

7th Edition

Essentials of **NURSING INFORMATICS**



Virginia K. Saba

Kathleen A. McCormick

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Essentials of Nursing Informatics

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Essentials of Nursing Informatics

SEVENTH EDITION

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ISBN: 978-1-26-045679-0

MHID: 1-26-045679-X

The material in this eBook also appears in the print version of this title: ISBN: 978-1-26-045678-3,
MHID: 1-26-045678-1.

eBook conversion by codeMantra
Version 1.0

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FOREWORD

In the years since the previous edition of *Essentials in Nursing Informatics* was published, U.S. hospitals have achieved nearly universal adoption of electronic health record (EHR) systems. Physician offices are only slightly behind in joining the digital ranks, and health professionals across the nation now utilize EHR systems in daily practice. The “HITECH Act” has forever changed health informatics, and we now face new challenges in improving usability, interoperability, and learning capability of these systems. With the rise of artificial intelligence and a need to reduce documentation burden required by current EHR systems, we see significant opportunity and responsibility for healthcare providers to address these challenges. Nurse informaticists are at the center of this transformational opportunity.

Historically, care teams communicated primarily through written notes in the patient chart. Paper represented a technical barrier, as the best patient care is dependent on data availability over time, across locations, and among healthcare team members—including the patient. Access to the most accurate and complete information remains vital, and nursing informaticists are leading much of the work being done to improve the speed, accuracy, and utility of clinical information.

We have made progress in gaining nearly instant access to patient data and evidence-based decision support that enables nurses, physicians, and other clinicians to make better decisions about patient care. These technologies, however, require continued optimization of the technology, the interoperability, and the workflow to drive improvement in user experience, reduce documentation burden, and improve patient outcomes.

The accelerating demands for gathering and using data to improve patient care and clinical operations have increased awareness of informatics as a core skill, intensifying the need for clinicians to better understand these increasingly ubiquitous technologies. This edition incorporates updated teaching aids to help educators develop more sophisticated users of technology, who are equipped to improve processes and workflows that result in safer, more effective, and efficient patient care.

As the specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge—and

ultimately, build wisdom—into nursing practice, nursing informatics is uniquely positioned to help lead the optimization journey that will simplify data capture, promote sharing of data in a mobile environment, and create high-performing, patient-centric clinical information systems.

The vision for a better future of healthcare is tightly associated with the future of health information technology, and data are the fuel for this journey. Thus, nurse informaticists are critical healthcare leaders for the 21st century, experts in the right place at the right time, bringing the clinical, technical, and leadership skills together to create effective partnerships among their numerous constituencies—leadership teams, clinicians, data scientists, information technologists, and more. Their role is central in advancing value and science-driven healthcare, and so their work in moving healthcare informatics from data management to decision support is essential.

In the 15 years since the call for EHRs was made in the 2004 Presidential State of the Union message, we have witnessed rapid evolution of health information technology and its use in healthcare systems. The next 15 years will bring the increasing convergence of data from myriad sources outside of the formal healthcare setting into the context of clinical care. We will move up the analytic hierarchy from descriptive to diagnostic, predictive, and ultimately prescriptive and autonomous systems. Thus, the future of this field promises both challenge and opportunity for prepared participants.

Just as the field has evolved, so has nursing informatics. Its practitioners have already provided tremendous energy, insight, and leadership in helping to establish the necessary infrastructure and in driving gains in healthcare technology competency, information literacy, and better healthcare outcomes. Now more than ever, we believe nursing informatics holds great promise to enhance the quality, continuity, value, and experience of healthcare.

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PREFACE

This seventh edition of *Essentials of Nursing Informatics* was initiated in response to requests by educators to provide a digital as well as an online version for faculty to use in the development of their course work and by nurses and other users of the sixth edition. We expanded the content to stay current, since the publisher does not plan to generate a Study Guide for this version. To do so, we have added Questions and Answers in each chapter as well as added a Summary in each of the nine parts and one Appendix of the text. Further with the updated ANA Certification Examination, we returned the basic, detailed Fundamental Chapters to update so that the chapters completely address their focus and scope.

Each of the nine parts of this edition has had a Section Editor to assist the authors with their content: Part 1: *Nursing Informatics Technologies*—Carol J. Bickford and Marisa L. Wilson; Part 2: System Standards—Virginia K. Saba and Joyce Sensmeier; Part 3: System Life Cycle—Denise D. Tyler; Part 4: Informatics Theory Standards—Virginia K. Saba; Part 5: Policies and Quality Measures in Healthcare—Kathleen Smith; Part 6: Nursing Practice Applications—Heather Carter-Templeton; Part 7: Advanced Applications for the Fourth Nursing IT Revolution—Kathleen A. McCormick; Part 8: Educational Applications—Diane J. Skiba; and Part 9: Research Applications—Veronica D. Feeg. For this edition, faculty recommended that we write a part summary introducing important concepts in each part.

This book was written by experts in nursing and informatics, but when we were editing this book, the most unusual circumstances occurred. The COVID-19 pandemic swept across continents. Nurses in practice were stretched by large volumes of critical care to a large cohort of patients. Unique digital concepts were developed on site, implemented to large groups of healthcare professionals in the ICU, the hospital, nearby local pop-up hospitals, primary care offices, networks of specialty healthcare workers, and skilled nursing facilities and nursing homes. The mandate for interconnected healthcare, telehealth, and digital education quickly became an adopted norm.

Several new chapters were added in Part 7: Advanced Applications for the Fourth Nursing IT Revolution (Kathleen McCormick—Section Editor). This part has the following chapters: New Models of Healthcare Delivery

(Chap. 36), *Artificial Intelligence in Healthcare* (Chap. 37), *Telehealth: Healthcare Evolution in the Technology Age* (Chap. 38), *Nursing's Role in Genomics and Information Technology for Precision Health* (Chap. 39), *Big Data Analysis of Electronic Health Record (EHR) Data* (Chap. 40), *Nursing Data Science and Quality Clinical Outcomes* (Chap. 41), *Nursing Informatics Innovations to Improve Quality Patient Care on Many Continents* (Chap. 42), and *Global eHealth and Informatics* (Chap. 43). We requested authors to include updates on the digital health requirements, policies, and regulations as a result of the COVID-19 pandemic.

The updates in chapters include new references, policies, and skills required by nurses in the field. A complete update and an overview of the Federal Health Care Sector Nursing Informatics are described by experts representing all the federal sectors. The Veteran's Administration Nursing Plan of Care Framework is described. Instead of an International Section, the nurse authors from Australia, South Korea, Finland, South America, Canada, the United Kingdom, and North America have described their expertise in Six Sigma, Measuring and Evaluating Quality, describing Consumer Patient Engagement and Connectivity in Patients with Chronic Diseases in the Community and in their Home, and Global eHealth initiatives in Nursing Informatics. Their chapters represent the expertise that they bring to *Essentials of Nursing Informatics*, seventh edition.

Our new Media Editor, Diane J. Skiba, is considering including a website for slides, abstracts, and any other materials of interest that the authors determined would support the faculty and/or enhance the educational process. We feel that this new edition will provide the new theories, federal policies, and new content that have impacted the field of Nursing Informatics that are continually changing.

Virginia and Kathleen have felt that they have, during the past 20+ years, and their six editions, with their specialist authors in the field, provided the most current and reliable information as this new Nursing Specialty advanced, grew, and changed with the technological advancements that impacted on the changing healthcare processes. We feel honored that this text has been used by the key administrative leaders, educators, and researchers

in the field. We feel that this text has helped keep Nursing Informatics in the forefront of our discipline. We hope you will be as pleased with this seventh edition as you have been with the past editions. We hope it will help faculty

teach the content, assist nurses with the certification requirements, and help us advance Nursing Informatics in the 21st century.

Dr. Virginia K. Saba
Dr. Kathleen A. McCormick

ACKNOWLEDGMENTS

This seventh edition of *Essentials of Nursing Informatics* is dedicated to all the section editors, chapter authors, and their co-authors. Each of these prestigious contributors are experts in their respective positions, implementing systems, policies, research, and educational programs to support and advance Nursing Informatics in this country and abroad.

We acknowledge our international colleagues in Nursing Informatics. We also acknowledge the McGraw Hill staff Susan Barnes Oldenburg, Richard Ruzicka, and Christina Thomas and their contractors Touseen Qadri from MPS Limited who contributed to the editing of this book, completing the production of this book, as well as supporting the expansion of the book with new resources.

We also want to especially remember those authors and other supporters of Nursing Informatics who have left us last year: Helen Connors, Kathleen (Milholland) Hunter, Margaret Ross Kraft, Melissa Barthold, Julie McAfoos, Andrew McLaughlin, Dr. Donald, Lindberg, and others who have left their mark on the field.

The authors also acknowledge their families because without their encouragement and help this book would not be a reality. We thank the Lord for giving us the opportunity to embark on a seventh edition and for the help we received in completing it.

*Dr. Virginia K. Saba
Dr. Kathleen A. McCormick*

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Nursing Informatics Technologies

Carol J. Bickford and Marisa L. Wilson

A new feature of the seventh edition of *Essentials in Nursing Informatics* is a part summary that provides an overview for each of the nine parts of this edition. Each part represents a specific focus on this Nursing Informatics specialty and provides appropriate information in separate chapters. The coronavirus pandemic that occurred during the publishing process also allowed some authors to address its impact on specific practice areas.

The informatics nurse uses data to create information and knowledge to support best care practices. The informatics nurse engages the data to information to knowledge process using technology to support patient care, increase efficiency, ensure quality, and improve outcomes. In order to do this, the informatics nurse needs to understand the foundations of computer hardware and software as well as the processes for managing data and information. Understanding how computer hardware and software works is core to fulfilling the tenets of nursing informatics as outlined in the American Nurses Association (ANA) *Nursing Informatics: Scope and Standards of Practice, Second Edition*. Part 1 content description follows.

Chapter 1, entitled *Historical Perspectives in Nursing Informatics*, authored by Dr. Virginia K. Saba, Dr. Bonnie L. Westra, and Dr. Julie J. Brixey, provides a historical overview of Nursing Informatics (NI) during 10-year period starting in the 1960s with the introduction of computer technology in healthcare. The chapter provides landmark events that influenced the growth of NI as a new nursing specialty. It provides an update on new activities since the previous edition, including new information on where and who were involved in advancing this specialty. It includes the new criteria, established by the NI pioneers, that addressed nursing practice standards, educational content, certification requirements, etc. It also updated the Landmark Events and Pioneers in Computers and Nursing, and Nursing Informatics table with the name of the major NI pioneer involved.

Chapter 2, *Computer Systems Basics—Hardware*, authored by Dr. Mary L. McHugh, provides a helpful overview of basic computer hardware components, their characteristics, and functions. Because computers are ubiquitous in everyone's personal life and the healthcare industry, an understanding of the operations of such an infrastructure is foundational for the informatics nurse. The five basic types of computers and the associated internal components and diverse peripherals are described, as is the critical connectivity provided by network hardware.

Chapter 3, developed by Dr. David J. Whitten who updated Dr. Kathleen Charters' earlier description of *Advanced Hardware and mHealth* supports innovative mobile healthcare models. This chapter informs the readers of the use of increasingly sophisticated mechanical devices and electronic systems that will allow providers to provide care, consultation, and communications in and across a multitude of settings. This chapter reviews the use of advanced tablets, smartphones, wearables, and implantable or injectable devices made possible by the acceleration of increasingly sophisticated and powerful hardware within an infrastructure that supports these activities.

Chapter 4, *Computer Systems Basics—Software*, authored by Dr. Mary L. McHugh, clarifies the differences and complementary interrelationships of the three basic types of software: system software, utility programs, and applications software. Discussion of the evolution of the generations and levels of programming languages promotes appreciation of the complexity of today's information systems' environments and the value of expert programmers, colleagues, and specialists partnering with the informatics nurse to ensure continuity of operations and services.

In Chapter 5, Drs. David J. Whitten expanded the previous authors'—Drs. Peter Murray and W. Scott Erdley—focus on an important topic *Open Source and Free Software* or Free/Libre Open Source Software (FLOSS). Most informatics nurses will work with vendor software products. However, they need to be aware of the resources available for use that are free and open source. The informatics nurse needs to be familiar with the risks and rewards of using this software and the differences between this and proprietary software when making choices. The authors provide a history of FLOSS, along with development models, that dates back to the 1950s. They describe the benefits and issues related to the choice to use FLOSS versus proprietary software. Whitten also provided detailed steps that one would consider when choosing software, whether FLOSS or proprietary. The authors also cover the topic of licensing, which with the FLOSS model encourages sharing of the software to facilitate dissemination.

Chapter 6 covers *Data and Data Processing*. Drs. Irene Joos, Cristina Bahm, and Ramona Nelson offer a broad presentation of this topic. Nelson's Data to Information to Knowledge to Wisdom Model's megastructures and concepts underline NI, as well as processes for creating and using knowledge that the data care providers collect. In this chapter, the authors describe important concepts in generating data. They introduce information on big data, data repositories, database management systems, database models, and processes for curating data. The function and processes of interoperability are described. Auditing data, information creation, and interpretation in the form of analytics are explained. Clinical decision support and expert systems are presented as examples of processes using data to support value-based care.

Historical Perspectives of Nursing Informatics

Virginia K. Saba / Bonnie L. Westra / Juliana J. Brixey

• OBJECTIVES

1. Identify a brief historical perspective of nursing informatics.
2. Explore lessons learned from the pioneers in nursing informatics.
3. List the major landmark events and milestones of nursing informatics.

• KEY WORDS

Computers
Computer Literacy
Computer Systems
Data Standards
Electronic Health Records (EHR)
Healthcare Information Technology (HIT)
Information Systems
Internet
Nursing Informatics (NI)

OVERVIEW

Nursing Informatics is a phrase that evolved from the French word “informatique” which referred to the field of applied computer science concerned with the processing of information such as nursing information. The computer was seen as a tool that could be used in many environments.

In the early 1960s, the computer was introduced into healthcare facilities for the processing of basic administrative tasks. Thus the computer revolution in healthcare began and led to today’s healthcare information technology (HIT) and/or electronic health record (EHR) systems.

The importance of the computer as an essential tool in HIT systems and the delivery of contemporary healthcare is indisputable. HIT is an all-encompassing term

referring to technology that captures, processes, and generates healthcare information. Computerization and/or electronic processing affect all aspects of healthcare delivery including (a) provision and documentation of patient care, (b) education of healthcare providers, (c) scientific research for advancing healthcare delivery, (d) administration of healthcare delivery services, (e) reimbursement for patient care, (f) legal and ethical implications, as well as (g) safety and quality issues.

Since the inception of the computer, there has been a shift from the use of mainframe, mini, or microcomputers (PCs) to integrating multiple technologies and telecommunication devices such as wireless, handheld, mobile computers, and smart (cell) phones designed to support the continuity of care across healthcare settings and HIT systems. There has also been a shift from storage

devices to cloud storage. Furthermore, there is less need to develop written instructions for software programs as today's applications are icon-based, user-friendly, and menu-driven. Additionally, video tutorials are available for many programs. Touch-screen devices are replacing the need for a mouse.

Today, computers in nursing are used to manage patient care information, monitor quality, and evaluate outcomes. Computers and networks are also being used for communicating (sending and receiving) data and messages via the Internet, accessing resources, and interacting with patients on the Web. Nurses are increasingly using systems for planning, budgeting, and policy-making for patient care services. Computers are also used to document and process real-time plans of care, support nursing research, test new systems, design new knowledge databases, develop data warehouses, and advance the role of nursing in the healthcare industry and nursing science. Moreover, computers are enhancing nursing education and distance learning with new media modalities.

This chapter is an updated and revised version of the chapter "Historical Perspectives of Nursing Informatics" (Saba & Westra, 2015) published in the 6th edition of the *Essentials of Nursing Informatics* (Saba & McCormick, 2015). In this chapter the significant events influencing the growth of nursing informatics (NI) as a nursing specialty are analyzed according to (1) seven time periods, (2) a view of the newest technological innovations used by nurses, (3) a description of Nursing Informatics Pioneers including a synthesis of lessons learned from videotaped interviews with NI pioneers, (4) electronic health records from a historical perspective, and (5) landmark events in nursing and computers, with Table 1-1 listing those events that influenced the introduction of computers into the nursing profession including key "computer/informatics" nurse that directed the activity. Also, Table 1-2 lists current organizations supporting nursing informatics.

MAJOR HISTORICAL PERSPECTIVES OF NURSING AND COMPUTERS

Seven Time Periods

Computers were introduced into the nursing profession over 40 years ago. Major milestones of nursing are interwoven with the advancement of computer and information technologies, the increased need for nursing data, development of nursing applications, and changes making the nursing profession an autonomous discipline. The key activities and events for each decade are presented to provide a background and the sequence of events to

demonstrate nursing's commitment to Computers and Nursing including Information Technology.

Prior to 1960s Computers were first developed in the late 1930s to early 1940s. As computers have evolved, computing power has increased. This was attributed to the increasing number of transistors or chips placed in an integrated circuit. In the mid-1960s Gordon Moore noted that the number doubled approximately every two years. This argument has become known as Moore's law (Techopedia, 2019).

Use of computers in the healthcare industry did not occur until the 1950s and 1960s. During this time, there were only a few experts nationally and internationally who formed a cadre of pioneers that adapted computers to healthcare and nursing which was undergoing major changes. Several professional advances provided the impetus for the profession to embrace computers—a new technological tool. Computers were initially used in healthcare facilities for basic office, administrative, and financial accounting functions. These early computers used punch cards to store data and card readers to read computer programs, sort, and prepare data for processing. Computers were linked together and operated by paper tape using teletypewriters to print their output. As computer technology advanced, healthcare technologies also advanced. The major advances are listed chronologically in Table 1-1.

1960s During the 1960s the uses of computer technology in healthcare settings began to be explored. Questions such as "Why use computers?" and "What should be computerized?" were discussed. Nursing practice standards were reviewed, and nursing resources were analyzed. Studies were conducted to determine how computer technology could be utilized effectively in the healthcare industry and what areas of nursing should be automated. The nurses' station in the hospital was viewed as the hub of information exchange; therefore, numerous initial computer applications were developed and implemented in this location.

By the mid-1960s, clinical practice presented nurses with new opportunities for computer use. Increasingly complex patient care requirements and the proliferation of intensive care units (ICUs) required that nurses become super users of computer technology as nurses monitored patients' status via cardiac monitors and instituted treatment regimens through ventilators and other computerized devices such as infusion pumps. A significant increase in time spent by nurses documenting patient care, in some cases estimated at 40%, as well as a noted rise in medication administration errors prompted the need to investigate emerging hospital computer-based information systems (Sherman, 1965; Wolkodoff, 1963).

TABLE 1.1 Landmark Events and Pioneers in Computers and Nursing, and Nursing Informatics

Year(s)	Title/Event	Sponsor(s)	Coordinator/Chair/NI Representative(s)
1973	First Invitational Conference: <i>Management Information Systems (MISs) for Public and Community Health Agencies</i>	National League for Nursing (NLN) and Division of Nursing, Public Health Service (DN/PHS), Arlington, VA	Goldie Levenson (NLN) Virginia K. Saba (DN/PHS)
1974 to 1975	Five Workshops in USA on <i>MISs for Public and Community Health Agencies</i>	NLN and DN/PHS, selected US Cities	Goldie Levenson (NLN) Virginia K. Saba (DN/PHS)
1976	<i>State-of-the-Art Conference on Management for Public and Community Health Agencies</i>	NLN and DN/PHS, Washington, DC	Goldie Levenson (NLN) Virginia K. Saba (DN/PHS)
1977	First Research: <i>State-of-the-Art Conference on Nursing Information Systems</i>	University of Illinois College of Nursing, Chicago, IL	Harriet H. Werley (UIL) Margaret Grier (UIL)
1977	First undergraduate academic course: <i>Computers and Nursing</i>	The State University of New York at Buffalo, Buffalo, NY	Judith Ronald (SUNY, Buffalo)
1979	First Military Conference on <i>Computers in Nursing</i>	TRIMIS Army Nurse Consultant Team, Walter Reed Hospital, Washington, DC	Dorothy Pocklington (TRIMIS Army) Linda Guttman (ANC)
1980	First Workshop: <i>Computer Usage in Healthcare</i>	University of Akron, School of Nursing, Continuing Education Department, Akron, OH	Virginia Newbern (UA/SON) Dorothy Pocklington (TRIMIS Army) Virginia K. Saba (DN/PHS)
1980	First Computer Textbook: <i>Computers in Nursing</i>	Nursing Resources, Boston, MA	Rita Zielstorff, Editor
1981	First <i>Special Interest Group Meeting on Computers in Nursing</i> at SCAMC	Annual SCAMC Conference Event, Washington, DC	Virginia K. Saba, Chair (DN/PHS)
1981 to 1991	First Nursing Papers at Fifth Annual Symposium on Computer Applications in Medical Care (SCAMC)	Annual SCAMC Conference Sessions, Washington, DC	Virginia K. Saba (DN/PHS) Coralee Farlee (NCHSR)
1981 to 1984	Four National Conferences: <i>Computer Technology and Nursing</i>	NIH Clinical Center, TRIMIS Army Nurse Consultant Team, and DN/PHS NIH Campus, Bethesda, MD	Virginia K. Saba (DN/PHS) Ruth Carlson and Carol Romano (CC/NIH) Dorothy Pocklington and Carolyn Tindal (TRIMIS Army) Transport Research and Innovation Monitoring and Information System Army
1981	Early academic course on <i>Computers in Nursing</i> (NIH/CC)	Foundation for Advanced Education in Sciences (FAES) at NIH, Bethesda, MD	Virginia K. Saba (DN/PHS) Kathleen A. McCormick (NIH/PHS)
1982	<i>Study Group on Nursing Information Systems</i>	University Hospitals of Cleveland, Case Western Reserve University, and National Center for Health Services Research (NCHSR/PHS), Cleveland, OH	Mary Kiley (CWS) Gerry Weston (NCHSR)

(continued)

TABLE 1.1 Landmark Events and Pioneers in Computers and Nursing, and Nursing Informatics (*continued*)

Year(s)	Title/Event	Sponsor(s)	Coordinator/Chair/NI Representative(s)
1982 to 2013	Initiated Annual <i>International Nursing Computer Technology Conference</i>	Rutgers, State University of New Jersey, College of Nursing, CE Department, selected cities	Gayle Pearson (Rutgers) Jean Arnold (Rutgers) Mary Anne Rizzolo
1982	First International Workshop: <i>The Impact of Computers on Nursing</i>	London Hospital, UK and IFIP-IMIA, Harrogate, UK	Maureen Scholes (UK) Barry Barber (UK)
1982	First Newsletter: <i>Computers in Nursing</i>	School of Nursing, University of Texas at Austin, Austin, TX	Gary Hales (UT)
1982/1984	Two Boston University (BU) <i>Workshops on Computers and Nursing</i>	Boston University School of Nursing, Boston, MA	Diane Skiba (BU)
1982	<i>PLATO IV CAI Educational Network System</i>	University of Illinois School of Nursing, Chicago, IL	Pat Tymchyshyn (UIL)
1982	Capital Area Roundtable in Informatics in Nursing (CARING) Founded	Greater Washington, DC	Founding Members: Susan McDermott P.J. Hallberg Susan Newbold
1983 to Present (Every 3 Years)	Initiated nursing papers at MEDINFO <i>World Congress on Medical Informatics, International Medical Informatics Association (IMIA)</i>	1983—Amsterdam, NL 1986—Washington, DC, USA 1989—Singapore, Malaysia 1992—Geneva, Switzerland 1995—Vancouver, Canada 1998—Seoul, South Korea 2001—London, United Kingdom 2004—San Francisco, CA, United States 2007—Brisbane, Australia 2010—Capetown, South Africa 2013—Copenhagen, Denmark 2015—São Paulo, Brazil 2017—Hangzhou, China 2019—Lyon, France 2021—Sydney, Australia	Elly Pluyter-Wenting, First Nursing Chair
1983	Second Annual Joint <i>SCAMC Congress and IMIA Conference</i>	SCAMC and IMIA, San Francisco, CA and Baltimore, MD	Virginia K. Saba, Nursing Chair
1983	Early Workshop: <i>Computers in Nursing</i>	University of Texas at Austin, Austin, TX	Susan Grobe (UT—Austin)
1983	First Hospital Workshop: <i>Computers in Nursing Practice</i>	St. Agnes Hospital for HEC, Baltimore, MD	Susan Newbold
1983	First: <i>Nursing Model for Patient Care and Acuity System</i>	TRIMIS Program Office, Washington, DC	Karen Rieder (NNC) Dena Nortan (NNC)

1983 to 2012	Initiated International Symposium: <i>Nursing Use of Computers and Information Science</i> , International Medical Informatics Association (IMIA) Working Group 8 on Nursing Informatics (NI).	1983—Amsterdam, Netherlands 1985—Calgary, Canada	1983—Maureen Scholes, First Chair 1985—Kathryn J. Hannah and Evelyn J. Guillemin
2008 to 2014 2014 to Present (Q 2 Years)	Renamed: IMIA Nursing Informatics, Special Interest Group (IMIA/NI-SIG)	1988—Dublin, Ireland 1991—Melbourne, Australia 1994—San Antonio, TX, USA 1997—Stockholm, Sweden 2000—Auckland, New Zealand 2003—Rio de Janeiro, Brazil 2006—Seoul, Korea 2009—Helsinki, Finland 2012—Montreal, Canada 2014—Taipei, Taiwan 2016—Geneva, Switzerland 2018—Guadalajara, Mexico 2021—Sidney, Australia	Noel Daley and Maureen Scholes Evelyn S. Hovenga and Joan Edgecumbe Susan Grobe and Virginia K. Saba Ulla Gerdin and Marianne Tallberg Robyn Carr and Paula Rocha Heimar Marin and Eduardo Marques Hyeoun-Ae Park Anneli Ensio and Kaija Saranto Patricia Abbott (JHU) Polun Chang Patrick Weber Diane Skiba. Judy Murphy
1984	American Nursing Association (ANA) Initiated <i>First Council on Computer Applications in Nursing (CCAN)</i>	ANA	Harriet Werley, Chair First Exec. Board: Ivo Abraham Kathleen McCormick Virginia K. Saba Rita Zielstorff
1984	First Seminar: <i>Microcomputers for Nurses</i>	University of California at San Francisco, College of Nursing, San Francisco, CA	William Holzemer, Chair
1984	First Nursing Computer Journal: <i>Computers in Nursing CIN</i> , Renamed <i>Computers, Informatics, Nursing</i>	JB Lippincott, Philadelphia, PA	Gary Hales (UT Austin) First Editorial Board: Patricia Schwirian (OSU) Virginia K. Saba (GT) Susan Grobe (UT) Rita Zielstorff (MGH Lab)
1984 to 1995	<i>First Annual Directory of Educational Software for Nursing</i>	Christine Bolwell and National League for Nursing (NLN)	Christine Bolwell

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TABLE 1.1 Landmark Events and Pioneers in Computers and Nursing, and Nursing Informatics (*continued*)

Year(s)	Title/Event	Sponsor(s)	Coordinator/Chair/NI Representative(s)
1985	NLN initiated First National Forum: <i>Computers in Healthcare and Nursing</i>	National League for Nursing, New York City, NY	Susan Grobe, Chair First Exec. Board: Diane Skiba Judy Ronald Bill Holzemer Roy Simpson Pat Tymchyshyn
1985	<i>First Annual Seminar on Computers and Nursing Practice</i>	NYU Medical Center, NY, NY	Patsy Marr New York University (NYU) Janet Kelly (NYU)
1985	<i>First Invitational Nursing Minimum Data Set (NMDS) Conference</i>	University of Illinois School of Nursing, Chicago, IL	Harriet Werley (UIL) Norma Lang (UM)
1985	Early academic course: <i>Essentials of Computers</i> , in Undergraduate and Graduate Programs	Georgetown University School of Nursing, Washington, DC	Virginia K. Saba (GU)
1985 to 1990	Early 5-year Project: Continuing Nursing Education: <i>Computer Technology, Focus: Nursing Faculty</i>	Southern Regional Education Board (SREB), Atlanta, GA	Eula Aiken (SREB)
1985	<i>First Test Authoring Program (TAP)</i>	Addison-Wesley Publishing, New York, NY	William Holzemer (UCSF)
1985	First Artificial Intelligence System for Nursing	Creighton On-line Multiple Medical Education Services (COMMES), Creighton University	Sheila Ryan, Dean and Faculty Professor, Steven Evans, Developer
1986	Two early <i>Microcomputer Institutes for Nurses</i>	Georgetown University, School of Nursing, Washington, DC University of Southwest Louisiana Nursing Department, Lafayette, LA	Virginia K. Saba (GU) Dorothy Pocklington (USL) Diane Skiba (BU)
1986	Established first nurse educator's newsletter: <i>Micro World</i>	Christine Bolwell and Stewart Publishing, Alexandria, VA	Christine Bolwell, Editor
1986	<i>CIN</i> First Indexed in MEDLINE and CINAHL	J. B. Lippincott Publisher, Philadelphia, PA	Gary Hales, Editor
1986	<i>First NI Pyramid—NI Research Model</i>	Published in <i>CIN</i> Indexed in MEDLINE and CINAHL	Patricia Schwirian (OSU)
1987	Initiated and Created Interactive Videodisc Software Programs	<i>American Journal of Nursing</i> , New York, NY	Mary Ann Rizzolo (AJN)
1987	<i>International Working Group Task Force on Education</i>	IMIA/NI Working Group 8 and Swedish Federation, Stockholm, Sweden	Ulla Gerdin (NI) Kristina Janson Jelger and Hans Peterson (Swedish Federation)

1987	Videodisc for Health Conference: <i>Interactive Healthcare Conference</i>	Stewart Publishing, Alexandria, VA	Scott Stewart, Publisher
1988	Recommendation #3: <i>Support Automated Information Systems.</i>	National Commission on Nursing Implementation Project (NCNIP), Secretary's Commission on Nursing Shortage	Vivian DeBack, Chair
1988	Priority Expert Panel E: <i>Nursing Informatics Task Force</i>	National Center for Nursing Research, National Institutes of Health, Bethesda, MD	Judy Ozbolt, Chair
1988	First Set of Criteria for Vendors	ANA (American Nurses Association/Council on Nursing Science)/CANS	Mary McHugh Chair Rita Zielstorff Jacqueline Clinton
1989	Invitational Conference: <i>Nursing Information Systems</i> , Washington, DC	National Commission on Nursing Implementation Project (NCNIP), ANA, NLN, and NIS Industry	Vivian DeBack, Chair
1989 to Present	Initiated First Graduate Programs with Specialty in Nursing Informatics, Master's and Doctorate	University of Maryland School of Nursing, Baltimore, MD	Barbara Heller, Dean Program Chairs: Carol Gassert, Patricia Abbott, Kathleen Charters, Judy Ozbolt, and Eun-Shim Nahm
1989 to 2009	Virtual Learning Resources	Fuld Institute for Technology in Nursing Education (FITNE)	Julie McAfoos, Pioneer Software Developer.
1989	ICN Resolution Initiated Project: <i>International Classification of Nursing Practice (ICNP)</i>	International Council of Nurses Conference, Seoul, Korea	Fadwa Affra (ICN)
1990 to 1995	<i>Annual Nurse Scholars Program</i>	(HBO) Healthcare Technology Company and HealthQuest Corporation	Roy Simpson (HBO) Diane Skiba (BU) Judith Ronald (SUNY Buffalo)
1990	ANA House of Delegates Endorsed: <i>Nursing Minimum Data Set (NMDS)</i> to Define Costs and Quality of Care	ANA House of Delegates	Harriet Werley (UM)
1990	Invitational Conference: <i>State-of-the-Art of Information Systems</i>	NCNIP, Orlando, FL	Vivian DeBack, Chair
1990	Renamed ANA: Steering Committee on Databases to Support Nursing Practice	ANA, Washington, DC	Norma Lang, Chair Kathy Milholland Hunter (ANA)
1990	Task Force: <i>Nursing Information Systems</i>	NCNIP, ANA, NLN, NIS Industry Task Force, Project Hope, VA	Vivian DeBack, Chair
1991 to 2001	First Annual <i>European Summer Institute</i>	International Nursing Informatics Experts	Jos Aarts and Diane Skiba (USA)
1991	First <i>Nursing Informatics Listserv</i>	University of Massachusetts, Amherst, MA	Gordon Larrivee
1991	Formation of Combined Annual SCAMC <i>Special Nursing Informatics Working Group</i> and AMIA NIWG	AMIA/SCAMC Sponsors, Washington, DC	Judy Ozbolt, First Chair

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