

# Introduction: The Evolution of Health Informatics

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*Over time the collaborative opportunities to create a more effective and efficient healthcare system will become more interesting and motivating than the historical struggles and hierarchical relations of the past.*

## OBJECTIVES

At the completion of this chapter the reader will be prepared to:

1. Analyze how historical events have influenced the definition and current scope of practice of health informatics in healthcare
2. Discuss the development of health informatics as a discipline, profession, and specialty
3. Analyze informatics-related professional organizations and their contributions to professional development and informatics

## KEY TERMS

**Biomedical informatics**, 13  
**Clinical informatics**, 11  
**Computer science**, 3  
**Dental informatics**, 6  
**Health informatics**, 2

**Informatics**, 4  
**Information science**, 3  
**Medical informatics**, 5  
**Nursing informatics**, 6

## ABSTRACT

Health informatics has evolved as both a discipline or field of study and an area of specialization within the health professions. This chapter describes the historical process of that evolution as a basis for understanding the current status of health informatics as both a discipline and a specialty within healthcare. The historical roots within computer and information science are explored. The development of professional organizations, educational programs, and the knowledge base as documented in conference presentations, proceedings, journals, and books is described. The history of and process for naming the specialty and the discipline are then analyzed.

incorporates processes, procedures, theories, and concepts from computer and information sciences, the health sciences (e.g., nursing and medical science), and the social sciences (e.g., cognitive and organizational theory). Health informatics professionals use the tools of information technology to collect, store, process, and communicate health data, information, knowledge, and wisdom. The goals of health informatics are to support healthcare delivery and improve the health status of all. Information technology and related hardware, as well as software, are viewed as tools to be used by consumers, patients, and clients; healthcare providers; and administrators in achieving these goals. Health informatics incorporates processes, procedures, theories, and concepts from a number of different health professions and is therefore a unique interprofessional field of study as well as an area of specialization within the different health professions. This chapter explores the evolution of health informatics as both a discipline and a specialty practice within healthcare.

## INTRODUCTION

**Health informatics** has evolved as a discipline and an area of specialization within the health professions. As both a practice specialty and a field of study, health informatics

## THE ROOTS OF INFORMATICS WITHIN THE COMPUTER AND INFORMATION SCIENCES

Health informatics emerged as a distinct specialty within healthcare over time as nurses, physicians, and other health-care visionaries applied innovative developments in the computer and information sciences to complex problems in healthcare. Computer science brings to health informatics the technology and software coding required for this specialty while information science contributes the procedures and processes needed to develop and process data, information, and knowledge. The health professions provide the knowledge and wisdom to use computer and information science effectively in delivering healthcare and improving the health of all people. Understanding the scope and boundaries of health informatics begins with an appreciation of its roots within computer and information sciences.

### Computer Science

**Computer science** is defined as the “systematic study of algorithmic methods for representing and transforming information, including their theory, design, implementation, application, and efficiency . . . The roots of computer science extend deeply into mathematics and engineering. Mathematics imparts analysis to the field; engineering imparts design.”<sup>1(para 1)</sup> The word *computer* is derived from the Latin word *computare*, which means to count or sum up. The word first appeared in English in 1646, meaning a person who computes or processes mathematical data.

However, a key problem with these early human computers was that they made errors. In the early 1800s, Charles Babbage, a mathematician, became increasingly concerned with the high error rate in the calculation of mathematical tables. Impressed by existing work on calculating machines, he proposed the development of a “difference engine.” As a result of his efforts to create a general-purpose, programmable computer employing punch cards, he is often identified as the first person to create a nonhuman computer or a programmable mechanical device aimed at solving problems.<sup>2</sup> While Babbage was not successful in building a functioning computer, the process of using punch cards to input data and obtain output did become an effective technology in other fields, such as rug making.

The Babbage approach to creating a computer included input and output but not storage. Herman Hollerith took this idea a step forward in the late 1800s when he used punch cards for input, processing, creating output, and storing data. Hollerith, like Babbage, was motivated by his concern with laborious, time-consuming, and error-prone human operations. In Hollerith’s case, the problems were evident in the processes used for collecting and calculating the 1880 U.S. census and related data. His invention, which both sorted and tabulated data, “was the first wholly successful information processing system to replace pen and paper.”<sup>3(para 2)</sup> In 1896, starting with this and related inventions, Hollerith founded the Tabulating Machine Company. In 1911 the Tabulating Machine Company merged with two

other companies, creating the company that is now IBM. Hollerith’s technology, developed for completing the U.S. census for 1890, was used well into the 1960s. By the 1960s automation was becoming part of healthcare and health informatics was beginning to emerge as a new discipline.

The move from a mechanical to an electronic digital computer is usually dated to the creation of ENIAC (Electronic Numerical Integrator and Computer) in the 1940s. This was a large machine requiring huge amounts of space, a specialized environment, and specially trained personnel. It initiated the concept of centralized computing and the information services department. Twenty years after ENIAC began functioning, the first Department of Computer Sciences in the United States was established in 1962 at Purdue University within the school’s Division of Mathematical Sciences.<sup>4</sup> The foundational relationship between the science of mathematics and the development of computer science provides certain benefits for health informatics. The culture of mathematics brings to the study of informatics systematic, logical approaches, processes, and procedures for understanding natural phenomena and solving problems.

In the 1980s the personal computer (PC) emerged and forever changed the role of the user as well as the organizational infrastructure for supporting computerization within institutions. Computerization within healthcare institutions was no longer totally centralized and computer use was no longer limited to specially trained personnel. As healthcare providers became direct users of the computer, they began to discover a wide range of new uses for these tools. The increased interest in the value of computers and the increased level of computer literacy among a number of healthcare providers proved a major advantage to the creation of the informatics specialty. These same factors have also created a certain tension between centralized and decentralized infrastructures to support technology within healthcare settings.

### Information Science

**Information science** is a discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. It is concerned with that body of knowledge relating to the origination, collection, organization, storage, retrieval, interpretation, transmission, transformation, and utilization of information. This includes the investigation of information representations in both natural and artificial systems, the use of codes for efficient message transmission, and the study of information processing devices and techniques, such as computers and their programming systems.”<sup>5(p3)</sup>

Establishing the beginning of information science is difficult since it emerged from the convergence of various disparate disciplines, including library, computer, communication, and behavioral sciences.<sup>6</sup> However, there are key dates and events that can be used to demonstrate the evolution of information science as a distinct specialty whose roots extend deeply into the profession of library science. These include the following:

- In 1937 the American Documentation Institute (ADI) was established. The initial organizational focus was the development of microfilm as an aid to information dissemination. Because of the expansion and diversification of its members, ADI changed its name to the American Society for Information Science in 1968 and then to the American Society for Information Science and Technology in 2000.<sup>7</sup>
- In 1948 the Royal Society of Great Britain held a conference bringing together “libraries, societies, and institutions responsible for publishing, abstracting, and information services to examine the possibility of improvement in existing methods of collection, indexing, and distribution of scientific literature, and for the extension of existing abstracting services.”<sup>8(p136)</sup> The decision by this prestigious group to hold such a conference demonstrated the growing importance of managing information.
- In 1963 the first textbook that treated information science as a discrete discipline was published. The book was titled *Information Storage and Retrieval: Tools, Elements and Theories*.<sup>6</sup>
- In 1964 the National Library of Medicine (NLM) began using the computerized MEDLARS (Medical Literature Analysis and Retrieval System) as a mechanism to create *Index Medicus*.<sup>9</sup>
- In 1971 the NLM began offering national online access to MEDLINE.
- In 1972 the NLM began training physicians and other health scientists in the use of computer technology for medical education and the provision of healthcare. This was the beginning of its informatics training programs.<sup>10</sup> The NLM would go on to play a major role in the development of the health informatics specialty.

The relationship between library science and the development of information science provides certain benefits for health informatics. The culture of library science brings to the study of informatics policies and procedures for managing information, an awareness of the value of the information to the user of that information, and a culture of service. Evidence of this cultural value can be inferred from the guiding principles of the American Library Association outlined in Box 1-1.

### Health Informatics

The development of health informatics is usually traced to the 1950s with the beginning uses of computers in healthcare.<sup>11</sup> This early period in the history of informatics extended into the 1960s and was characterized by experimenting with the use of this new technology in medicine and in nursing education.<sup>12</sup> For example, Robert Ledley, a dentist interested in biomedical research, published with Lee Lusted one of the first papers in this field. The paper, titled “Reasoning Foundations of Medical Diagnosis,” discussed computer-based medical diagnosis.<sup>13</sup> Ledley went on to invent the computed tomography (CT) scanner in the 1970s. An example from nursing is the work of Connie Settlemyer, a graduate student in the University of Pittsburgh School of Nursing in the late

#### BOX 1-1 AMERICAN LIBRARY ASSOCIATION: GUIDING PRINCIPLES

Advocacy for Libraries and the Profession  
 Diversity  
 Education and Lifelong Learning  
 Equitable Access to Information and Library Services  
 Intellectual Freedom  
 Literacy  
 Organizational Excellence  
 Transforming Libraries in a Dynamic and Increasingly Global Digital Information Environment

TABLE 1-1 CHARTING USING THE SOAPE FORMAT

LETTER	ITEM	DESCRIPTION
S	Subjective data or observations	Data provided by the patient, family, or others that cannot be observed, such as pain
O	Objective data or observations	Data that can be observed, such as the condition of an incision (inflamed, open with purulent drainage)
A	Assessment	The conclusion, diagnosis, or interpretation of the data, such as wound infection
P	Plan	A list of goals and planned interventions
E	Evaluation	A description of the outcomes or responses to the interventions

1960s. Settlemyer designed a mainframe-based computer-assisted instruction program for teaching students how to chart using the common problem-oriented format referred to as SOAPE or SOAP. See Table 1-1 for an overview of this format. This program was then used to teach undergraduate nursing students at the University of Pittsburgh throughout the 1970s.

During this same period the term *informatics* was established. **Informatics** is actually the English translation of terms used in other languages. Because of differences in language it is difficult to determine whether the initial use of the word *informatics* was referring to the discipline of informatics, information science, computer science, or a combination of these. A.I. Mikhailov at Moscow State University is credited with first using the Russian terms *informatik* and *informatikii*. In 1968, Mikhailov published the book *Oznovy Informatiki*, which was translated as *Foundations of Informatics*. In 1976, he published a second book, *Nauchnye Kummunikatsii i Informatika*, which was translated as *Scientific Communication and Informatics*. In this book he defined informatics as the science that “studies the structure and general properties of scientific information and the laws of all processes of scientific communication.”<sup>14(p39)</sup>

In the 1960s the word *informatique* began to appear in the French literature. *Informatique* translates to English as informatics or computing, data processing, or the handling of information, especially by a computer. During these same years the German term *informatik* was used. *Informatik* translates as meaning computing, calculating, figuring, or reckoning. The term *medical informatics* began to appear in English publications in the early 1970s. While the term **medical informatics** was not explicitly defined in these initial publications, it was generally accepted to mean the use of a computer to process medical data and information.<sup>14</sup>

While the period previous to the 1970s was characterized by experimentation and the establishment of the term *informatics*, the next 10 to 15 years were characterized by the beginning use of computers in actual patient care and the development of health informatics as a discipline. Beginning in 1971, El Camino worked in partnership with Lockheed to install the world's first computer-aided medical information system, known as MIS.<sup>15</sup> A number of hospitals followed this example by installing information systems to manage business and inventory data.

At that time nurses, and unit secretaries under the direction of nurses, were responsible for completing the paper forms necessary to implement physicians' orders that had been handwritten on patients' charts. These paper forms were used to communicate the orders to other departments and to capture the hospital charges associated with these orders. As a result, the functions of "order entry" and "results reporting" were in some of the first hospital information systems with direct patient care implications. Nurses, along with employees in specialty departments such as labs and radiology, were some of the first healthcare providers directly affected by the use of this technology in healthcare. During this same decade computers were beginning to be used in specialty areas such as the cardiac lab as hemodynamic monitoring systems. In these environments computers were used to do calculations, returning accurate results within seconds. By the end of the 1970s both commercial and academic developments in computers, libraries, and healthcare had created a fertile environment for the growth and development of the new discipline of health informatics.

## ESTABLISHING THE SPECIALTY OF HEALTH INFORMATICS

Over the next several decades, evidence that a new specialty was being established can be seen in the following:

1. Publications of health informatics books
2. Development of new journals
3. Establishment of professional organizations
4. Number of informatics conferences that are now recurring events
5. Creation of university-level educational programs
6. Development of certification programs

The history of each of these activities contributed to the development of the knowledge base that is unique to the discipline. Over time a result of these activities is an organized

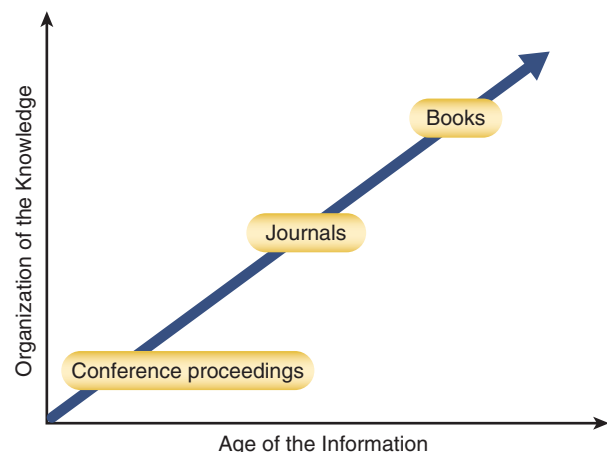
body of knowledge that is specific to the discipline. The newest information within the discipline is often presented at conferences. While a conference may have a theme and even subthemes, the focus is on presenting the newest information and not an organized body of knowledge. "The timeliest articles on computer applications in medicine [are] found in proceedings and transactions of meetings sponsored by professional and commercial organizations."<sup>14(p46)</sup> As journals develop, the information and knowledge specific to the discipline become more established and organized. As the knowledge increases, the organizational structure of that knowledge is recognized and accepted within the discipline. At this point in the development of any discipline, including health informatics, books play a key role in presenting the knowledge of the discipline in an organized format. For example, scan the table of contents of this book and notice the overall organization of the knowledge specific to this discipline. This general pattern of increasing organization within publications over time is demonstrated in Figure 1-1. As the discipline matures, these elements intersect with conferences and journal material coinciding and then feeding more formal material to books.

## Books

Books related to computers and healthcare began appearing in the 1960s. Examples of these types of books are included in Box 1-2. However, the use of the word *informatics* in a

### BOX 1-2 EARLY BOOKS ON COMPUTERS AND HEALTHCARE

*Computer Applications in the Behavioral Sciences* (1962) by Harold Borko  
*Computer Applications in Medicine* (1964) by Edward Eaton Mason and William G. Bulgren  
*Use of Computers in Biology and Medicine* (1965) by Robert Steven Ledley with the assistance of James Bruce Wilson  
*Computers in Biomedical Research* (1965) by Ralph W. Stacy and Bruce D. Waxman



**FIG 1-1** General trends in the development of knowledge within a discipline.

book title did not appear until 1971 when the International Federation for Documentation published *An Introductory Course on Informatics/Documentation* by A.I. Mikhailov and R.S. Giljarevskij. This was followed in 1977 by *Informatics and Medicine: An Advanced Course*, edited by P.L. Reichertz and G. Goos. In the 1980s books related to computers and nursing began to appear. The first of these books, *Nursing Information Systems* by Werley and Grier, established and explained the minimum data set in nursing practice.<sup>16</sup> This was quickly followed by one of the classic publications in informatics, *Computers in Nursing* by Rita Zielsorff.<sup>17</sup>

The 1980s were characterized by several publications dealing with computers and nursing. Well-recognized examples include the first edition of *Essentials of Computers* by Virginia Saba and Kathleen McCormick in 1987 and *Guidelines for Basic Computer Education in Nursing* by Diane Skiba and Judith Ronald. In 1988 the first book using the term **nursing informatics** in its title was published. This book, authored by Ball, Hannah, Newbold, and Douglas, was titled *Nursing Informatics: Where Caring and Technology Meet*.<sup>18</sup> In 1990 one of the first medical informatics textbooks, titled *Medical Informatics: Computer Applications in Health Care and Biomedicine*, was published by Shortliffe, Perreault, Wiederhold, and Fagan.<sup>19</sup> In this same year the first **dental informatics** book, *Dental Informatics: Strategic Issues for the Dental Profession*, part of the series *Lecture Notes in Medical Informatics*, was edited and published by John J. Salley, John L. Zimmerman, and Marion Ball. Today most if not all of the major publishers in the healthcare arena publish books related to health informatics. A search of offerings on Amazon or the Books in Print database can result in well over 1000 hits. However, because different editions, as well as hardback and paperback editions, are counted as separate books, it is impossible to get an accurate count of the total number of informatics books now in print. See Table 1-2 for a brief book list.

## Journals

Following the same pattern as books, new journals began to be published in the 1960s and used the word *computer* as opposed to *informatics*. Homer Warner at the University of Utah edited the first peer-reviewed journal within the new discipline. This journal, titled *Computers in Biomedical Research*, began publishing in 1967.<sup>14</sup> Table 1-3 includes the names and beginning dates of other initial health informatics journals from this time period.

In 1982, the first edition of the journal *Computers in Nursing* was published as a newsletter. The newsletter became an official journal published by Lippincott in 1984. Today the journal is known as *CIN: Computers Informatics Nursing*. While these journals provided a publishing resource for the evolving discipline, articles were also being published in other professional journals. In 1960, a total of 38 articles were indexed under the subject “computers in medicine.”<sup>14</sup> Since that date close to 15,000 articles have been indexed in MEDLINE and CINAHL using the key word “informatics.”

TABLE 1-2 EXAMPLES OF INFORMATICS BOOKS

TITLE	AUTHORS OR EDITORS	EDITION AND DATE OF COPYRIGHT
<i>Biomedical Informatics: Computer Applications in Health Care and Biomedicine</i>	Edward H. Shortliffe and James J. Cimino	3rd edition, 2006
<i>Health Informatics: Practical Guide for Healthcare and Information Technology Professionals</i>	Robert E. Hoyt, Nora Bailey, and Ann Yoshihashi	5th edition, 2012
<i>Information Technology for the Health Professions</i>	Lillian Burke and Barbara Weill	3rd edition, 2008
<i>Essentials of Nursing Informatics</i>	Virginia Saba and Kathleen McCormick	5th edition, 2012
<i>Introduction to Computers for Healthcare Professionals</i>	Irene Joos, Ramona Nelson, and Marjorie J. Smith	5th edition, 2010
<i>Informatics and Nursing: Opportunities and Challenges</i>	Jeanne Sewell and Linda Thede	4th edition, 2013

TABLE 1-3 EARLY JOURNALS IN HEALTH INFORMATICS

NAME	BEGINNING DATE	PUBLISHER
<i>Computers and Medicine</i>	1972	American Medical Association
<i>Journal of Clinical Computing</i>	1972	Gallagher Printing
<i>Journal of Medical Systems</i>	1977	Plenum Press
<i>MD Computing 1983</i>	1983	Springer-Verlag

While the term *informatics* began appearing in the titles of articles in the early 1970s, it was not until 1986 that the first journal article using the term *nursing informatics* was indexed in MEDLINE as well as CINAHL. This article, titled “The NI Pyramid—A Model for Research in Nursing Informatics,” presented a model for research in nursing informatics.<sup>20</sup> This model is described in Chapter 2 of this book. As with books, the number of journals has expanded significantly. As of

September 2012 the NLM catalog of journals included 119 informatics journals. Fifty-four of these journals are referenced in the National Center for Biotechnology Information (NCBI) database. Updated numbers can be seen by searching the database online at [www.ncbi.nlm.nih.gov/nlmcatalog](http://www.ncbi.nlm.nih.gov/nlmcatalog). Note that not all of the referenced journals are traditional print journals. The *Online Journal of Public Health Informatics* (<http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/ojphi/index>), established in 2009, is and always has been an online journal. The journals in this growing database reflect the overall field of informatics as well as subspecialties within informatics. For example, one of the journals indexed in MEDLINE—*CIN: Computers Informatics Nursing*—is specific to nursing informatics. The proceedings from the International Medical Informatics Association (IMIA) Nursing Informatics Conferences were added to this list starting in late 2012.

### Professional Organizations

Many of the early practitioners interested in the field of health informatics soon discovered there were no formal education programs or colleagues in their professional associations and local community who were also interested in the growing impact of computers. As a result, beginning in the late 1960s and early 1970s, professional organizations began to emerge, playing a significant role in the development of this specialty and providing a major source of education and networking for these early pioneers.<sup>21</sup> Initially informatics groups formed within other larger professional groups. For example, the American Medical Association (AMA) formed a committee on computers in medicine in 1969.<sup>14</sup> As these initial efforts expanded, professional organizations focused on health informatics began to split off from the larger organizations. At the same time that national and international groups were being established, a number of health informatics groups were established as smaller local groups.

The 1980s were a key decade for these activities. IMIA, which was established in 1967 as a technical committee of the International Federation for Information Processing (IFIP), became an independent organization in 1987. Prior to this, IMIA established Working Group 8 on Nursing Informatics in 1981 with representatives from 25 countries. The IMIA Nursing Informatics group continues to this day as a special interest group within IMIA. In the United States, the Symposium on Computer Applications in Medical Care (SCAMC) merged with the American Association for Medical Systems and Informatics (AAMSI) and the American College of Medical Informatics (ACMI) in 1989 to become the American Medical Informatics Association (AMIA). AMIA established a Special Interest Group: Computers in Nursing in the same year.

In 1986 the Hospital Management Systems Society (HMSS), an affiliate of the American Hospital Association (AHA), became the Healthcare Information and Management Systems Society (HIMSS), reflecting the growing influence of information systems and telecommunications

professionals within HIMSS as well as healthcare. In 1993 HIMSS became an independent, not-for-profit corporation.<sup>22</sup>

The American Nurses Association (ANA) established the Council on Computer Applications in Nursing in 1984, and the National League for Nursing (NLN) established the National Forum on Computers in Health Care and Nursing. Beginning in the 1980s and continuing over the next three decades, several local nursing informatics groups were formed. One of the largest and best known of these organizations is the Capital Area Roundtable on Informatics in Nursing (CARING) established in 1982. In 2010, the American Nurses Informatics Association (ANIA) from California and CARING from Washington, D.C. merged, creating ANIA-CARING, a national nursing informatics organization that includes five regions. With more than 3000 members in 34 countries and 50 states, ANIA is one of the largest nursing informatics organizations in existence.<sup>23</sup> Today a number of other local or regional nursing informatics groups continue to exist. In 2004, realizing the advantage of collaboration between these different nursing groups, 18 national and regional nursing informatics groups established the Alliance for Nursing Informatics (ANI) with the financial and leadership support of AMIA and HIMSS.<sup>24</sup> As of July 2012, there were 30 member groups. Box 1-3 lists examples of ANI's accomplishments.

An additional major informatics organization is the American Health Information Management Association. This Association has taken a slightly different path than the other significant informatics-related organizations. In 1928 the Association of Record Librarians of North America (ARLNA) was formed. One of the goals of this new organization was to improve the record of care provided to patients through the use of standards. Professionals within ARLNA were titled as registered record librarians (RRLs). In the mid-1940s the association changed its name to the American Association of Medical Record Librarians (AAMRL). However, this was not the last name change. As medical records

#### BOX 1-3 EXAMPLES OF THE ALLIANCE FOR NURSING INFORMATICS' ACCOMPLISHMENTS

- Successfully asked Google to appoint a nurse to the Google Health Advisory Council.
- Worked closely with Technology Informatics Guiding Educational Reform (TIGER) initiative to increase the knowledge and awareness of students and practicing nurses concerning informatics.
- Provided expert testimony for the Institute of Medicine and the Robert Wood Johnson forum on the Future of Nursing.
- Recommended numerous nursing experts for service on national committees and expert panels.
- Submitted comments to the National Institute of Standards and Technology (NIST) on Usability Framework as well as a number of other such documents.

were increasingly computerized and as members assumed increasing responsibility within that process, the emphasis on information management became obvious. In 1991 the AAMRL changed its name to the American Health Information Management Association (AHIMA).<sup>25</sup> Today, AHIMA continues to play “a leadership role in the effective management of health data and medical records needed to deliver quality healthcare to the public.”<sup>26</sup> Box 1-4 lists the major health informatics organizations and includes additional information on nursing informatics groups.

Given the number of health informatics–related professional organizations with similar names, it is not surprising that there is sometimes confusion, even among specialists in the field, concerning the missions and goals of the different groups. For example, because of the overlapping and complementary interests of AMIA and AHIMA, members of these organizations have at times expressed confusion about how the interests and activities of these organizations relate to one another. In response to this, AMIA and AHIMA jointly developed a document addressing potential questions

## BOX 1-4 MAJOR HEALTH INFORMATICS AND NURSING INFORMATICS GROUPS

### Health-Related Informatics Associations with Special Interest Groups

- American Medical Informatics Association (AMIA): [www.amia.org](http://www.amia.org)
  - “AMIA leads the way in transforming health care through trusted science, education, and the practice of informatics, a scientific discipline.”
  - Regular member dues are \$300.
  - A significant number of members are involved in academic settings.
  - Publishes a monthly peer-reviewed journal: *Journal of the American Medical Informatics Association (JAMIA)*.
  - Is the official American representative to the International Medical Informatics Association (IMIA).
  - Includes a special interest group in nursing located at [www.amia.org/programs/working-groups/nursing-informatics](http://www.amia.org/programs/working-groups/nursing-informatics). This group is responsible for appointing the nursing representative to the IMIA—Nursing Informatics Special Interest Group.
- Healthcare Information and Management and Systems Society (HIMSS): [www.himss.org/ASP/index.asp](http://www.himss.org/ASP/index.asp)
  - “Advancing the best use of information and management systems for the betterment of health care.”
  - Regular member dues are \$160.
  - A significant number of members are involved in the practice setting or work for information technology (IT) vendors.
  - With more than 44,000 individual members, more than 570 corporate members, and more than 170 not-for-profit organizations, HIMSS offers a wide range of activities and services.
  - Includes a nursing informatics community located at [www.himss.org/asp/nursingInformaticsCommunity.asp](http://www.himss.org/asp/nursingInformaticsCommunity.asp).

### Health-Related Informatics Associations with Specific Areas of Interest

- American Telemedicine Association (ATA): [www.americantelemed.org/](http://www.americantelemed.org/)
  - “Telemedicine will be fully integrated into healthcare systems to improve quality, access, equity and affordability of healthcare throughout the world.”
  - Regular member dues are \$220.
  - Members include individuals and organizations interested in telemedicine, including healthcare and academic

institutions and corporations that provide products and services supporting remote healthcare.

- Includes a telehealth nursing special interest group located at [www.americantelemed.org/i4a/pages/index.cfm?pageid=3327](http://www.americantelemed.org/i4a/pages/index.cfm?pageid=3327).
- American Health Information Management Association (AHIMA): [www.ahima.org](http://www.ahima.org)
  - “Leading the advancement and ethical use of quality health information to promote health and wellness worldwide.”
  - Regular dues are \$160.
  - Members are employed mainly in medical records management.
- College of Healthcare Information Management Executives (CHIME): [www.cio-chime.org/](http://www.cio-chime.org/)
  - “CHIME was created as a complement to HIMSS, intending to provide a specific focus for healthcare CIOs.”
  - Regular dues are \$405 for joint CHIME-HIMSS membership or \$290 for CHIME-only membership.
  - Members are the highest-ranking IT executives within their organizations.

### Nursing Informatics Associations

- Alliance for Nursing Informatics (ANI): [www.allianceni.org/](http://www.allianceni.org/)
  - “Transform health and health care through nursing informatics.”
  - The organization is jointly sponsored by AMIA and HIMSS; there are no dues for members.
  - Regular membership is open to nursing informatics–related organizations. A list of the members with links to each organization is located at [www.allianceni.org/members.asp](http://www.allianceni.org/members.asp). A comprehensive list of the local nursing informatics groups can be found in this list.
- American Nursing Informatics Association (ANIA): [www.ania.org/](http://www.ania.org/)
  - “To provide education, networking, and information resources that enrich and strengthen the roles in the field of nursing informatics.”
  - Regular membership dues are \$60.
  - Membership is open to individuals interested in nursing informatics and includes around 3000 members.

about the two professional associations and their relationship with one another. “AMIA is the professional home for informatics professionals who are concerned with basic research in the field or any of the biomedical or health application domains, either as researchers or practitioners. AHIMA is the professional home for health information management professionals, with a focus on those elements of informatics that fall under the health informatics area of applied research and practice.”<sup>27</sup> The need for such a statement and the wide range of professional organizations focused on informatics reflect the interprofessional nature of informatics and the evolution of health informatics as a distinct area of specialization within the different health professions.

### Educational Programs

During the 1950s selected medical schools at major universities began to fund medical computer centers to support the computing requirements of a variety of new biomedical research projects. During the 1960s and 1970s the federal government, mainly via the National Institutes of Health (NIH), played a major role in supporting these efforts. In 1962 NIH was authorized to spend an additional \$2 million to fund regional biomedical instrumental centers. By 1968 there were 48 fully operational biomedical computer centers. By introducing medical students, interns, and residents to informatics, these centers were fertile ground for the future development of medical informatics as a specialty. Individual lectures, elective courses, and, in time, medical informatics programs began to develop. In 1968 James Sweeney at Tulane University became the first professor of computer medicine in the United States.<sup>14</sup> One of the earliest departments of medical informatics was established in 1964 at the University of Utah.<sup>28</sup>

Starting in the 1980s the NLM became more active in supporting medical informatics education through its extramural grants program. In 1984 the NLM began the Integrated Advanced Information Management Systems (IAIMS) grant program with the goal of helping health science institutions and medical centers integrate information systems to support patient healthcare, health professions education, and basic and clinical research. By 1986 the NLM was supporting five academic sites, training a total of 29 students.<sup>29</sup> Two decades later the NLM was supporting 18 sites around the nation, with 270 students.<sup>29</sup> While most of these informatics-related educational programs were located in medical schools and attracted mainly physicians, a number of programs offered master’s and doctoral degrees that were interprofessional in their recruitment of students.

The early acceptance of other professions in these programs may have supported the position that medical informatics programs are interprofessional and that the term *medical* was meant to be inclusive of all health-related professions in the same way that the term *man* can refer to both men and women. However, a number, if not most, of the

health professions did not and still do not consider the term *medical* as inclusive of all health-related specialties. This is especially true for nurses who continued to develop their own university-based educational programs and be recognized as a separate profession in their own right. By 2012 AMIA took a formal position that medical informatics and nursing informatics are both subspecialties; medical informatics is not an inclusive name for both.<sup>30</sup>

In 1977, the State University of New York at Buffalo offered the first computer-related course in a nursing program, a three-credit elective. Just one decade later, in 1988, the University of Maryland offered the first master’s program in nursing informatics (NI). Within just a few years a doctoral degree with a focus in NI was offered. This was followed in 1990 by a master’s program at the University of Utah and in 1995 by a graduate program at New York University.<sup>31</sup> Over the next several years a number of educational programs in NI were established. These programs reflected their unique setting as well as the strengths and interests of their individual faculty and varied from postbaccalaureate certificate programs to doctoral programs. Because of the wide variation in programs and the lack of any organization tracking them, it is impossible to determine how many nursing informatics programs have actually existed at any point in time.

In 2002 the AMIA Nursing Informatics Working Group (AMIA NI-WG) established a task force on NI curriculum that was charged with developing a working document on the status of graduate curricula in nursing informatics. The goal was to achieve a consensus on the requirements for a master’s-level informatics program. The task force which identified 18 graduate programs that had been in existence for at least 2 years, issued their report in 2004, and concluded that:

Despite several attempts, the task force did not reach consensus on a model that would represent the underlying themes and concepts, yet be flexible. The need for flexibility is important so that individual programs can determine the depth and breadth of the underlying themes and concepts, as well as the development of niche informatics areas, such as consumer informatics, telehealth, or educational applications. Such a model was deemed premature at this time. So a narrative organization of the concepts and themes and content was selected to represent the work of this task force.<sup>32</sup>

Today, as the number of nursing informatics educational programs and other informatics educational programs expand, a variety of degrees and certificates are offered. While nursing and medicine make up the largest groups within the healthcare specialties, a number of other healthcare disciplines have developed informatics programs specific to each discipline. For example, in 1996 Temple University established the nation’s first department of dental informatics.<sup>33</sup>

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 included funding for a new educational program for health informatics specialists,



a certificate (nondegree) program. Recognizing the shortage of informatics specialists, the designers of this 9-month program wanted to provide beginning formal education to health professionals to quickly increase the numbers of available informatics specialists. However, the creation of these programs means that additional avenues of informatics education are available, but it is unclear how these different levels of education should relate to each other and to the needs of healthcare. How employers will react to certificate program graduates will be a source of study in the future. Chapter 26 includes additional information on this program.

## Certification

While attempts to create a consistent and systematic approach to educating health informatics professionals have not been successful, some level of success has been achieved in informatics specialty recognition, developing certification processes, and identifying competencies within a scope of practice.

Nursing was the first group to develop a certification process within health informatics. As a result, other groups have looked to nursing's process as a model. In 1992, the ANA designated NI a specialty within the practice of nursing. Subsequently, an ANA task force developed a monograph outlining the scope of practice and describing the specialty attributes of nursing informatics.<sup>34</sup> The scope of practice was followed a year later by a second monograph outlining the standards of practice and professional performance for nursing informatics.<sup>35</sup> These resources defining the scope and standards of practice provided the necessary groundwork for the development of a certification process. In 1995 a certification examination was created at the generalist practitioner level by the American Nurses Credentialing Center (ANCC). A baccalaureate degree in nursing (BSN) was and still is required to sit for the certification exam.

In 2001 a new task force was established to update and combine the scope and standards documents. That document was updated and revised again in 2008.<sup>36</sup> A key statement within the Scope and Standards of Nursing Informatics Practice is the goal of nursing informatics:

The goal of Nursing Informatics (NI) is to improve the health of populations, communities, families, and individuals by optimizing information management and communication. These activities include the design and use of informatics solutions and technology to support all areas of nursing, including, but not limited to, the direct provision of care, establishing effective administrative systems, designing useful decision support systems managing and delivering educational experiences, supporting lifelong learning, and supporting nursing research.<sup>36(p1)</sup>

The NI certification examination is regularly revised to reflect evolving practice. Nurses who successfully complete the certification process include the letters RN-BC after their names to indicate they are registered nurses with board certification. The latest data available from March 8, 2010 list a total of 779 actively certified ANCC informatics nurses.<sup>37</sup>

While the ANCC offers only one level of certification for the informatics nurse, the 2008 ANA scope and standards of practice document makes a distinction between an informatics nurse and an informatics nurse specialist. An informatics nurse specialist requires graduate preparation while the informatics nurse does not require this level of preparation. However, with only one level of certification, this distinction is not always clear. For example, in 2002 Johnson & Johnson launched a campaign to deal with the predicted nursing shortage. The website DiscoverNursing.com is an online extension of that campaign. As of late 2012 the site included 104 specialties, including Informatics Nurse. The educational requirement listed on the site is a BSN. Results of a search of the Internet for available nursing informatics positions frequently show a requirement of a nurse with a BSN, or baccalaureate in a related field such as computer science, with a master's degree preferred.

The 2008 ANA task force that wrote the current scope and standards of practice recognized the wide variation in job titles, broad scope of responsibilities, and wide range of roles of informatics nurses. Rather than focus on roles and titles, the 2008 document identified nine functional areas within the nursing informatics scope of practice:

- Administration, leadership, and management
- Analysis
- Compliance and integrity management
- Consultation
- Coordination, facilitation, and integration
- Development
- Educational and professional development
- Policy development and advocacy
- Research and evaluation

NI specialists employed in research, administration, or education employ each of these functional areas to varying degrees, depending on the specific task at hand.<sup>36</sup> The task force's conclusion was further supported by a national informatics nurse role delineation and job analysis survey completed by ANCC in 2010 as a basis for updating the certification examination. This survey included 412 informatics-certified nurses from across the United States. Key findings of the survey are listed in Box 1-5. The majority of certified informatics nurse specialists are employed in healthcare settings providing leadership and support during the life cycle of a healthcare information system within healthcare institutions.<sup>37</sup> This is reflected in the content areas of the certification exam (Box 1-6). Students will want to keep in mind that certified NI specialists may not represent the specialty as a whole. Many NI specialists with graduate or doctoral degrees do not sit for the exam since it is targeted at a generic level and not typically used as an employment discriminator for individuals with these degrees.

The next group to develop a certification examination was HIMSS. In 2002, HIMSS launched CPHIMS, which stands for Certified Professional in Healthcare Information and Management Systems. The "examination is designed to test the knowledge, experience and judgment of IT professionals in healthcare informatics practice. Successful completion of the

### BOX 1-5 KEY FINDINGS OF THE AMERICAN NURSES CREDENTIALING CENTER 2010 ROLE DELINEATION STUDY: INFORMATICS NURSE

Highest level of education: master's degree, 40 percent; baccalaureate, 35 percent

Average number of years working within the specialty of informatics: 5.81 years

Majority of respondents (62 percent) practiced within a hospital setting

Ten top work activities included:

- Modeling ethical behavior in use of systems and data
- Promoting adherence to confidentiality across the organization, health exchanges, or state and national registries
- Identifying issues related to privacy
- Serving on clinical committees
- Observing process flows
- Documenting process flows
- Analyzing existing system problems that affect nursing workflow
- Serving as a liaison between clinical, administrative, educational, and information technology groups within the organization
- Serving as a system or technical resource to client (definition of client: consumers, patients, nurses, other healthcare providers, vendors, and other organizations)
- Serving on a go-live implementation team

### BOX 1-6 CONTENT AREAS IN THE AMERICAN NURSES CREDENTIALING CENTER CERTIFICATION EXAM FOR NURSING INFORMATICS

1. Information Management and Knowledge Generation (37.33%)

- A. Foundations of Nursing Informatics Knowledge
- B. Models and Theories
- C. Human-Computer Interactions

2. Professional Practice (27.67%)

- A. Nursing Informatics Practice
- B. Informatics and Health Care Industry Topics
- C. Regulatory Monitoring and Accreditation Requirements
- D. Education and Staff Development

3. System Life Cycle (22.00%)

- A. System
- B. System Analysis
- C. System Design, Development, and Customization
- D. System and Functional Testing
- E. System Implementation, Evaluation, Maintenance, and Support

4. Information Technology (14.00%)

- A. Hardware
- B. Software
- C. Communication Technologies
- D. Security, Privacy, and Confidentiality

examination verifies broad-based knowledge in healthcare information and management systems.<sup>38(p2)</sup> As with ANCC, the content tested on the CPHIMS examination was developed by conducting a role delineation study. However, with this exam, information technology (IT) professionals were surveyed to identify tasks that were performed routinely and considered important to competent practice. The content developed from the survey is divided into three major topics with subsections. Box 1-7 outlines the topic areas tested on this examination.

HIMSS's publications concerning the development of the certification examination do not describe how the IT professionals were selected. However, the qualifications to sit for the exam do indicate how the term *IT professional* is defined. These qualifications include (1) a baccalaureate degree, or global equivalent, plus 5 years of associated information and management systems experience, with 3 of those years in healthcare or (2) a graduate degree, or global equivalent, plus 3 years of associated information and management systems experience, with 2 of those years in healthcare. Associated information and management systems experience is defined as including experience in administration or management, clinical information systems, ehealth, information systems, or management engineering.

As with the ANCC exam, there is a heavy emphasis on systems life cycle. In addition, both certifications require recertification (including fees). ANCC has a 5-year period of certification and CPHIMS requires recertification in 3 years. As of 2011 there were 1651 individuals with CPHIMS certification. Of these individuals, 251 were healthcare providers, divided as follows:

- 68.5% Registered Nurse
- 18.3% Medical Doctor
- 8.8% Registered Pharmacist
- 4.4% Other<sup>39</sup>

AMIA is the third group to begin the process of formally recognizing an area of specialization related to informatics. A town hall discussion in 2005 at the AMIA annual meeting concluded that:

1. Informatics as a discipline is more than clinical informatics.
2. Clinical informatics is an interprofessional domain.
3. There is social value in formal clinical informatics training and certification.<sup>40</sup>

While the town hall discussion described **clinical informatics** as an interprofessional domain and AMIA adopted this as formal policy, the actual process for recognizing clinical informatics as a specialty since then has limited this recognition to clinical informatics as a medical specialty for physicians only. In 2007 AMIA was awarded a grant to develop two documents that are required by the American Board of Medical Specialties (ABMS) to establish a medical subspecialty. In 2009 the core content for the subspecialty of clinical informatics<sup>41</sup> and the program requirements for fellowship education in clinical informatics<sup>42</sup> were published. In July 2009 the American Board of Preventive Medicine (ABPM) agreed to sponsor the specialty application and in

### BOX 1-7 CONTENT AREAS IN THE CERTIFIED PROFESSIONAL IN HEALTHCARE INFORMATION AND MANAGEMENT SYSTEMS CERTIFICATION EXAM FOR INFORMATION TECHNOLOGY PROFESSIONALS

1. General
  - a. Healthcare Environment
  - b. Technology Environment
2. Systems
  - a. Analysis
  - b. Design
  - c. Selection, Implementation, Support, and Maintenance
  - d. Testing and Evaluation
  - e. Privacy and Security
3. Administration
  - a. Leadership
  - b. Management

March 2010 ABPM submitted the application to ABMS. After an extensive review, the proposal was approved by the ABMS Board in a vote on September 21, 2011. The certification exam is in development and the clinical informatics subspecialty board exam is expected to be administered for the first time in the fall of 2013.<sup>43</sup> The Accreditation Council for Graduate Medical Education will accredit the training programs in clinical informatics; however, this process is yet to be developed. During the first 5 years of the certification procedure, a grandfathering process will be used for physicians who have not completed a formal fellowship in clinical informatics.<sup>44</sup>

Finally, two other informatics-related certification examinations are in development as of late 2012. In 2010, the Office of the National Coordinator for Health Information Technology (ONC) awarded a \$6 million grant to Northern Virginia Community College to support the development of a competency examination program for individuals who complete the community college–based certificate (nondegree) for training in Information Technology Professionals in Health Care.<sup>45</sup>

In addition, at its June 2011 meeting the AMIA Academic Forum created the Advanced Interprofessional Informatics Certification (AIIC) Task Force with the goal of exploring an alternate pathway for certification of other informatics professionals in parallel with the clinical informatics certification of physicians. The AIIC Task Force delivered a recommendation to the AMIA board of directors to pursue establishment of an Advanced Interprofessional Informatics Certification. Work is progressing on a white paper that will present a structure for describing and categorizing the varying roles, functions, and related certification needs among those working in the healthcare environment.<sup>44</sup>

As demonstrated by this review of events from published books to the development of credentialing processes,

health informatics evolved as a fragmented interprofessional specialty from a variety of disciplines having their own histories, cultures, and established structures. Books are written with nursing informatics or medical informatics in the title, suggesting that these are texts for different health-related disciplines; however, core informatics domain knowledge spans these disciplines. Credentialing exams with overlapping content are developed by different informatics-related professional organizations and are targeted to select specialties within health informatics. The next section explores the implications of the history of health informatics.

## RECOGNITION OF THE SPECIALTY

While health informatics has evolved as an interprofessional informatics specialty with a focus on healthcare, combining the words *interprofessional* and *specialty* may have created an oxymoron. First, the study of informatics is not limited to healthcare. Informatics as a field of study has been combined with a number of other professions. For example, Indiana University–Purdue University Indianapolis (<http://informatics.iupui.edu/>) has established a School of Informatics, which offers, along with a number of other programs, an undergraduate degree in informatics with the opportunity to specialize in biology, business, computer information technology, computer science, health science, human–computer interaction, or legal informatics among other options. Purdue also offers a graduate program in bioinformatics that will prepare the student to design and execute translational research linking data to medicine and drug discoveries, as well as a separate graduate program in health informatics that will prepare the student to analyze and protect patient data, increase healthcare efficiencies, and produce quality patient care.<sup>46</sup>

Second, while health informatics is considered an area of specialization with a focus on healthcare, the question of which discipline it falls within has never been established. In other words, is health informatics a specialty within (1) computer science, (2) information science, (3) each of the various healthcare disciplines, or (4) an interdisciplinary healthcare specialty with students from the different healthcare specialties combined, or (5) a new specialty distinct from its historical roots in the other disciplines? Currently, examples of educational programs representing each of these approaches can be found in colleges and universities across the United States. These programs vary from offering a certificate to an associate degree to offering a postdoctoral fellowship. As a result, the type and amount of previous education required for admission to these different health informatics programs can vary widely. In addition, there is limited consistency in the number of credits and types of courses required in programs of the same type. In recognition of these issues, key leaders within the professional organizations have attempted to establish the appropriate name of this specialty, describe the relationship of the specialty to other related fields of study, and develop a scope of practice with core competencies for the specialty.

## NAMING THE SPECIALTY—NAMING THE DISCIPLINE

Earliest references in the late 1950s used the term *bioengineering*. However, as the computer emerged as integral to health informatics, a number of terms combining the disciplines of medicine and computing, including *medical computer science*, *medical computing*, and *computer medicine*, were used to reflect the new specialty.<sup>14</sup> As other healthcare disciplines continue to develop a focus on informatics, using the terms *medicine* or *medical* to include all specialties has become more controversial, as noted earlier in this chapter. Many disciplines solved this problem by combining the name of their field of practice with the word *informatics*. Box 1-8 provides several examples. This approach is consistent with the strong division of labor, often called scope of practice, and hierarchical structures in healthcare education and healthcare delivery. This approach is also based on the assumption that informatics is a subspecialty within a specific health-related profession. However, the approach of modifying the term *informatics* with a specific health-related discipline, area of interest, or specialization does not provide a name and definition for the discipline as a whole. As pointed out previously, over the years some have argued that *medicine* was an inclusive term covering all aspects, including all healthcare roles in preventing, diagnosing, and treating health problems, including disease. This is demonstrated by the current names of the international and national associations: the International Medical Informatics Association (IMIA) and the American Medical Informatics Association (AMIA). These are interdisciplinary informatics associations with members from various healthcare disciplines. The 3800 members of AMIA include both individual members such as physicians, nurses, dentists, biomedical engineers, medical librarians, those in information technology, and other health professionals and institutional or corporate members such as nonprofit organizations, universities, hospitals, libraries, and corporations with an interest in biomedical and health informatics.<sup>47</sup> Many educational programs changed their names to **biomedical informatics** to solve this issue and there have been suggestions to change the names of the IMIA and AMIA to use *biomedical* in place of the term *medical*,<sup>30</sup> however, not all members may consider the term *biomedical* as more inclusive than *medical informatics*.

Others have pointed out that the practice of medicine defines the scope of practice for a physician and therefore have suggested that *health* or *healthcare* is a more inclusive term since it includes all levels of wellness as well as disease and other health problems. For example, the Healthcare Information Management and Systems Society (HIMSS) can be described as an interprofessional informatics association but uses the term *healthcare*. The Scope and Standards of Nursing Informatics Practice, published by the ANA, states in the introduction:

Nursing Informatics (NI) is one example of a discipline-specific informatics practice within the broader category of health informatics.<sup>36(p1)</sup>

### BOX 1-8 NAMING HEALTH INFORMATICS: RELATED DISCIPLINES

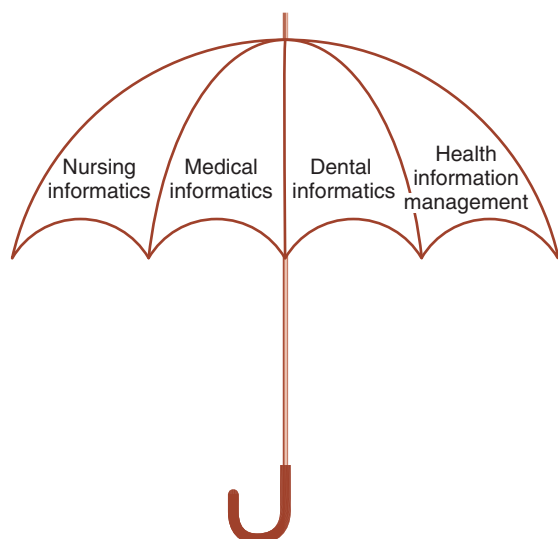
- Biomedical Imaging Informatics
- Biomedical Pattern Recognition
- Clinical Informatics
- Clinical Research Informatics
- Consumer Health Informatics
- Critical Care Informatics
- Dental Informatics
- Global Health Informatics
- Health and Medical Informatics Education
- Informatics in Genomic Medicine (IGM)
- Intensive Care Informatics
- Mental Health Informatics
- Nursing Informatics
- Open Source Health Informatics
- Pediatric Health Informatics & Technology (PHIT)
- Pharmacoinformatics or Pharmacy Informatics
- Primary Care Informatics or Primary Healthcare Informatics
- Public Health Informatics
- Public Health/Population Informatics
- Telemedicine and Mobile Computing Informatics
- Translational Bioinformatics
- Veterinary Informatics

Likewise the AMIA Nursing Informatics working group provides the following mission in describing its group:

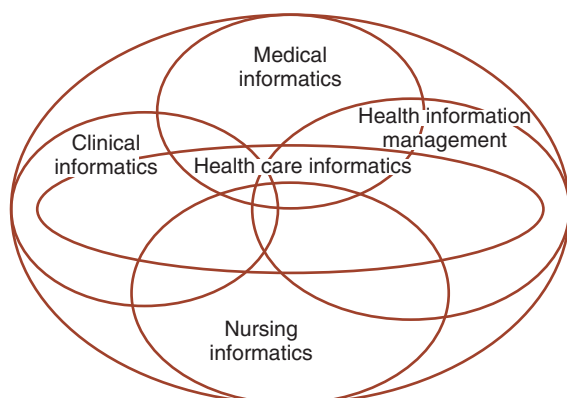
To promote the advancement of nursing informatics within the larger interdisciplinary context of health informatics. The organization and its members pursue this goal in many arenas: professional practice, education, research, governmental and other service, professional organizations, and industry. The Working Group represents the interests of nursing informatics for its members and AMIA through member services and outreach functions, provides official representation to IMIA-NI and liaises to other national and international groups.<sup>32</sup>

The challenge has been and may still be to select a name that describes the discipline as a whole and yet acknowledges the different informatics disciplines and their relationship with the broader field of study. In 2002 Englehardt and Nelson used the term *health informatics* but presented two different “interdisciplinary” models in response to these issues. Figure 1-2 shows an umbrella model that recognizes the clear boundaries between the different health informatics disciplines at the same time as it demonstrates that it is the connections between the boundaries or the frame of the umbrella that create the discipline. Figure 1-3 uses a Venn diagram to describe health informatics as overlapping the different health informatics disciplines yet being distinct. However, neither model suggests a name that would be inclusive of the different health informatics specialties and their relationships.

In 2006 Shortliffe and Blois recommended the term *biomedical informatics* in Chapter 1 of a book that was retitled for the third edition, *Biomedical Informatics: Computer*



**FIG 1-2** Umbrella Model of Health Informatics. (Copyright Ramona Nelson. Reprinted with permission.)



**FIG 1-3** Venn Diagram Model. (Copyright Ramona Nelson. Reprinted with permission.)

*Applications in Health Care and Biomedicine.* “In an effort to be more inclusive and to embrace the biological applications with which many medical informatics groups had already been involved, the name medical informatics has gradually given way to biomedical informatics. Several academic groups have already changed their names, and a major medical informatics journal *Computers and Biomedical Research* was reborn as *The Journal of Biomedical Informatics*.”<sup>19(p23)</sup> In arriving at this position, Shortliffe and Blois explain within the chapter why they believe the terms *health* and *health informatics* are not inclusive but rather exclude key groups:

Many observers have expressed concern that the adjective “medical” is too focused on physicians and fails to appreciate the relevance of this discipline to other health and life science professionals, although most people in the field do not intend that the word “medical” be viewed as being specifically physician-oriented or even illness-oriented. Thus, the term health informatics, or healthcare informatics, has gained some popularity, even though it has the disadvantage of tending to exclude applications to biology . . . and, as we will argue shortly, it tends to focus the field’s name on an application domain (public health and prevention)

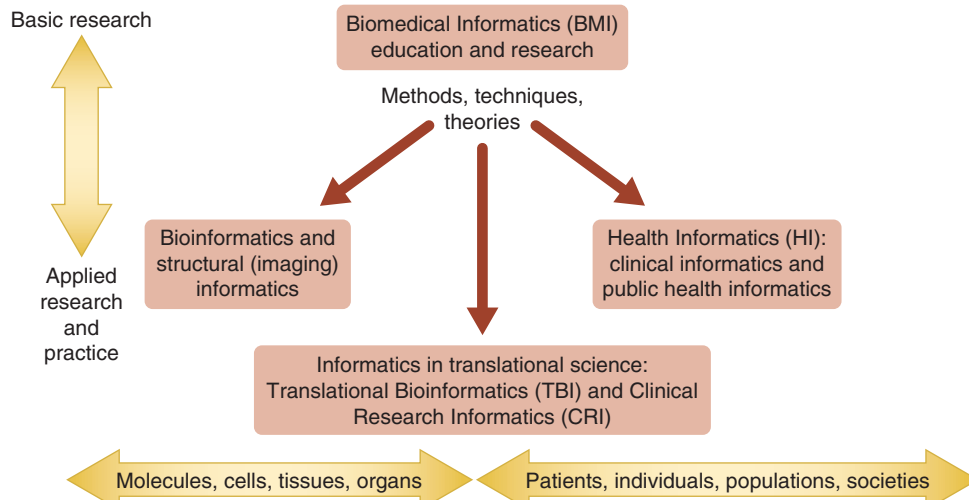
rather than the basic discipline and its broad range of applicability.<sup>19(p23)</sup>

The term *biomedical* and the rationale for selecting it resonated with a number of other leaders within AMIA. Six years later the *AMIA Board White Paper: Definition of Biomedical Informatics and Specifications of Core Competencies for Graduate Education in the Discipline* was formally approved by the AMIA Board on April 17, 2012 and published online in June 2012.<sup>30</sup> With the acceptance of this paper AMIA now defined biomedical informatics (BMI) as “the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision making, motivated by efforts to improve human health.”<sup>30(p3)</sup> The areas of research and application within BMI range from molecules to populations and societies.

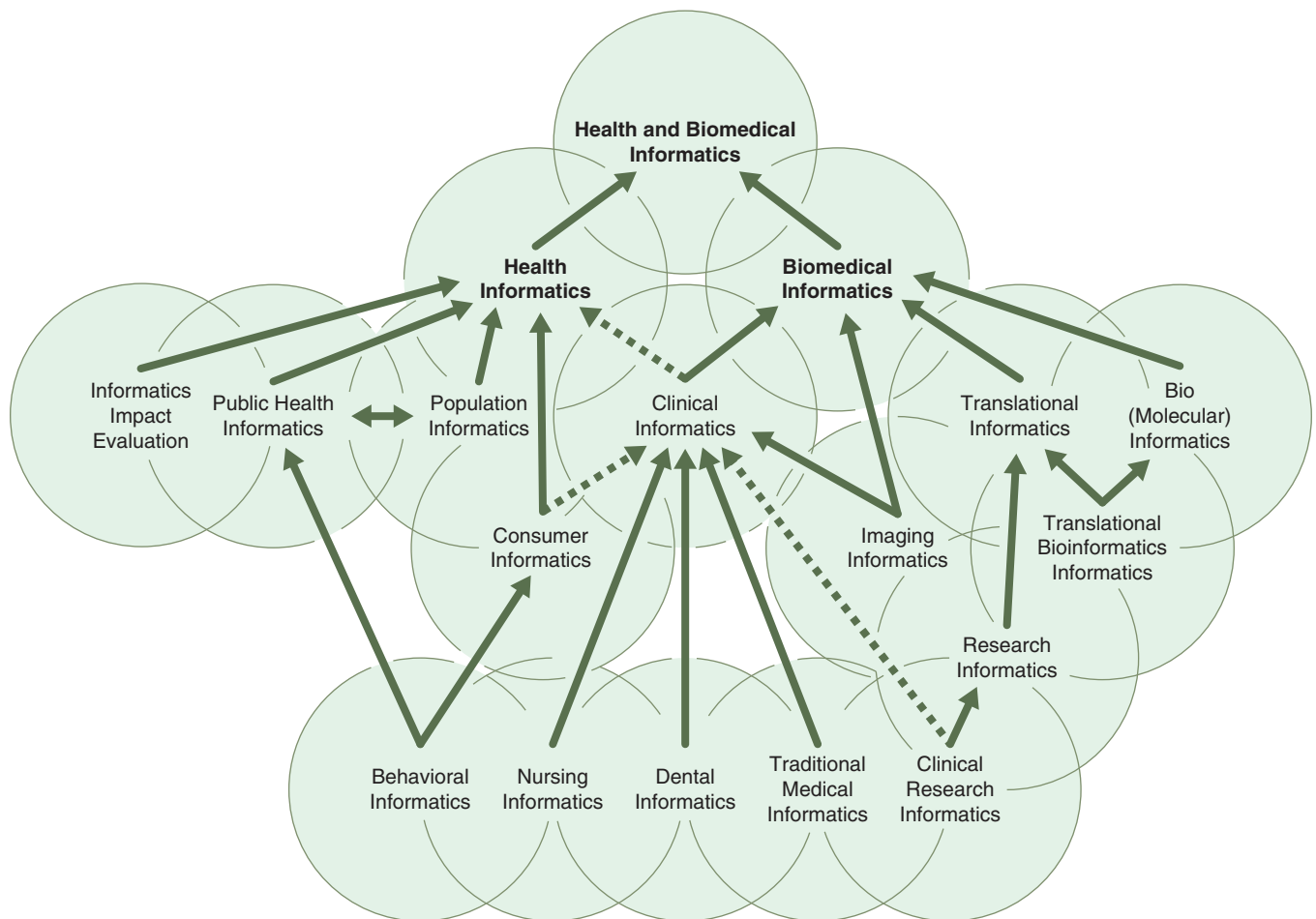
In selecting the term *biomedical informatics* the authors of the paper noted that they had adopted the newer position that the term *medical informatics* refers solely to the “component of research and practice in clinical informatics that focuses on disease and predominantly involves the role of physicians. Thus AMIA now uses *medical informatics* primarily as a parallel notion to other subfields of clinical informatics such as nursing informatics or dental informatics.”<sup>30(pp2–3)</sup> The term *health informatics* is also seen as limited in scope. “BMI is the core scientific discipline that supports applied research and practice in several biomedical disciplines, including health informatics, which is composed of clinical informatics (including subfields such as medical, nursing, and dental informatics) and public health informatics.”<sup>30(p3)</sup> Figure 1-4 demonstrates the relationships of these previously used terms now under the broad definition of BMI.

However, the authors of the AMIA paper may have realized that the term *biomedical informatics* may not have sounded inclusive to all health-related informatics disciplines in stating that “the phrase ‘biomedical and health informatics’ is often used to describe the full range of application and research topics for which BMI is the pertinent underlying scientific discipline” [emphasis added].<sup>30(p1)</sup>

Not all groups within healthcare identify biomedical as the inclusive term in that it contains the term *medical* as opposed to *health*. However, combining the terms *health* and *biomedical* informatics, as in the previous quote, may be more acceptable. For example, the Northwestern University Feinberg School of Medicine, Department of Preventive Medicine chose to name its program the Department of Health and Biomedical Informatics. This was after careful consideration of the evolution of the names for the discipline. A summary of this consideration is posted at [www.preventivemedicine.northwestern.edu/divisions/hbmi/about.html](http://www.preventivemedicine.northwestern.edu/divisions/hbmi/about.html) and is illustrated in Figure 1-5. As can be seen in these two figures, a common consensus has not yet been achieved but there are more similarities than there are differences. In both diagrams informatics is the broader or parent discipline and nursing, medicine, dentistry, etc. are specialties within that broader field.



**FIG 1-4** AMIA position: biomedical informatics and its areas of application and practice. (Redrawn from Kulikowski CA, Shortliffe EH, Currie LM, et al. AMIA Board white paper: definition of biomedical informatics and specification of core competencies for graduate education in the discipline. *J Am Med Inform Assoc.* 2012. With permission from BMJ Publishing Group Ltd.)



**FIG 1-5** Hierarchy of Informatics. This diagram shows the relationships between various sub-domains of Health and Biomedical Informatics. The domains are shown as blobs rather than as discrete boxes to emphasize the high degree of overlap among the domains. This hierarchy should be considered a snapshot in time rather than a definitive final solution. (Northwestern University Feinberg School of Medicine, Department of Preventive Medicine.)

## CONCLUSION AND FUTURE DIRECTIONS

This chapter has traced the evolution of informatics as a specialty within healthcare and as a discipline. The history of health informatics has been strongly influenced by the history of the health professions and their current infrastructures, such as the educational systems, professional organizations, and professional cultures. As informatics-related education among the professions becomes more consistent and as computerization becomes more integrated into every aspect of healthcare, these historical struggles will become yesterday's story. The emphasis will move from defining the differences and establishing boundaries between the professions to creating an interprofessional approach to meet the health-related needs of individuals and societies. Within this environment, one can expect the healthcare-related specialties to move forward in reaching a working consensus on their individual roles as well as their ever-changing scope of practice within health and biomedical informatics. The focus will evolve to shared core competencies, knowledge, and skills versus emphasizing differences. Over time the collaborative opportunities to create a more effective and efficient healthcare system will become more interesting and motivating than the historical struggles and hierarchical relations of the past.

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## DISCUSSION QUESTIONS

1. Healthcare as a professional field of practice is often traced to the Middle Ages. Its historical roots are tied to the hierarchical structure of the church and the military. How does this history influence the current structure and relationships between the subspecialties within healthcare and biomedical informatics?
2. Which professional associations would be most appropriate for professionals interested in nursing informatics, pharmacy informatics, or public health informatics? Explain the combination selected and the rationale for each choice.
3. Is biomedical and health informatics a discipline or is this an area of subspecialization of interest to health professionals such as nurses, physicians, dentists, etc.?
4. Should there be one certification process and set of credentials for all biomedical and health informatics specialists, or should each of the health professions develop a certification process specific to that specialty?
5. What interprofessional name would you recommend and why?

## CASE STUDY

In this case study you, as the reader, will need to fill in a number of the details. The case study begins at the point when you return to school for a graduate degree. Details related to your previous education, professional experience in healthcare, and goals in returning to school should be filled in from your own life story. The program of study for your graduate degree includes an Introduction to Informatics course. This is a required course for all students in the program. One of the first course requirements is that you join an informatics organization and complete a short paper explaining why and how you selected that specific organization. Be sure to explain how you analyzed the options and narrowed your choice to the one organization.

### Discussion Questions

1. Talk to several faculty members or others with an interest in informatics to see what organizations they belong to and why. Ask how they became interested in informatics and see if you can match their history with informatics to what you learned about the history of informatics in this chapter.
2. Review the organization websites in Box 1-4 to determine which organization fits best with your interests. Explain how you matched your areas of interest to the information on the website of your chosen organization.
3. Discuss how you would use the information from questions 1 & 2 in selecting appropriate mentors.