TEHRAN UNIVERSITY OF MEDICAL SCIENCES

An Introduction to Nursing Informatics (NI) Principles

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Learning Outcomes

At the end of the course, learners are expected to:

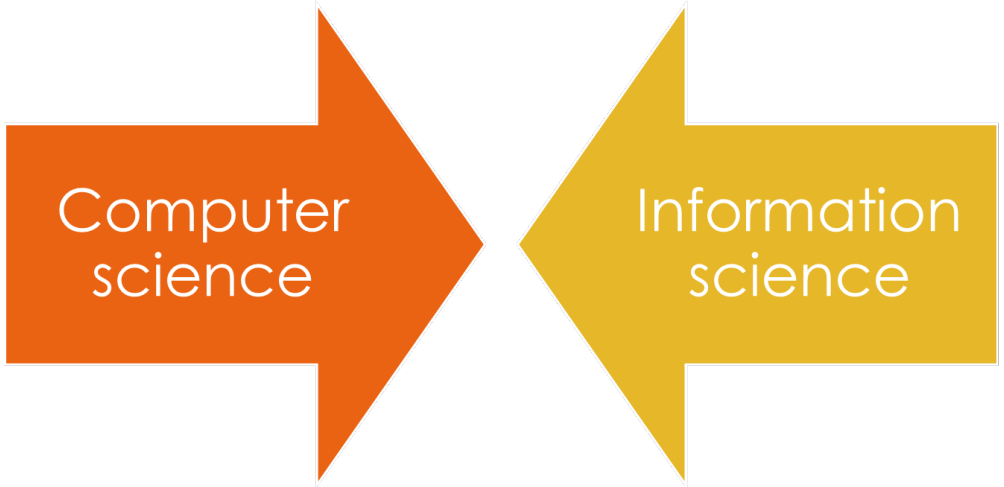
- Define Informatics and Nursing Informatics (NI);
- Explain the historical context of NI;
- Discuss Data, Information, Knowledge, Wisdom (DIKW) hierarchy
- Discuss the importance of developing NI Skills;

Learning Outcomes (Cont.')

- Identify NI relation with other informatics in biomedicine as the core science;
- Discuss NI applications in practice, research, education, administration;
- Identify Nursing Informatics Specialist's (NIS) roles;
- Discuss nursing challenges in embracing healthcare technology;

Informatics Meaning

- Informatics comes from the French word “informatique” meaning “computer science” (In 1970s).
- Informatics is defined as **computer science + information science.**



Informatics Meaning (Cont.')

- Used in conjunction with the name of **a discipline**, indicating an application of computer science and information science to the **management and processing of data, information, and knowledge** in the named discipline.
- Thus, we have different informatics including **biomedical informatics**, **health informatics**, **clinical/ medical informatics**, **nursing informatics**, **dental informatics**, **veterinary informatics** and so on … .

What Is Nursing Informatics?

- **Management and processing** nursing data, information and knowledge through using technology and in particular computers.
- Involves research and analysis aimed at supporting **nursing practice, research, education, and administration**.
- Deals specifically with the process of **gathering and acquiring** nursing healthcare data.

Historical Context

- Nurses have become proficient in utilizing and adapting complex technology into caring nursing practice for decades, at least since the time of **Florence Nightingale** in the United Kingdom and even earlier, when **Jeanne Mance** founded the first hospital in Montreal, Canada in 1642.
- Florence Nightingale vision was a "**standardized clinical record** that could be analyzed to assess and improve care processes and **patient outcomes**".

Jeanne Mance (1606-1673)

Florence Nightingale (1820-1910)

1950's
- Healthcare began to use computers for finance and administration

1970's
- Nursing profession became involved in the design, purchase, and implementation of information systems

1980's
- Emergence of Nursing Informatics Specialties (NIS) & NI programs
- Introduction of the Personal Computers (PC), HIS, MIS

1990's
- Telemedicine emerged as a specialty
- The first Nursing Informatics certification exam was administered

Post2000
- Exponential growth in the use and sophistication of computer hardware and software (DB, CDSS, Intelligence systems, TIGER innovation)
- Development of professional organizations

Thus, **Nursing** has evolved significantly over the past few decades, with many of the changes being driven by advances in **information and communication technology**.

Nursing Informatics Definitions

- Hannah, 1985
- Grobe, 1988
- Graves and Corcoran, 1989
- American Nurses Association (ANA), 1994; 2001; 2008
- Hebda, 1998
- Rognehaugh, 1999
- Staggers & Thompson, 2002
- McCartney, 2004
- Sackett et al., 2004
- Guenther, 2006
- International Medical Informatics Association (IMIA-NI), 2009

Hannah et al, 1985

- "Use of **information technologies** in relation to those functions, within the purview of nursing that are carried out by nurses when performing their duties".

Grobe, 1988

- "The application of the principles of **information science** and theory to the **study**, scientific **analysis**, and **management** of nursing information for purposes of establishing a body of nursing knowledge".

Graves and Corcoran, 1989

- "A combination of **computer science**, **information science** and **nursing science** designed to assist in the **management** and **processing** of nursing data, information and knowledge to support the practice of nursing and the delivery of nursing care".

American Nurses Association (ANA), 1994

- **1994:** "The specialty that integrates nursing science, computer science and information science in identifying, collecting, processing and managing **data** and **information** to support nursing practice, administration, education, research and the expansion of nursing knowledge".

Toni Hebda, 1998
Rognehaugh, 1999
Guenther, 2006

- They all emphasized on the application of **technology** in supporting different aspects of nursing including clinical practice, education, research and administration.

American Nurses Association (ANA), 2001

- **2001:** "A specialty that integrates nursing science, computer science and information science to manage and communicate data, knowledge and nursing practice".

Staggers & Thompson, 2002

- "A specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice.

Staggers & Thompson (Cont.')

- Nursing informatics facilitates the integration of data, information, and knowledge to support **patients**, **nurses**, and other **providers** in their **decision making** in all roles and settings.
- This support is accomplished through the use of information structures, information processes, and information technology".

McCartney, 2004

- "Nursing informatics is a 21st century science with great potential for improving the **quality, safety, and efficiency of health care**".

Sackett, 2004

- The combination of the concepts of three sciences i.e. **cognitive science**, information science, and computer science with an overall focus on nursing science.

American Nurses Association (ANA), 2008

- **2008:** "NI is a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, knowledge, and **wisdom** in nursing practice".

American Nurses Association (ANA), 2008

- **2008:** "NI is a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, knowledge, and **wisdom** in nursing practice".

IMIA-NI*, 2009

- "Science and practice (that) integrates nursing and its information and knowledge, with management of Information and Communication Technologies to promote the health of **people**, **families**, and **communities worldwide**."

* International Medical Informatics Association
Nursing Informatics Special Interest Group

- NI definition and nurses role rapidly changed and evolved over the years;

- This evolution moved from the **technology-focused** orientation (early 80s) to **information-focused** (1989) ending up to a combination of four sciences of technology, information, cognitive and nursing (1996);

- It also integrated the **knowledge hierarchy** (ANA 2008 definition) and the **international multifaceted aspects** (IMIA-NI 2009 definition).

Framework of NI

The framework for NI relies on the central concepts of data, information, knowledge and wisdom:

- **DATA:** is defined as discrete entities that are described objectively without interpretation
- **INFORMATION:** as data that is interpreted, organized or structured
- **KNOWLEDGE:** as information that has been synthesized so that interrelationships are identified and formalized.
- **WISDOM:** as application of that knowledge in activities/ action
- Resulting in **decisions** that guide practice.

DIKW Pyramid

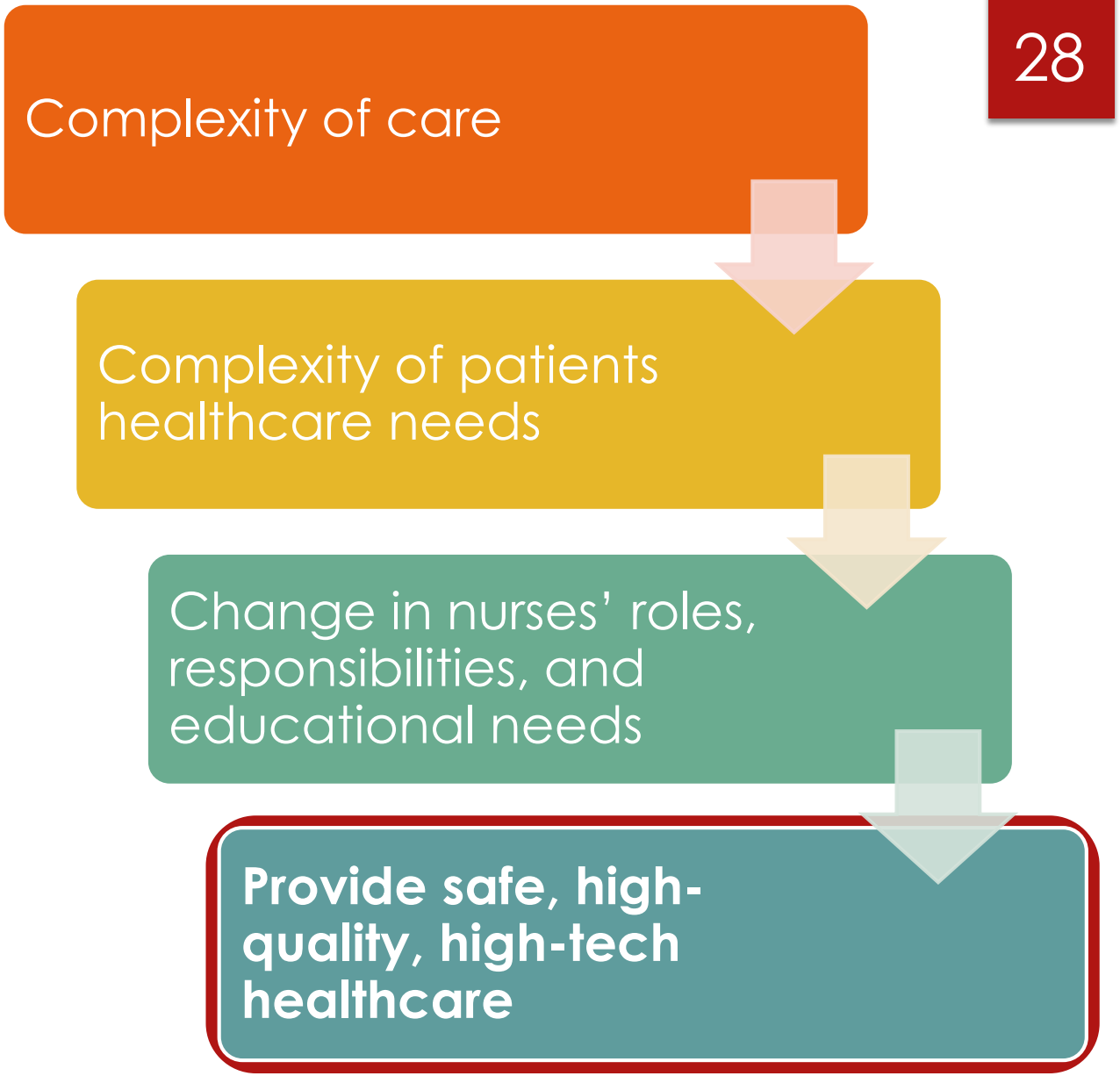
- Data are gathered consistent with the characteristics of **data quality**
- Data then are arranged and displayed to add context and create useful **information**
- Information are given meaning leading to **knowledge**
- Then knowledge are acted on with insight to make wise decisions leading to **wisdom**.

So, this progression is referred to as the **Knowledge Hierarchy** or the data, information, knowledge, wisdom (DIKW) pyramid, and is attributed to Ackoff.

Step	Description	Example: Low-Birth-Weight Babies
Wisdom	Knowledge + Insight + Action	Public health programs and services established or revised, education campaigns
Knowledge	Information + Meaning	Comparisons to prenatal care, socioeconomic status, trends, benchmarking, etc.
Information	Data + Context	Data analyzed and reported, e.g., mothers' age, race, residence
Data	Foundation for information	Individual birth certificates filed, including birth weight

Mervat Abdelhak and Mary Alice Hanken. Health Information: Management of a Strategic Resource. 2016. 5th Edition.

Why Nurses Need to Develop NI Skills?



Importance of NI

- Nurses spend about 50% of their time in the "gathering, and documenting information".
- Thus, NI provides an excellent chance to obtain the full potential of an **organized and well-managed information** by nursing personnel.

(Also Florence Nightingale's vision, 1863)

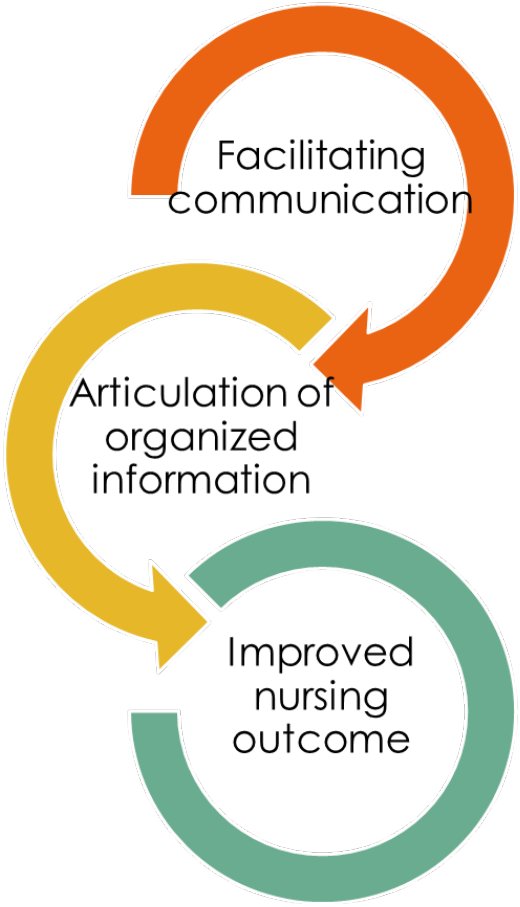
Importance of NI (Cont'd)

- A number of reports, including the very **influential IOM (2010) report**, the IOM (2010) urged nurses to achieve higher levels of education;
- The need for education in NI as well as lists of **competencies** offered by many national/ international nursing organizations

Nursing informatics:

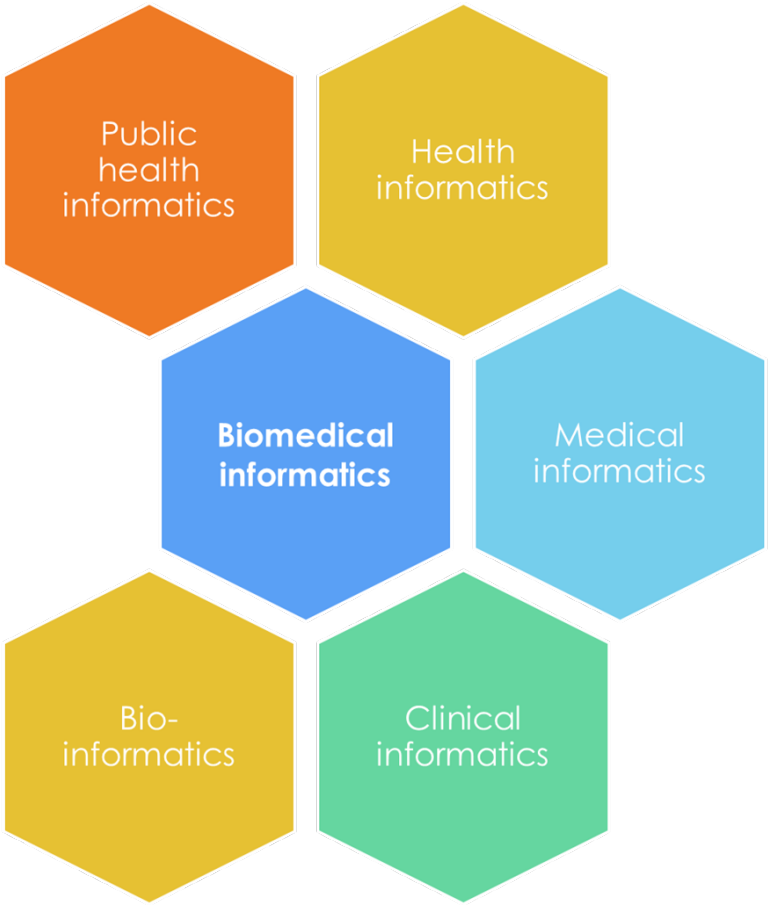
- Facilitates **communication**;
- And allows articulation of **organized information**;

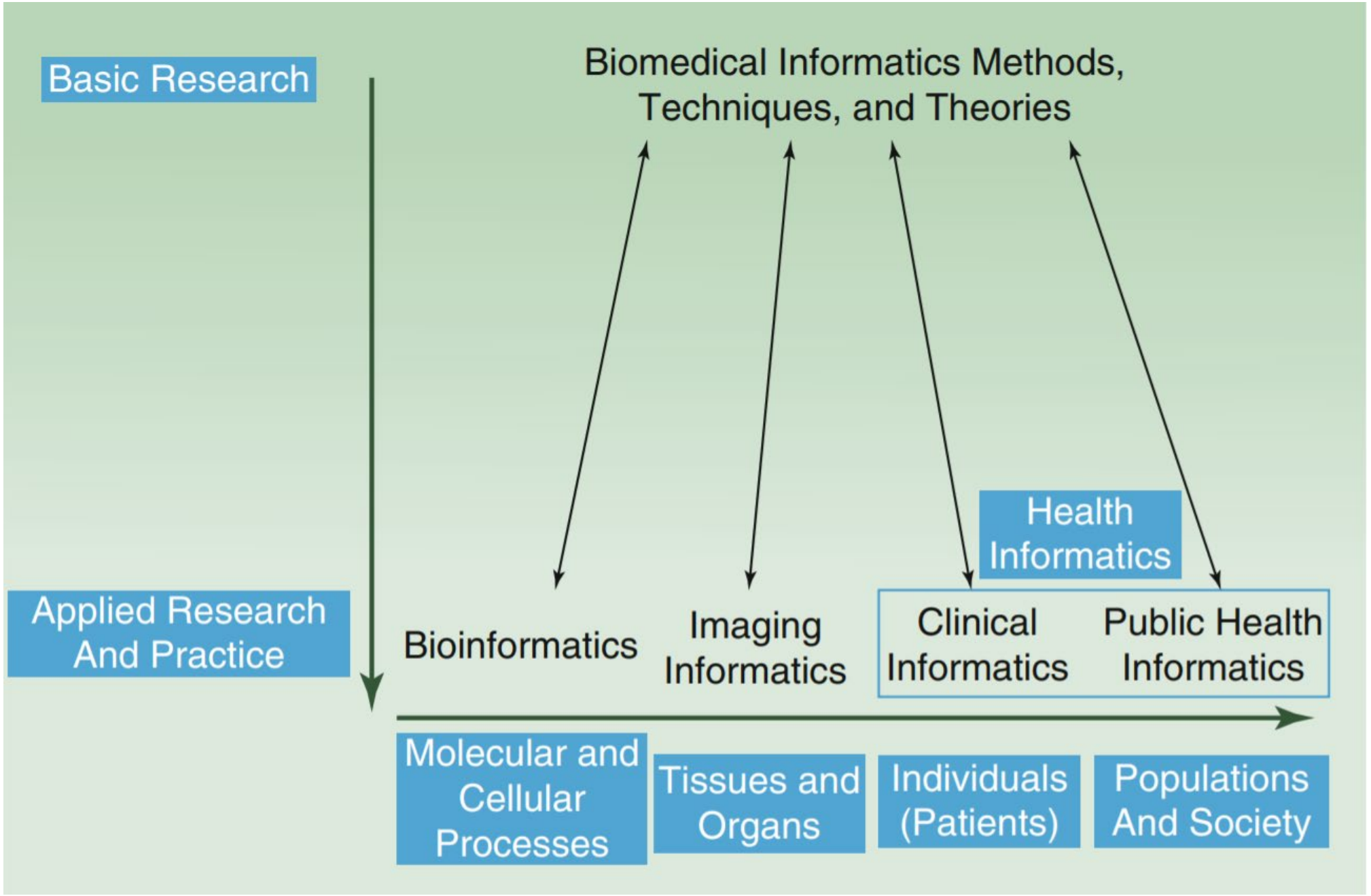
leading to credibility, more patient trust, and **improved nursing outcome**.



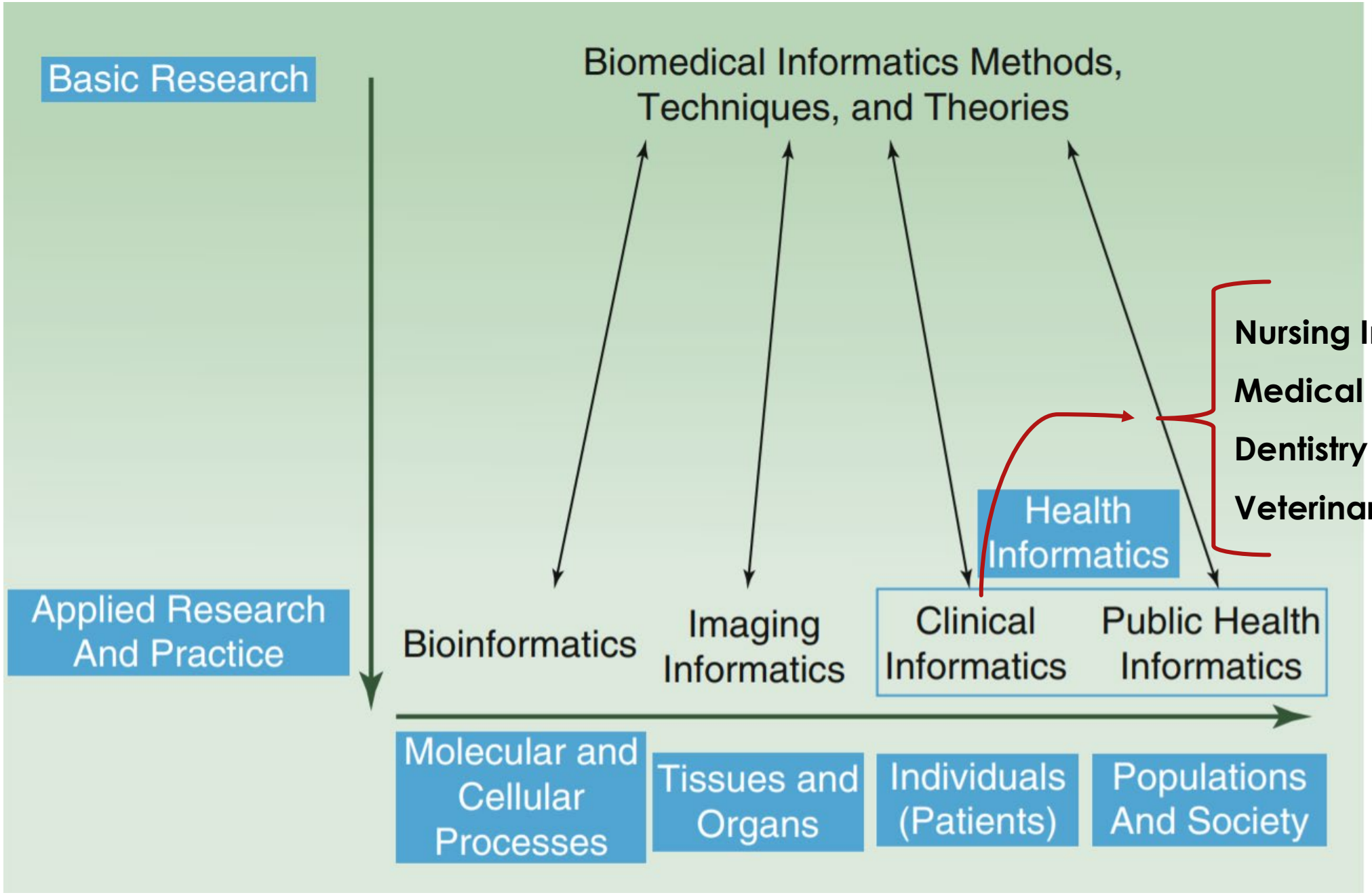
How Does NI Relates to Other Informatics?

- Informatics is used in conjunction with a discipline, indicating application of computer & information science to the management and processing of knowledge hierarchy in that discipline.
- Thus, we have biomedical informatics, health informatics, clinical/ medical informatics, nursing informatics, … .





Edward H. Shortliffe and James J. Cimino; editors. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 2014. 4th Edition



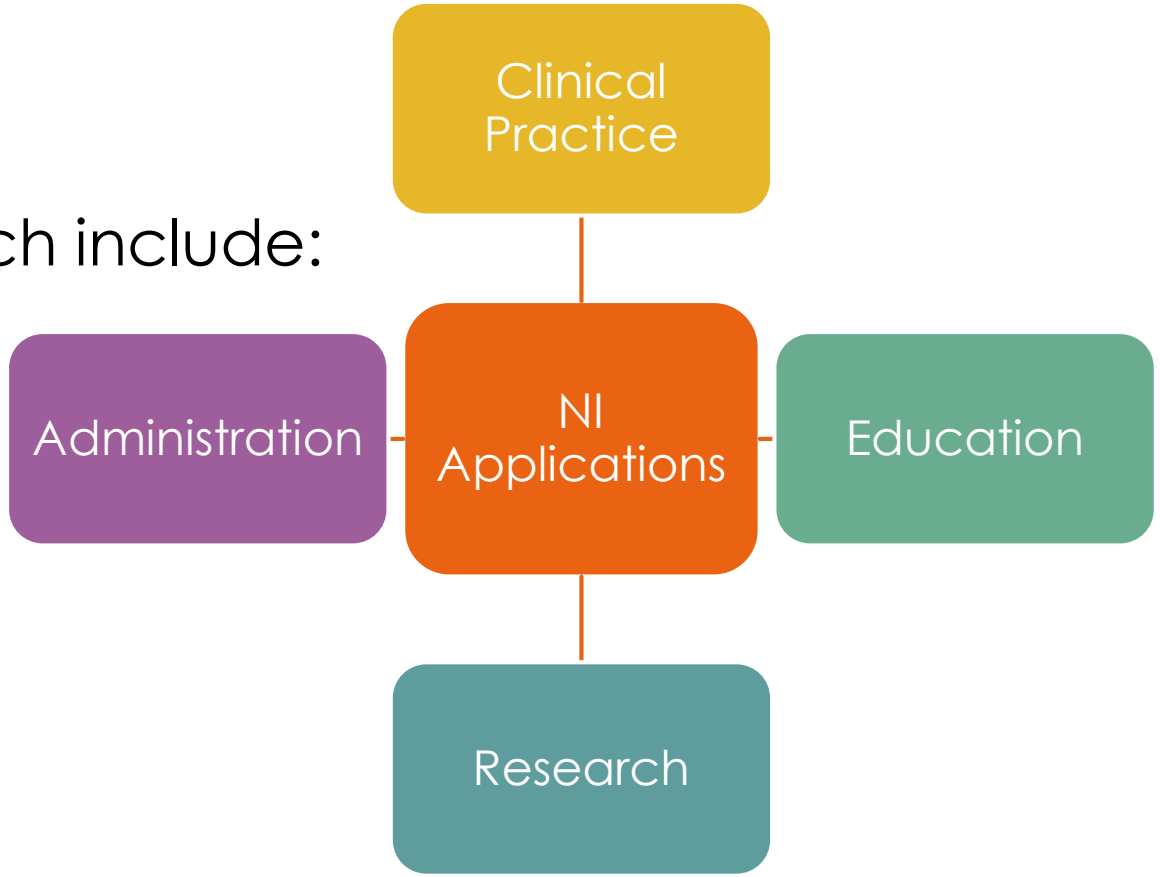
Edward H. Shortliffe and James J. Cimino; editors. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 2014. 4th Edition

NI Applications

Nursing Informatics can be applied

to all areas of nursing practice, which include:

- Clinical practice
- Administration
- Education
- Research



Clinical Practice

Called **Point-of-Care Systems/ Clinical Information Systems** and include:

- **Reminders and prompts** that appear during documentation to ensure comprehensive charting. For instance, **Work-lists** to remind staff of planned nursing interventions
- **Monitoring devices** that record vital signs and other measurements directly into the client record(electronic medical record)
- **Computer-generated nursing care plans** and clinical pathways
- **Automatic billing** for supplies or procedures with nursing documentation

Healthcare Information Technology Tools

- Computerized physician order entry (CPOE)
- Computer-Based Patient Record (CPR) including:
  - Electronic Medical Record (EMR)
  - Electronic Health Record (EHR)
  - Personal Health Record (PHR)
- Health portals
- Nursing Interventions Classification System (NIC) Terminology
- Nursing Outcomes Classification System Terminology (NOC)

Advantages of Computer-based Patient Record (CPR)

Whether it is an EMR, EHR, PHR, the healthcare facility would benefit from its potentials. Advantages include:

- **Improved access to the medical ward:** the EMR can be accessed from several different locations simultaneously, as well as by different levels of providers.
- **Decreased redundancy of data entry:** for example, allergies and vital signs need only be entered once.

Advantages of CPR (Cont.')

- **Decreased time spent in documentation:** automation allows direct entry from monitoring equipment, as well as point of care data entry.
- **Increased time for client care:** more time is available for client care because less time is required for documentation and transcription of physician orders.

Advantages of CPR (Cont.')

- **Improving Health Information Exchange (HIE):** electronically recorded data could be exchanged within a hospital system or among different health care information systems to provide safer and more timely, efficient, effective, and equitable patient-centered care.

Advantages of CPR (Cont.')

- **Facilitation of data collection for research:** electronically stored patient records provide quick access to clinical data for a large number of clients.
- Creation of a **lifetime clinical record** facilitated by information systems.

Advantages of CPR (Cont.')

- **Decision support tools as well as alerts and reminders** notify the clinician of possible concerns or omissions.
- An example of this, is the documentation of patient allergies in the computer system. The health care providers would be alerted to any discrepancies in the patient medication orders.

Clinical Practice Guidelines

- NI through its various applications, can also be used to ensure the patient is receiving the **most up-to-date care** for a variety of chronic conditions.
- This is possible by various trusted webpages and databases affiliated to health organizations such as the National Institute of Health (NIH) which is a governmental body or associations.

- Clinical information and clinical practice guidelines on management of **asthma**, **cholesterol**, **hypertension** and **obesity** can be found at: http://www.nih.gov
- Clinical practice guidelines for the management of **diabetes mellitus** and **menopause** can be found at: https://pro.aace.com/
- Further information can be found through the **Medscape Nurses** site: https://www.medscape.com/nurses

AACE/ACE Clinical Practice Guidelines for Developing a Diabetes Mellitus Comprehensive Care Plan - © 2015

These 2015 clinical practice guidelines (CPGs) for developing a diabetes mellitus (DM) comprehensive care plan are an update of the 2011 American Association of Clinical Endocrinologists (AACE) Medical Guidelines for Clinical Practice for Developing a Diabetes Mellitus Comprehensive Care Plan (1 [EL 4; NE]). The mandate for this CPG is to provide a practical guide for comprehensive care that incorporates an integrated consideration of micro- and macrovascular risk (including cardiovascular risk factors such as lipids, hypertension, and coagulation) rather than an isolated approach focusing merely on glycemic control. In addition to topics covered in the 2011 CPG, this update offers new and expanded information on vaccinations; cancer risk; and management of obesity, sleep disorders, and depression among persons with DM, as well as medical management of commercial vehicle operators and others with occupations that put them at increased risks of obesity and DM or in which hypoglycemia might endanger other individuals. In addition, discussions of hypertension management, nephropathy management, hypoglycemia, and antihyperglycemic therapy have been substantially revised and updated. The 2015 treatment goals emphasize individualized targets for weight loss, glucose, lipid, and hypertension management. In addition, the 2015 Guidelines promote personalized management plans with a special focus on safety beyond efficacy.

READ THE GUIDELINE DOWNLOAD THE PRESENTATION (PPT)

American Association of Clinical Endocrinology (AACE)
Clinical Practice Guidelines

Filter by Specialty

- ✔ All Specialties
- Allergy & Clinical Immunology
- Anesthesiology
- Cardiology
- Critical Care
- Dental & Oral Health
- Dermatology
- Diabetes & Endocrinology
- Emergency Medicine
- Family Medicine/Primary Care

Practice Guidelines (ACC/AHA, 2021)

ege of Cardiology and American Heart Association for the management of

uidelines (IDSA, 2020)

Diseases Society of America for diagnosing and managing babesiosis

ce Guidelines (EANO, 2021)

gnosis and treatment of diffuse gliomas of adulthood by the European
O, 2021)

Endometrial Carcinoma Clinical Practice Guidelines (ESGO/ESTRO/ESP, 2021)

2021 update of guidelines on endometrial carcinoma by the European Society of Gynaecological Oncology, European Society for Radiotherapy and Oncology, and European Society of Pathology

Jan 29, 2021

Uncomplicated Gonococcal Infection Clinical Practice Guidelines (CDC, 2020)

Nursing Administration

Health Care Information Systems

- Automated staff scheduling
- E-mail for improved communication
- Cost analysis and finding trends for budget purposes
- Quality assurance and outcomes analysis

Nursing Education

- Computerized-assisted instruction
- Interactive video technology
- Distance learning, e-Learning, web based courses and degree programs (MOOCs)
- Internet resources, Continuing Education Units (CEU's) and formal nursing courses and degree programs

Nursing Research

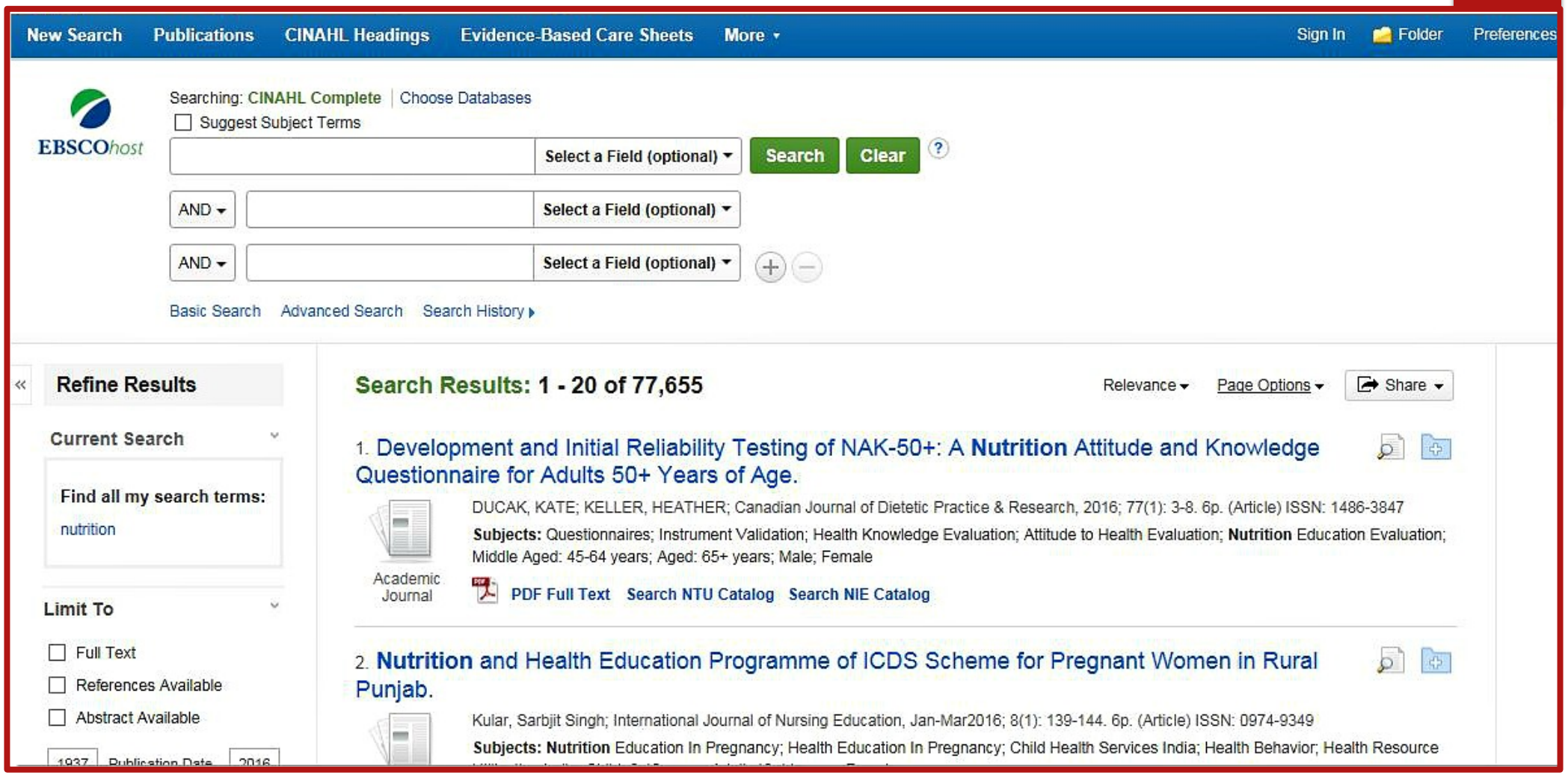
- Adoption of standardized language related to nursing terms-NANDA, etc.
- Computerized literature searching in CINAHL, Medline and Web sources
- Ability to find trends in aggregate data, that is data derived from large population groups-and do analysis using Statistical Software, SPSS

LINKING NURSING INFORMATICS TO THE RESEARCH PROCESS TO EXPAND EVIDENCE

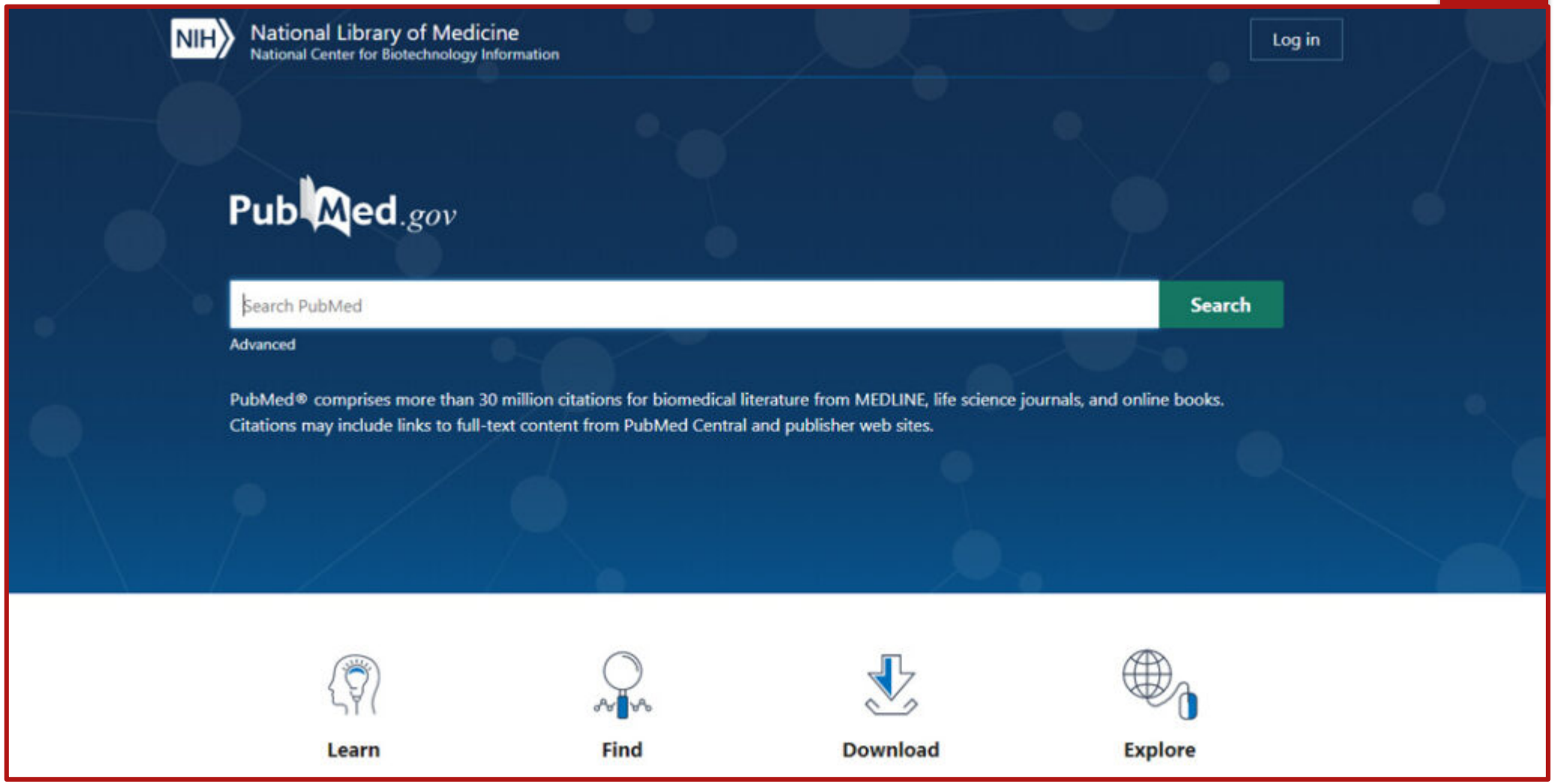
One example: The *what is* and *how to* of understanding application of the research process and its importance to nursing includes steps such as:

1. While providing patient care on the medical–surgical unit, a problem in patient care is identified, but there are no current processes in place to address the issue.
2. Using technology and searching databases for the latest EBPs and outcomes are initiated to find support for the current best practice. This is done based on practice experience, collecting and documenting evidence using technology, asking questions—the how, what, and why—then formulating a hypothesis and offering considerations for possible applications and outcomes based on evidence.
3. Based on the evidence, a process is developed to address the specific patient problem.
4. Finally, evaluation of the outcomes is completed, leading to new developments, improvements, and education so as to provide best practices through application of the EBP.
5. A final step is to develop a procedure to use to address the problem going forward.

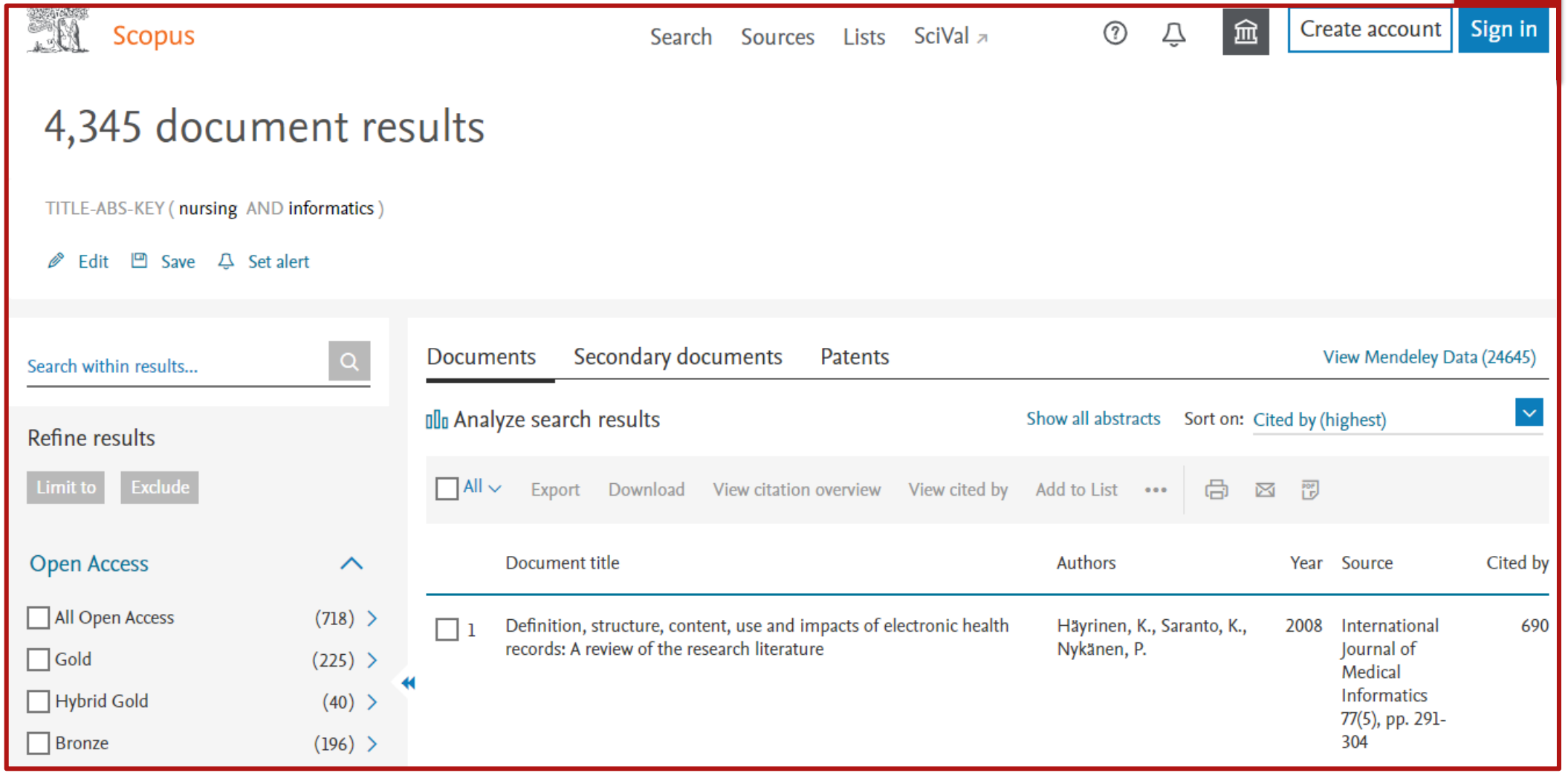
Sipes, C. Application of nursing informatics: competencies, skills, decision-making. Springer, 2019.



CINAHL Complete



PubMed/ Medline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Gold (225)
Hybrid Gold (40)
Bronze (196)
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1
Definition, structure, content, use and impacts of electronic health records: A review of the research literature
Häyrinen, K., Saranto, K., Nykänen, P.
2008
International Journal of Medical Informatics 77(5), pp. 291-304
690

Scopus

Nursing Informatics Specialist

- Because of the increased importance of computers and information technology in the practice of professional nursing, a new role has emerged, the **Nursing Informatics Specialist (NIS).**
- **NIS definition:** the NIS is a nurse who has formal education, certification and practical experience in using computers in patient care settings.

Nursing Informatics Specialists' Roles

Nursing Informatics Specialist (NIS) could act as:

- Project managers/ clinical project manager
- Clinical analyst
- Nursing informatics manager
- Clinical IT directors
- Chief Information Officers (CIO)
- Chief Nurse Officers

HIMSS 2020 Nursing Informatics Workforce Survey

Healthcare Information and Management Systems Society (HIMSS) workforce survey asked informatics nurses about their most common job duties.

According to 44% of the responses, **systems implementation** is the most common job duty.

Functions of NIS (ANA, 1994)

- **Theory development:** the NIS contributes to the scientific knowledge-base of nursing informatics.
- **Analysis of information needs:** the identification of information that nurses‘ need to in order to accomplish their work including client care, education, administration, and research.
- **Selection of computer systems:** the NIS, guides the user in making informed decisions related to the purchase of computer systems.

Functions of NIS (Cont.')

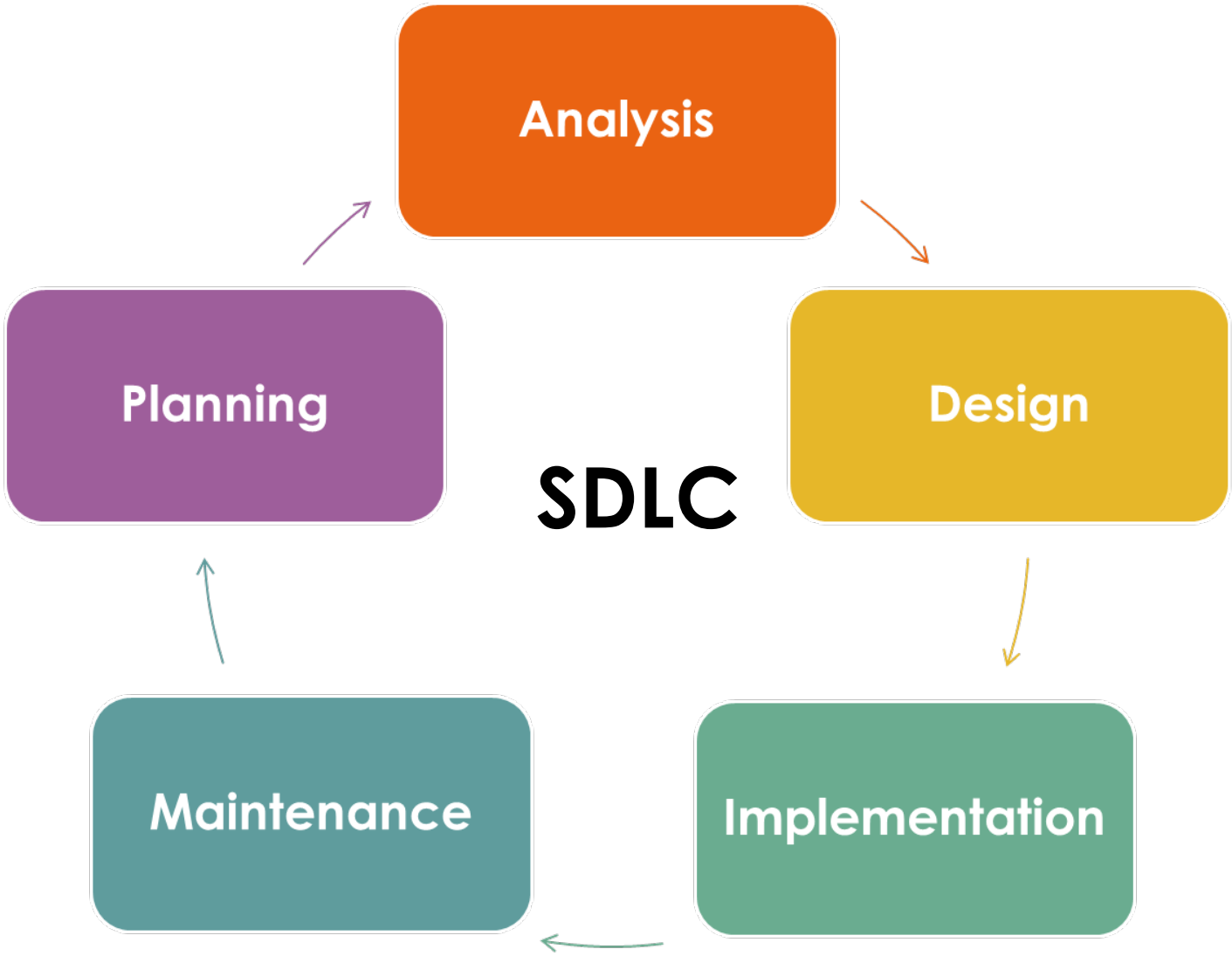
- **Design of computer systems and customizations:** the NIS collaborates with users and computer programmers to make decisions about how data will be displayed and accessed.
- **Testing of computer systems:** systems must be checked for proper functioning before they are made available for use in patient care.

Functions of NIS (Cont.')

- **Training users of computer systems:** users need to be trained in how the system works, the importance of accurate data entry, and how the system will benefit them, and more importantly how it will improve patient outcomes.
- **Evaluation of the effectiveness of computer systems:** the unique role of the NIS makes them the ideal person to evaluate the effectiveness of computer systems.

Functions of NIS (Cont.')

- **Ongoing maintenance and enhancements:** NIS makes sure the computerized system functions properly and explores possible enhancements to the system that will better serve the users and the patients.
- **Identification of computer technologies that can benefit nursing:** NIS must keep abreast of the changes in the fields of computers and information technology, including new hardware and software that will benefit the nurse and patient.



NIS have major functions in different phases of System Development Life Cycle (SDLC)

Barriers to Using EHR

- Rigorous **training** on EHR system (Indian health care settings)
- **Technical** (e.g. bad performance of the software) and **organizational** barriers (e.g. lack of time)(German university hospitals)
- **Computer-related** (interface, slow system), **nurse-related** (lack of experience, poor time management), and **contextual** barriers (training, support from staff). (rural Midwestern hospital in the US)

1.Verma M, Gupta S. Problems Faced by Nurses in Use of Electronic Health Records During Clinical Practice. Stud Health Technol Inform. 2016;225:985-6.
2.Vollmer AM, Prokosch HU, Bürkle T. Identifying barriers for implementation of computer based nursing documentation. Stud Health Technol Inform. 2014;201:94-101.
3.Whittaker AA, Aufdenkamp M, Tinley S. Barriers and facilitators to electronic documentation in a rural hospital. J Nurs Scholarsh. 2009;41(3):293-300.

Challenges to Using Computerized Literature Searching

- Nurses' use of electronic literature has remained limited
- A review to investigate barriers to using electronic evidence based literature by nurses performed in 2017 demonstrating some key findings.

Sadoughi F, Azadi T, Azadi T. "Barriers to use Evidence Based Electronic Literature in Nursing Practice: A Systematized Review". Health Information & Libraries Journal 2017;34 (3), 187-199.

- There are a number of barriers in using evidence based electronic literature in nursing practice.
- **Time requirements**, **searching skills**, **access requirements**, **computer literacy**, **interface characteristics**, **quality of information**, **nurses' preferences** and **organizational setting** were identified as major barriers to apply electronic evidence based literature.

Hospitals' management should provide nurses with dedicated hours for searching and reading new information during their routine activities.

Conclusion

- Today healthcare demands are far more complex than reducing time spent on paper work.
- The high-intensity generation, management, processing of data and knowledge are integral components of nursing care.
- So, informatics gives nurses the means to carry out these aspects of care efficiently and effectively to improve outcomes for patients.
- The skills and knowledge of Nurse Informaticians make them valuable assets to any organization and to the future development of the field.

Conclusion (Cont'd)

- Virginia Saba (1992) predicted, "By the turn of the century, most health care delivery systems will function with computers and will be managed by computer literate nurses.
- I believe, that by the turn of the century, "**high tech and high touch**" will be an integral part of the health care delivery system,"

References

- Hannah, K. J., Guillemin, E. J., and Conklin, D. N. eds. Nursing uses of computer and information science. Amsterdam, The Netherlands: Elsevier Science, 1985.
- Graves JR, Corcoran S. The study of nursing informatics. Image: the journal of nursing scholarship. 1989;21(4):227-31.
- American Nurses Association (ANA). The scope of practice for nursing informatics. Washington DC: American Nurses Publishing, 1994.
- Staggers N, Thompson CB. The evolution of definitions for nursing informatics: a critical analysis and revised definition. J Am Med Inform Assoc. 2002;9(3):255-261.
- Edward H. Shortliffe and James J. Cimino; editors. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 2014. 4th Edition
- Mervat Abdelhak and Mary Alice Hanken. Health Information: Management of a Strategic Resource. 2016. 5th Edition.
- Sipes, C. Application of nursing informatics: competencies, skills, decision-making. Springer, 2019.

Questions for Discussion

Discussion 1

How much information technology is integrated into nursing curriculum in your country?

Has NI been recognized as a specialty in nursing in your country? Does your country offer formal/ informal education in NI?

Discussion 2

Are nurses appropriately and sufficiently equipped with informatics skill to play the role of a Nurse Informatics Specialist (NIS) in your country?

Discussion 3

To how much extent nurses are involved in implementation of a healthcare information technology in your country?

Materials for Further Reading

- Staggers N, Thompson CB. The evolution of definitions for nursing informatics: a critical analysis and revised definition. J Am Med Inform Assoc. 2002;9(3):255-261. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC344585/
- Hanan Asiri. An Overview of Nursing Informatics (NI) as a Profession: How we Evolved Over the Years. In Proceedings of the 9th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2016) - Volume 5: HEALTHINF, pages 200-212. DOI: 10.5220/0005658202000212
- Edward H. Shortliffe and James J. Cimino; editors. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 2014. 4th Edition. P.25-29.
- Sipes, C. Application of nursing informatics: competencies, skills, decision-making. Springer, 2019. Ch. 1, Ch. 2, Ch. 5, Ch. 6, Ch. 7