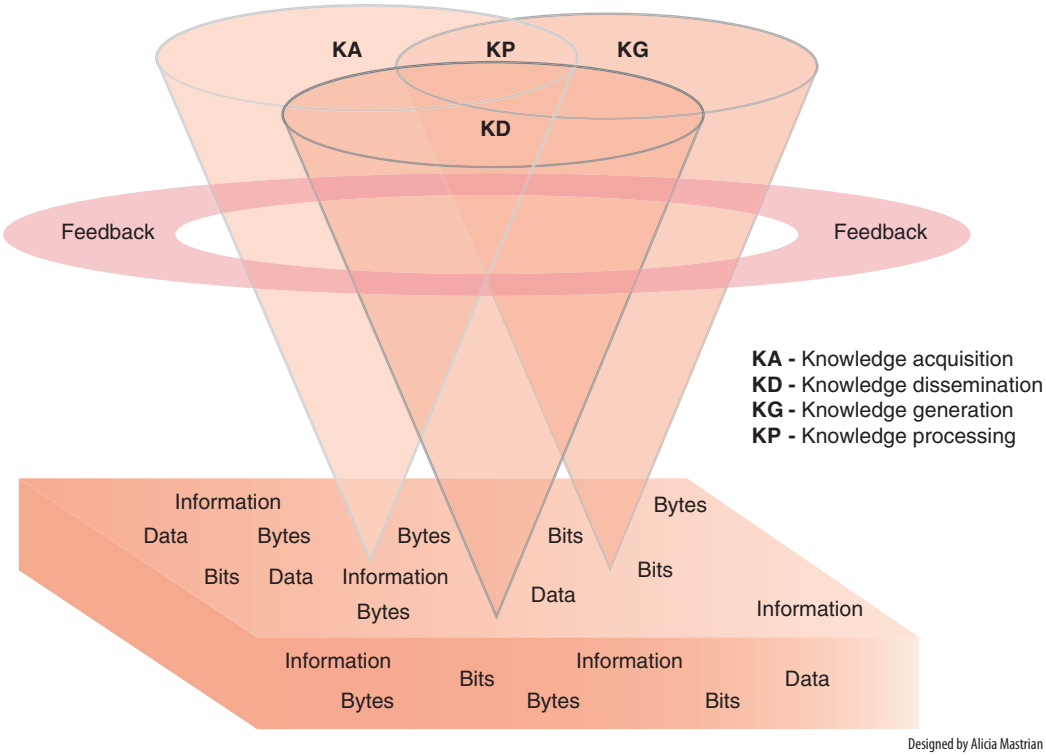


**Figure 1-2** Foundation of Knowledge Model

they are knowledge developers and generators, changing and evolving knowledge based on the tasks at hand and the information available.

In the case scenario, at first glance one might label Tom as a knowledge worker, a knowledge acquirer, and a knowledge user. However, stopping here might sell Tom short in his practice of nursing science. Although he acquired and used knowledge to help him achieve his work, he also processed the data and information he collected to develop a nursing diagnosis and a plan of care. The knowledge stores Tom used to develop and glean knowledge from valuable information are generative (having the ability to originate and produce or generate) in nature. For example, Tom may have learned something new about his patient's culture from the patient or his wife that he will file away in the knowledge repository of his mind to be used in another similar situation. As he compares this new cultural information to what he already knows, he may gain insight into the effect of culture on a patient's response to illness. In this sense, Tom is a knowledge generator. If he shares this newly acquired knowledge with another practitioner, and as he records his observations and his conclusions, he is then disseminating knowledge. Tom also uses feedback from the various technologies he has applied to monitor his patient's status. In addition, he may rely on feedback from laboratory reports or even other practitioners to help him rethink, revise, and apply the knowledge about this patient that he is generating.

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To have ongoing value, knowledge must be viable. Knowledge viability refers to applications (most technology based) that offer easily accessible, accurate, and timely information obtained from a variety of resources and methods and presented in a manner so as to provide the necessary elements to generate new knowledge. In the case scenario, Tom may have felt the need to consult an electronic database or a clinical guidelines repository that he has downloaded on his tablet or smartphone, or that resides in the emergency room's networked computer system, to assist him in the development of a comprehensive care plan for his patient. In this way, Tom uses technology and **evidence** to support and inform his practice. It is also possible in this scenario that an alert might appear in the patient's electronic health record or the clinical information system (CIS) reminding Tom to ask about influenza and pneumonia vaccines. Clinical information technologies that support and inform nursing practice and nursing administration are an important part of nursing informatics.

This text provides a framework that embraces knowledge so that readers can develop the wisdom necessary to apply what they have learned. Wisdom is the application of knowledge to an appropriate situation. In the practice of nursing science, one expects actions to be directed by wisdom. Wisdom uses knowledge and experience to heighten common sense and insight to exercise sound judgment in practical matters. It is developed through knowledge, experience, insight, and reflection. Wisdom is sometimes thought of as the highest form of common sense, resulting from accumulated knowledge or erudition (deep, thorough learning) or enlightenment (education that results in understanding and the dissemination of knowledge). It is the ability to apply valuable and viable knowledge, experience, understanding, and insight while being prudent and sensible. Knowledge and wisdom are not synonymous: Knowledge abounds with others' thoughts and information, whereas wisdom is focused on one's own mind and the synthesis of experience, insight, understanding, and knowledge. Wisdom has been called the foundation of the art of nursing.

Some nursing roles might be viewed as more focused on some aspects rather than other aspects of the foundation of knowledge. For example, some might argue that nurse educators are primarily knowledge disseminators and that nurse researchers are knowledge generators. Although the more frequent output of their efforts can certainly be viewed in this way, it is important to realize that nurses use all of the aspects of the Foundation of Knowledge model regardless of their area of practice. For nurse educators to be effective, they must be in the habit of constantly building and rebuilding their foundation of knowledge about nursing science. In addition, as they develop and implement curricular innovations, they must evaluate the effectiveness of those changes. In some cases, they use formal research techniques to achieve this goal and, therefore, generate knowledge about the best and most effective teaching strategies. Similarly, nurse researchers must acquire and process new knowledge as they design and conduct their research studies. All nurses have the opportunity to be involved in the formal dissemination of knowledge via their participation in professional conferences, either as presenters or as attendees. In addition, some nurses disseminate knowledge by formal publication of their ideas. In the cases of conference presentation and publication, nurses may receive feedback that stimulates rethinking about the knowledge they have generated and disseminated, in turn prompting them to acquire and process data and information anew.

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All nurses, regardless of their practice arena, must use informatics and technology to inform and support that practice. The case scenario discussed Tom's use of various monitoring devices that provide feedback on the physiologic status of the patient. It was also suggested that Tom might consult a clinical database or nursing practice guidelines residing on a tablet or smartphone, in the cloud (a virtual information storage system), or on a clinical agency network as he develops an appropriate plan of action for his nursing interventions. Perhaps the CIS in the agency supports the collection of data about patients in a **relational database**, providing an opportunity for **data mining** by nursing administrators or nurse researchers. In this way, administrators and researchers can glean information about best practices and determine which improvements are necessary to deliver the best and most effective nursing care (Swan, Lang, & McGinley, 2004).

The future of nursing science and nursing informatics is closely associated with nursing education and nursing research. Skiba (2007) suggested that techno-savvy and well-informed faculty who can demonstrate the appropriate use of technologies to enhance the delivery of nursing care are needed. Along those lines, Whitman-Price, Kennedy, and Godwin (2012) conducted research among senior nursing students to determine perceptions of personal phone use to access healthcare information during clinical. Their study indicated that ready access to electronic resources enhanced clinical decision making and confidence in patient care. Girard (2007) discussed cutting-edge operating room technologies, such as nanosurgery using nanorobots, smart fabrics that aid in patient assessment during surgery, biopharmacy techniques for the safe and effective delivery of anesthesia, and virtual reality training. She made an extremely provocative point about nursing education: "Educators will need to expand their knowledge and teach for the future and not the past. They must take heed that the old tried-and-true nursing education methods and curriculum that has lasted 100 years will have to change, and that change will be mandated for all areas of nursing" (p. 353). Bassendowski (2007) specifically addressed the potential for the generation of knowledge in educational endeavors as faculty apply new technologies to teaching and the focus shifts away from individual to group instruction that promotes sharing and processing of knowledge.

Several key national groups continue to promote the inclusion of informatics content in nursing education programs. These initiatives include the Vision Series by the National League for Nursing (NLN; 2015); recommendations in the *Quality and Safety Education for Nurses (QSEN)* learning modules (2014a); the Technology Informatics Guiding Education Reform (TIGER) Initiative (Healthcare Information and Management Systems Society, 2016); and Nursing Informatics Deep Dive by the American Association of Colleges of Nursing (AACN; 2016). These organizations focus on the need to integrate informatics competencies into nursing curricula to prepare future nurses for the tasks of managing data, information, and knowledge; alleviating errors and promoting safety; supporting decision making; and improving the quality of patient care. Nurse educators are challenged to prepare informatics-competent nurses who can practice safely in technology-laden settings.

The TIGER (2007) initiative identified steps toward a 10-year vision and stated a key purpose: "to create a vision for the future of nursing that bridges the quality chasm with information technology, enabling nurses to use informatics in practice

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and education to provide safer, higher-quality patient care" (p. 4). The pillars of the TIGER vision include the following:

- *Management and Leadership*: Revolutionary leadership that drives, empowers, and executes the transformation of health care.
- *Education*: Collaborative learning communities that maximize the possibilities of technology toward knowledge development and dissemination, driving rapid deployment and implementation of best practices.
- *Communication and Collaboration*: Standardized, person-centered, technology-enabled processes to facilitate teamwork and relationships across the continuum of care.
- *Informatics Design*: Evidence-based, interoperable intelligence systems that support education and practice to foster quality care and safety.
- *Information Technology*: Smart, people-centered, affordable technologies that are universal, useable, useful, and standards based.
- *Policy*: Consistent, incentives-based initiatives (organizational and governmental) that support advocacy and coalition-building, achieving and resourcing an ethical culture of safety.
- *Culture*: A respectful, open system that leverages technology and informatics across multiple disciplines in an environment where all stakeholders trust each other to work together toward the goal of high quality and safety (p. 4).

*The Essentials of Baccalaureate Education for Professional Nursing Practice* (AACN, 2008, pp. 18–19) includes the following technology-related outcomes for baccalaureate nursing graduates:

1. Demonstrate skills in using patient care technologies, information systems, and communication devices that support safe nursing practice.
2. Use telecommunication technologies to assist in effective communication in a variety of healthcare settings.
3. Apply safeguards and decision-making support tools embedded in patient care technologies and information systems to support a safe practice environment for both patients and healthcare workers.
4. Understand the use of CIS to document interventions related to achieving nurse-sensitive outcomes.
5. Use standardized terminology in a care environment that reflects nursing's unique contribution to patient outcomes.
6. Evaluate data from all relevant sources, including technology, to inform the delivery of care.
7. Recognize the role of information technology in improving patient care outcomes and creating a safe care environment.
8. Uphold ethical standards related to data security, regulatory requirements, confidentiality, and clients' right to privacy.
9. Apply patient care technologies as appropriate to address the needs of a diverse patient population.
10. Advocate for the use of new patient care technologies for safe, quality care.

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11. Recognize that redesign of workflow and care processes should precede implementation of care technology to facilitate nursing practice.
12. Participate in the evaluation of information systems in practice settings through policy and procedure development.

The report suggests the following sample content for achieving these student outcomes (AACN, 2008, pp. 19–20):

- Use of patient care technologies (e.g., monitors, pumps, computer-assisted devices)
- Use of technology and information systems for clinical decision making
- Computer skills that may include basic software, spreadsheet, and healthcare databases
- Information management for patient safety
- Regulatory requirements through electronic data-monitoring systems
- Ethical and legal issues related to the use of information technology, including copyright, privacy, and confidentiality issues
- Retrieval information systems, including access, evaluation of data, and application of relevant data to patient care
- Online literature searches
- Technological resources for evidence-based practice
- Web-based learning and online literature searches for self and patient use
- Technology and information systems safeguards (e.g., patient monitoring, equipment, patient identification systems, drug alerts and IV systems, and bar coding)
- Interstate practice regulations (e.g., licensure, telehealth)
- Technology for virtual care delivery and monitoring
- Principles related to nursing workload measurement and resources and information systems
- Information literacy
- Electronic health record and physician order entry
- Decision support tools
- Role of the nurse informaticist in the context of health informatics and information systems

The Informatics and Healthcare Technologies Essentials of Master's Education in Nursing includes the following elements:

***Essential V: Informatics and Healthcare Technologies***
*Rationale*
Informatics and healthcare technologies encompass five broad areas:

- Use of patient care and other technologies to deliver and enhance care
- Communication technologies to integrate and coordinate care
- Data management to analyze and improve outcomes of care
- Health information management for evidence-based care and health education
- Facilitation and use of electronic health records to improve patient care (AACN, 2011, pp. 17–18)

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## Quality and Safety Education for Nurses

As nursing science evolves, it is critical that patient care improves. Sometimes, unfortunately, patient care is less-than-adequate and is unsafe. Therefore, quality and safety have become paramount. The QSEN Institute project seeks to prepare future nurses who will have the knowledge, skills, and attitudes (KSAs) necessary to continuously improve the quality and safety of the healthcare systems within which they work.

Prelicensure informatics KSAs include the following (QSEN Institute, 2014c):

| INFORMATICS | | |
|---|---|---|
| **Knowledge** | **Skills** | **Attitudes** |
| Explain why information and technology skills are essential for safe patient care | Seek education about how information is managed in care settings before providing care<br><br>Apply technology and information management tools to support safe processes of care | Appreciate the necessity for all health professionals to seek lifelong, continuous learning of information technology skills |
| Identify essential information that must be available in a common database to support patient care<br><br>Contrast benefits and limitations of different communication technologies and their impact on safety and quality | Navigate the electronic health record<br><br>Document and plan patient care in an electronic health record<br><br>Employ communication technologies to coordinate care for patients | Value technologies that support clinical decision making, error prevention, and care coordination<br><br>Protect the confidentiality of protected health information in electronic health records |
| Describe examples of how technology and information management are related to the quality and safety of patient care<br><br>Recognize the time, effort, and skill required for computers, databases, and other technologies to become reliable and effective tools for patient care | Respond appropriately to clinical decision-making supports and alerts<br><br>Use information management tools to monitor outcomes of care processes<br><br>Use high quality electronic sources of healthcare information | Value nurses' involvement in design, selection, implementation, and evaluation of information technologies to support patient care |
| **Definition:** Use information and technology to communicate, manage knowledge, mitigate error, and support decision making. | | |

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Graduate-level informatics KSAs include the following (QSEN Institute, 2014b):

| INFORMATICS | | |
|---|---|---|
| **Knowledge** | **Skills** | **Attitudes** |
| Contrast benefits and limitations of common information technology strategies used in the delivery of patient care<br><br>Evaluate the strengths and weaknesses of information systems used in patient care | Participate in the selection, design, implementation, and evaluation of information systems<br><br>Communicate the integral role of information technology in nurses' work<br><br>Model behaviors that support implementation and appropriate use of electronic health records<br><br>Assist team members to adopt information technology by piloting and evaluating proposed technologies | Value the use of information and communication technologies in patient care |
| Formulate essential information that must be available in a common database to support patient care in the practice specialty<br><br>Evaluate benefits and limitations of different communication technologies and their impact on safety and quality | Promote access to patient care information for all professionals who provide care to patients<br><br>Serve as a resource for how to document nursing care at basic and advanced levels<br><br>Develop safeguards for protected health information<br><br>Champion communication technologies that support clinical decision making, error prevention, care coordination, and protection of patient privacy | Appreciate the need for consensus and collaboration in developing systems to manage information for patient care<br><br>Value the confidentiality and security of all patient records |
| Describe and critique taxonomic and terminology systems used in national efforts to enhance interoperability of information systems and knowledge management systems | Access and evaluate high quality electronic sources of healthcare information<br><br>Participate in the design of clinical decision-making supports and alerts<br><br>Search, retrieve, and manage data to make decisions using information and knowledge management systems<br><br>Anticipate unintended consequences of new technology | Value the importance of standardized terminologies in conducting searches for patient information<br><br>Appreciate the contribution of technological alert systems<br><br>Appreciate the time, effort, and skill required for computers, databases, and other technologies to become reliable and effective tools for patient care |
| **Definition:** Use information and technology to communicate, manage knowledge, mitigate error, and support decision making. | | |

Reprinted from *Nursing Outlook, 57*(6), Cronenwett, L., Sherwood, G., Pohl, J., Barnsteiner, J., Moore, S., Sullivan, D., Ward, D., Warren, J., Quality and safety education for advanced nursing practice, pages 338–348, copyright © 2009, with permission from Elsevier.

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This text is designed to include the necessary content to prepare nurses for practice in the ever-changing and technology-laden healthcare environments. Informatics competence has been recognized as necessary in order to enhance clinical decision making and improve patient care for many years. This is evidenced by Goossen (2000), who reflected on the need for research in this area and believed that the focus of nursing informatics research should be on the structuring and processing of patient information and the ways that these endeavors inform nursing decision making in clinical practice. The increased use of technology to enhance nursing practice, nursing education, and nursing research will open new avenues for acquiring, processing, generating, and disseminating knowledge.

In the future, nursing research will make significant contributions to the development of nursing science. Technologies and translational research will abound, and clinical practices will continue to be evidence based, thereby improving patient outcomes and decreasing safety concerns. Schools of nursing will embrace nursing science as they strive to meet the needs of changing student populations and the increasing complexity of healthcare environments.

## Summary

Nursing science influences all areas of nursing practice. This chapter provided an overview of nursing science and considered how nursing science relates to typical nursing practice roles, nursing education, informatics, and nursing research. The Foundation of Knowledge model was introduced as the organizing conceptual framework for this text. Finally, the relationship of nursing science to nursing informatics was discussed. In subsequent chapters the reader will learn more about how nursing informatics supports nurses in their many and varied roles. In an ideal world, nurses would embrace nursing science as knowledge users, knowledge managers, knowledge developers, knowledge engineers, and knowledge workers.

### THOUGHT-PROVOKING QUESTIONS

1. Imagine you are in a social situation and someone asks you, "What does a nurse do?" Think about how you will capture and convey the richness that is nursing science in your answer.
2. Choose a clinical scenario from your recent experience and analyze it using the Foundation of Knowledge model. How did you acquire knowledge? How did you process knowledge? How did you generate knowledge? How did you disseminate knowledge? How did you use feedback, and what was the effect of the feedback on the foundation of your knowledge?

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