Tehran University of Medical Sciences

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Information Management Systems in Nursing

TEHRAN UNIVERSITY OF MEDICAL SCIENCES

Nurses' Role in Technology Selection, Design and Implementation

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About Me

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Google Scholar Citation Page:
https://scholar.google.com/citations?user=DlRudcMAAAAJ&hl=en

- PhD in Health Information Management;
- MSc & BSc in Medical Information Sciences;
- Lecturer of *"Health Informatics"*, *"Health Information Resources Management"*, *"Medical Information Systems"* and more for graduate and undergraduate students at Tehran University of Medical Sciences and Aja University of Medical Sciences since 2015;
- Contribution to the translation of two major reference textbooks into Persian in the fields of *"Healthcare Information Systems"* and *"Project Management for Healthcare Information Technology"*;
- Author/ reviewer of various papers in the field of health information management and systems.

Presentation Outline

- Technology impact on nursing processes and care
- Challenges for nurses in system design and implementation
- Recognizing the importance of nurses' role in technology implementation
- The System Development Life Cycle Process
- Mapping ANA competencies with SDLC phases

Application of Technologies in Healthcare

- Modern technologies as an essential factor for the advancement of nursing practice
- Healthcare industry including patient monitoring requires ICT.
- ICT systems as essentials of efficient implementation of nursing documentation and effective provision of health care.
  - Processing and application of information
  - Easier access to patient's history of care
  - Data entry and clinical documentation
  - Data conversion into useful clinical information
  - Health information exchange (HIE)
  - eHealth domains (e.g., management, computerized decision support systems [CDSSs], communication, and information systems)

Application of data <u>affecting the healthcare system</u>

Katarina Jeleč, Sabina Sukalić, Adriano Friganović. Nursing and Implementation of Modern Technology. SIGNA VITAE 2016; 12(1): 23-27.

Technology Impact on Nursing Practice

- Reducing documentation time of the nurses
- Reducing physical exertion of nurses
- Increasing the productivity
- Improving communication between nurses and patients, other health professionals, and patients' families.
- Improving patient safety if the entire medical history of patients available to every department in the hospital
- On the whole, ICT impact on nurses' practice include planning, providing, documentation, and reviewing clinical care

Katarina Jeleč, Sabina Sukalić, Adriano Friganović. Nursing and Implementation of Modern Technology. SIGNA VITAE 2016; 12(1): 23-27.

A systematic review by Rouleau G. et al, 2017 was performed to examine the dimensions and indicators of nursing care that have the potential to be influenced by the use of ICTs.

Rouleau G, Gagnon MP, Côté J, Payne-Gagnon J, Hudson E, Dubois CA. Impact of Information and Communication Technologies on Nursing Care: Results of an Overview of Systematic Reviews. J Med Internet Res. 2017 Apr 25;19(4):e122.

J Med Internet Res. 2017 Apr; 19(4): e122.
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PMCID: PMC5424122
PMID: 28442454

J Med Internet Res

EN

Impact of Information and Communication Technologies on Nursing Care: Results of an Overview of Systematic Reviews

Monitoring Editor: Gunther Eysenbach

Reviewed by Dawn Dowding, Jane M Carrington, and Pauline Johansson

Geneviève Rouleau, RN, PhD(c),[1,2] Marie-Pierre Gagnon, PhD,[1,3] José Côté, RN, PhD,[2,4] Julie Payne-Gagnon, MA,[3] Emilie Hudson, RN, BSc,[5] and Carl-Ardy Dubois, PhD[4]

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[2] Research Center of the Centre Hospitalier de l'Université de Montréal, Research Chair in Innovative Nursing Practices, Montreal, QC, Canada
[3] Research Centre of the Centre Hospitalier Universitaire de Québec-Université Laval, Quebec, QC, Canada,
[4] Faculty of Nursing Sciences, Université de Montréal, Montreal, QC, Canada
[5] School of Nursing, McGill University, Montreal, QC, Canada
Marie-Pierre Gagnon, Faculty of Nursing Sciences, Université Laval, Pavillon Ferdinand-Vandry, 1050

By systematically reviewing 22 reviews published between 2002 and 2015, they found out many nursing care themes or indicators were influenced by the use of ICTs.

Rouleau G, Gagnon MP, Côté J, Payne-Gagnon J, Hudson E, Dubois CA. Impact of Information and Communication Technologies on Nursing Care: Results of an Overview of Systematic Reviews. J Med Internet Res. 2017 Apr 25;19(4):e122.

1. Time management
2. Time spent on patient care
3. Documentation time
4. Information quality and access
5. Quality of documentation
6. Knowledge updating and utilization
7. Nurse autonomy
8. Intra and inter-professional collaboration
9. Nurses' competencies and skills
10. Nurse-patient relationship
11. Assessment
12. Care planning, and evaluation
13. Teaching of patients and families
14. Communication and care coordination
15. Perspectives of the quality of care provided
16. Nurses and patients satisfaction or dissatisfaction with ICTs
17. Patient comfort and quality of life related to care
18. Empowerment
19. Functional status

A randomized controlled trial by Bosman RJ. et al, 2002 was performed to evaluate the effect of the use of an ICIS on nursing activity.

Bosman RJ, Rood E, Oudemans-van Straaten HM, Van der Spoel JI, Wester JP, Zandstra DF. Intensive care information system reduces documentation time of the nurses after cardiothoracic surgery. Intensive Care Med. 2003 Jan;29(1):83-90.

Clinical Trial > Intensive Care Med. 2003 Jan;29(1):83-90. doi: 10.1007/s00134-002-1542-9. Epub 2002 Nov 22.

Intensive care information system reduces documentation time of the nurses after cardiothoracic surgery

Robert Jan Bosman [1], Emmy Rood, Heleen Maria Oudemans-van Straaten, Johan Ids Van der Spoel, Johannus Petrus Jacobus Wester, Durk Freark Zandstra

Affiliations + expand

PMID: 12528027 DOI: 10.1007/s00134-002-1542-9

Abstract

Objective: Nowadays, registration of patient data on paper is gradually being replaced by registration using an intensive care information system (ICIS). The aim of this study was to evaluate the effect of the use of an ICIS on nursing activity.

Design: Randomized controlled trial with a crossover design.

Setting: An 18-bed medical-surgical ICU in a teaching hospital. PATIENTS, NURSES AND INTERVENTIONS: During a 6week period 145 consecutive adult patients admitted to the ICU after uncomplicated cardiothoracic surgery were randomized into two groups: for one group the documentation was carried out using a paper-based registration (Paper), in the second group an ICIS was used for documentation.

Intensive Care Information System (ICIS) Impact on Nursing Documentation Time

- An 18-bed medical-surgical ICU in a teaching hospital in Amsterdam, Netherlands implemented an ICIS on all beds in April 2001
- Aiming at improving the quality and quantity of the documented data without an increase in the amount of nurses' time spent on documentation
- A Randomized Controlled Trial (RCT) with a crossover design was implemented
- They revealed that the use of the ICIS in patients after cardio – thoracic surgery affects nursing activity.
- Using ICIS reduces the time nurses spent on documentation up to 30%.
- This time was completely re-allocated to patient care

Bosman RJ, Rood E, Oudemans-van Straaten HM, Van der Spoel JI, Wester JP, Zandstra DF. Intensive care information system reduces documentation time of the nurses after cardiothoracic surgery. Intensive Care Med. 2003 Jan;29(1):83-90.

A mixed- method study by Probst CA. et al, 2017 was performed to examine the impact of worksystem improvement on nurses' time and patient safety.

Probst CA, Carter M, Cadigan C, Dalcour C, Cassity C, Quinn P, Williams T, Montgomery DC, Wilder C, Xiao Y. Utilizing a Human Factors Nursing Worksystem Improvement Framework to Increase Nurses' Time at the Bedside and Enhance Safety. J Nurs Adm. 2017 Feb;47(2):94-100.

J Nurs Adm. 2017 Feb;47(2):94-100. doi: 10.1097/NNA.0000000000000446.

Utilizing a Human Factors Nursing Worksystem Improvement Framework to Increase Nurses' Time at the Bedside and Enhance Safety

C Adam Probst [1], Megan Carter, Caton Cadigan, Cortney Dalcour, Cindy Cassity, Penny Quinn, Tiana Williams, Donna Cook Montgomery, Claudia Wilder, Yan Xiao

Affiliations + expand

PMID: 28067682 DOI: 10.1097/NNA.0000000000000446

Abstract

Objective: The aim of this study is to increase nurses' time for direct patient care and improve safety via a novel human factors framework for nursing worksystem improvement.

Background: Time available for direct patient care influences outcomes, yet worksystem barriers prevent nurses adequate time at the bedside.

Methods: A novel human factors framework was developed for worksystem improvement in 3 units at 2 facilities. Objectives included improving nurse efficiency as measured by time-and-motion studies, reducing missing medications and subsequent trips to medication rooms and improving medication safety.

Results: Worksystem improvement resulted in time savings of 16% to 32% per nurse per 12-hour shift. Requests for missing medications dropped from 3.2 to 1.3 per day. Nurse medication room trips

Impact of Nursing Worksystem on Nurses' Time and Patient Safety

- In 3 units at 2 facilities in US, an improved nursing worksystem incorporating EHR was implemented to evaluate its impact on nursing time and patient safety in the US.
- A mixed-method study including time-motion studies and interview with nurses was performed aiming at improving nurse efficiency, reducing missing medications and subsequent trips to medication rooms and improving medication safety.
- Worksystem resulted in time savings of 16% to 32%; Requests for missing medications dropped from 3.2 to 1.3 per day; Nurse medication room trips were reduced by 30%.
- The improved nursing worksystem made to achieve significant time savings, reduce missing medication requests, lower reported medication errors and reduce trips to medication rooms.

Probst CA, Carter M, Cadigan C, Dalcour C, Cassity C, Quinn P, Williams T, Montgomery DC, Wilder C, Xiao Y. Utilizing a Human Factors Nursing Worksystem Improvement Framework to Increase Nurses' Time at the Bedside and Enhance Safety. J Nurs Adm. 2017 Feb;47(2):94-100.

A mixed- method study by Verwey R. et al, 2008 was conducted to evaluate the effectiveness of an Electronic Nursing Record (ENR).

Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.

› Stud Health Technol Inform. 2008;141:130-8.

The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn

R Verwey [1], R A B Claassen, M J Rutgers, L P de Witte

Affiliations + expand

PMID: 18953133

Abstract

This article describes the implementation of an Electronic Nursing Record (ENR) in Maasland Hospital (Orbis Medical and Healthcare group) in Sittard, the Netherlands. Through analysis of documents, structured interviews and participatory observation, a study was made of the plans prior to the introduction of the ENR, how the process proceeded, which enhancing and constraining factors influenced the process and how the nursing staff experienced the introduction of the ENR. The implementation of the system took place in 2006 and 2007. The selection and design of the system was carried out first, followed by a pilot phase. After thorough review and adjustment, the introduction of the ENR in the other wards of the hospital followed according to plan. The implementation process was carried out by several nurses in different roles (project management, project group members, key-users and teachers). The introduction of the system had two objectives: saving time by promoting efficiency and quality improvement by the introduction of standardization in documentation and the use of nursing care plans. The study indicates, however, that no time-efficiency was achieved by using the ENR so far. This had an adverse effect on the acceptance of the

Implementation of An Electronic Nursing Record (ENR)

- An Electronic Nursing Record (ENR) was implemented in a general hospital in the Netherlands during 2006 and 2007.
- A mixed-method study (literature review, interviews and observation) was conducted to examine the impact on time-saving and quality improvement through using standardized nursing care plans.
- Nurses were positive about the set-up of the implementation process, especially the contribution of the project group, the key-users on the ward and the resources which were made available (the staffing, external expertise and training).
- The study indicates, however, that no time-efficiency was achieved by using the ENR. This had an adverse effect on the acceptance of the system by the nurses.

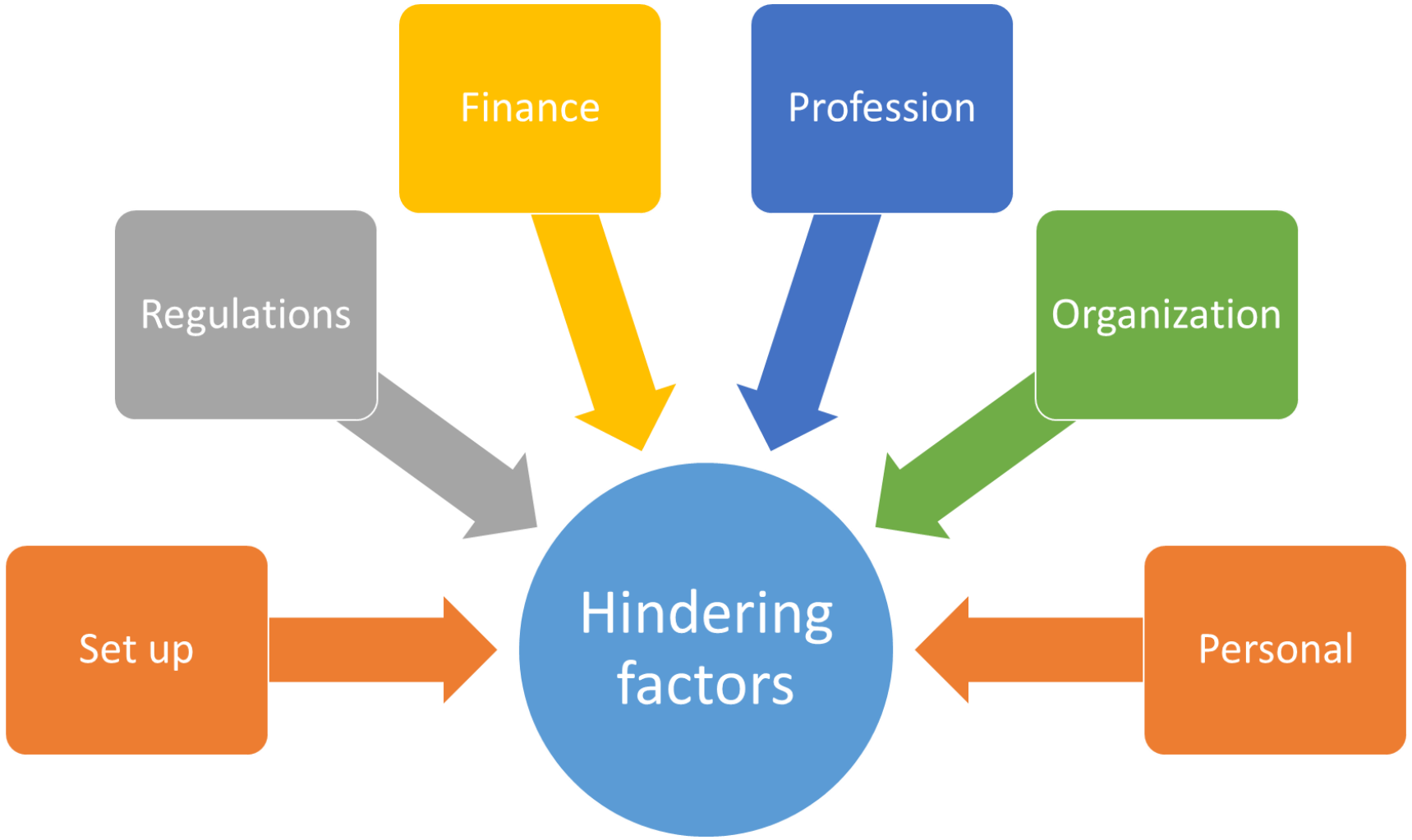
Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.

Factors Hindering Technology Realization

- Bad technological design that do not observe human factors and ergonomic principles
- Bad technological interface with the patient or the environment
- Inadequate plan for implementing new technologies into practice
- Inadequate maintenance plan

Powell CG, Nelson LA, Patterson ES. Patient Care Technology and Safety. In: Hughes RG, editor. Patient Safety and Quality: An Evidence- Based Handbook for Nurses. Rockville (MD): AHRQ; 2008. p. 207-220.

Factors Hindering Technology Realization in Nursing



Implementation/ Set Up

- Also, include technical matters
- High workload, time deficit for adequate documentation
- Using the system is more time-consuming than paper based documentation
- Unclear aims in introducing the system
- Computers and networks have a lot of maintenance problems
- The computer terminals/ communication networks are old and slow
- Data entry and data retrieval is difficult from the system
- There are not enough computer terminals

- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation: A Field Study of Saudi Arabian Hospitals. Procedia Computer Science. 2013; 21() 335-342.

Regulation

- Lack of policies/ procedures that govern technology use
- Lack of laws/ legislations that govern EHR/ HIS adoption
- Lack of data protection and confidentiality policies
- Lack of laws/ legislations that govern data protection and confidentiality
- Lack of supervision on EHR/ HIS use

- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
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Financial Matters

- High initial cost of implementation
- High operation and maintenance costs
- Lack of capital resources to invest HIT (EHR/ HIS)
- Lack of feasibility studies on the benefits versus costs of implementing and using EHR/ HIS
- Uncertainty about existing return on investment after implementing and using EHR/ HIS

- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation: A Field Study of Saudi Arabian Hospitals. Procedia Computer Science. 2013; 21() 335-342.

Profession

- Lack of healthcare professionals' support to EHR/ HIS
- Lack of time allocated for learning and training on using EHR/ HIS
- EHR/ HIS adds more work/ needs more time/effort
- EHR/ HIS adds more professional responsibilities
- EHR/ HIS slows down work/decreases productivity

- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation: A Field Study of Saudi Arabian Hospitals. Procedia Computer Science. 2013; 21() 335-342.

Organization

- Too little guidance on the ward after the "go-live stage“
- Training occurred during the pilot phase because too little practice was offered
- Digital training not tailored to needs
- Hardware provisions (laptops and connection to the intranet) not sufficient
- Low numbers of health/ nurse informatics specialists
- Workflow needs redesign to match with EHR/ HIS
- Implementation took more time than expected

- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
- De Leeuw JA, Woltjer H, Kool RB. Identification of Factors Influencing the Adoption of Health Information Technology by Nurses Who Are Digitally Lagging: In-Depth Interview Study J Med Internet Res 2020;22(8):e15630
- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation: A Field Study of Saudi Arabian Hospitals. Procedia Computer Science. 2013; 21() 335-342.

Organization (Cont'd)

- Hospital management doesn't have the necessary experience to choose and implement the best EHR/ HIS
- Hospital management doesn't have the necessary experience to evaluate and maintain the performance of EHR/ HIS
- Hospital management doesn't provide effective monitoring or protection on EHR/ HIS
- Hospital management has no strategic planning for the adoption and implementation of EHR/ HIS

- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
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- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation: A Field Study of Saudi Arabian Hospitals. Procedia Computer Science. 2013; 21() 335-342.

Personal Matters

- Including behavioral and attitude factors
- Lack of knowledge and motivation of some of the nurses
- Lack of computer knowledge and skills
- Many changes in the organization in a short time
- Negative beliefs and impressions about health IT solutions
- Person-related barriers

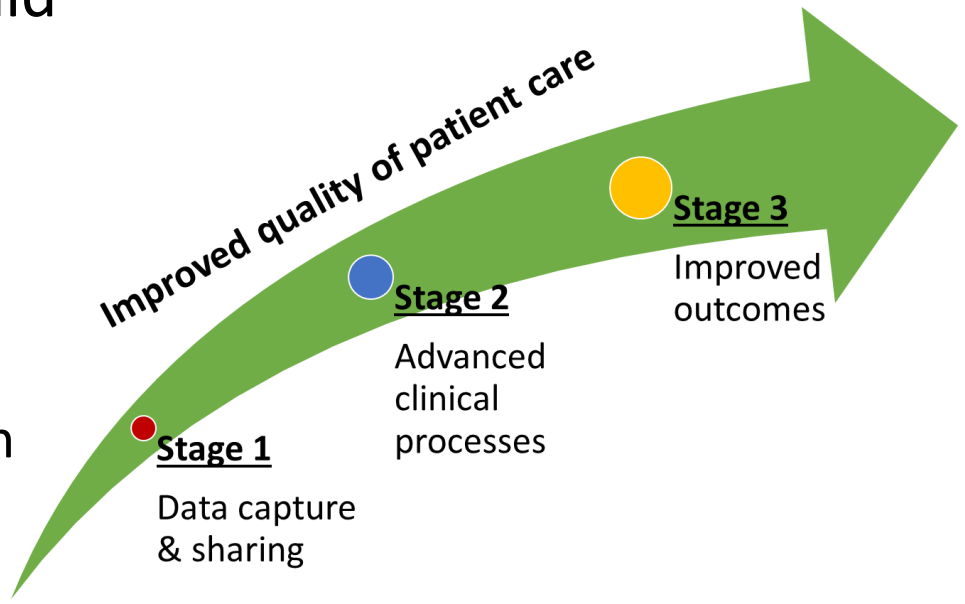
- Verwey R, Claassen RA, Rutgers MJ, de Witte LP. The implementation of an Electronic Nursing Record in a general hospital in the Netherlands: lessons to learn. Stud Health Technol Inform. 2008;141:130-8.
- Khalifa M. Barriers to Health Information Systems and Electronic Medical Records Implementation: A Field Study of Saudi Arabian Hospitals. Procedia Computer Science. 2013; 21() 335-342.

Recognizing Nurses' Role in Technology Implementation

- Meaningful Use (MU) incentive program
- Patient Safety and Quality Improvement Act (PSQI)
- Patient Protection and Affordable Care Act (PPACA)
- Health Information Technology for Economic and Clinical Health Act (HITECH)

The Meaningful Use (MU) Incentive Program

- Established by Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009
- Created by the Centers for Medicare & Medicaid (CMS) in 2011
- The goal of MU is to:
  - —improve quality, safety, efficiency
  - —reduce health disparities
  - —engage patients
  - —improve health coordination and population health
  - —and to maintain privacy and security of patient health information (PHI)



Patient Safety and Quality Improvement Act

- Created in 2005 in response to growing concern about patient safety in the United States
- Goal: to improve patient safety by encouraging voluntary and confidential reporting of events that adversely affect patients.
- Focus: how **patient safety event information** is collected, developed, analyzed, and maintained.
- This has driven the nurse informaticist to be a key contributor to the efforts of creating clinical documentation systems

Patient Protection and Affordable Care Act (PPACA)

- Also known as “healthcare reform” or “Obamacare”
- Includes HIT requirement for all HCPs
- Long-term goal is a single, national EHR database
  - Data mineable for public health and pharmacological research
  - Any HCP can access a patient’s record to provide care
  - Complete patient information for more accurate medical decision-making

Rosenbaum S. The Patient Protection and Affordable Care Act: implications for public health policy and practice. Public Health Rep. 2011;126(1):130-135.

Health Information Technology for Economic and Clinical Health Act (HITECH)

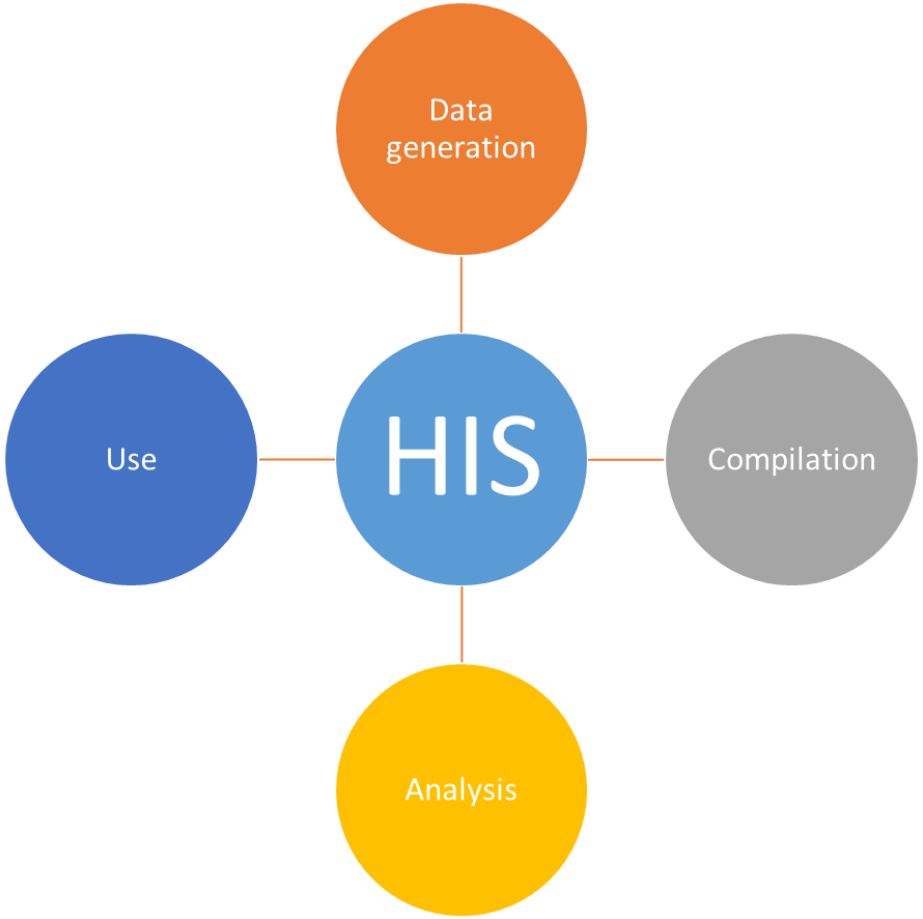
- Enacted as part of the American Recovery and Reinvestment Act of 2009
- Sometimes called the Health Information Technology Initiative
- Integral part of the PPACA
- Requires and incentivizes HCPs to move records to an approved patient management application
- Standardizes information requirements and data formats
- End expectation: one integrated medical record per patient, to be used by all his HCPs
- Also addressing the privacy and security concerns associated with the electronic transmission of health information by strengthening the enforcement of the HIPAA rules.

Importance of Healthcare Data

- Providers (treat patients and choose among treatment options, approaches, and modalities)
- Payers (verify eligibility for treatment and to determine medical necessity for care)
- Researchers (various comparative outcomes measurement projects)
- Regulators and policy makers (make prudent and cost-effective decisions to ensure the public health and well-being of citizens)
- Patients (take more autonomy, responsibility and roles on their self- care activities)

Healthcare Information Systems (HIS)

- A health information system (HIS) encompasses a range of technology in health care used to acquire, store, deliver and analyze medical data.
- Underpinnings for decision-making
- Four key functions:
  - Data generation
  - Compilation
  - Analysis and synthesis
  - Communication and use



Health Metrics Network Framework and Standards for Country Health Information Systems, World Health Organization, January 2008

Types of Healthcare Information Systems

- Healthcare Information Systems or "HIS" is a broad term generally used when referring to electronic systems designed to manage healthcare data.
- Different types of HIS in all areas of nursing practice:
  - Clinical practice
  - Administration
  - Education
  - Research

EHR (Electronic Health Record) & EMR (Electronic Medical Record)

- Also called Computer-Based Patient Record (CPR)
- **EMR** is an electronic medical record of a patient that is stored inside the clinic systems and doesn't get removed. Used mostly by primary care physicians and specialists, this record can include the following info:
  - Allergies
  - Medications
  - Family history
  - Diagnosis
  - Surgery information
  - Progress notes

EHR (Electronic Health Record) & EMR (Electronic Medical Record) (Cont'd)

- EHR is a **complete overview** of patient health history, and can include information like:
  - Visits to other healthcare professionals
  - Insurance information
  - Records of hospitalization
  - And more
- While EMR may need to be printed to get shared with other healthcare professionals, EHR can be classified as a digital record that contains everything that EMR does, plus more.

Computerized Physician Order Entry (CPOE)

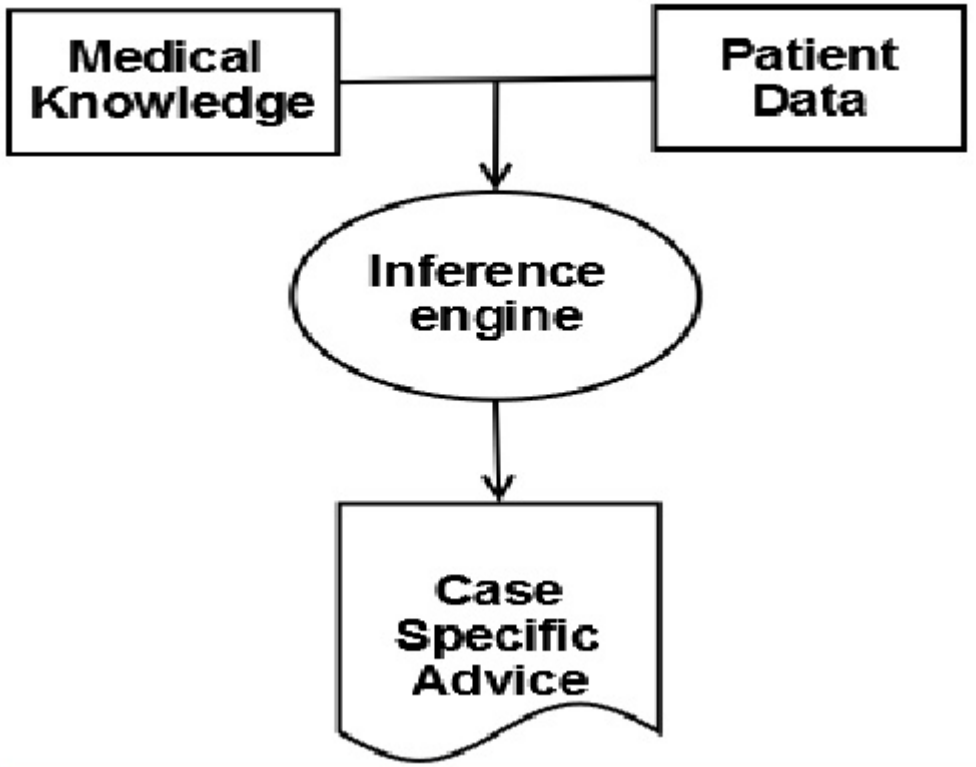
- Also called Computerized provider order entry or Computerized provider order management
- Process of electronic entry of medical practitioner instructions including medication, laboratory, and radiology orders via a computer application for the treatment of patients under his or her care.
- It matters because:
  - **Reduce errors and improve patient safety**
  - **Improve efficiency**
  - **Improve reimbursements**
- CPOE is safer and more efficient for providers and patients.

Clinical Information Systems (CIS)

- Called Point-of-Care Systems
- A clinical information system (CIS) is designed to rapidly capture, store, process, and transfer information across decision-makers.
- Mostly used by hospitals (labs, pharmacies, radiology and ICU), CIS can include health history, prescriptions, doctor's notes, dictation, and all other information that is kept together electronically.
- Examples include: Laboratory Information System (LIS), Nursing Information System (LIS), Radiology Information System (LIS), etc.
- This system's biggest benefit is that it allows communication across different systems, and can import/export data between instruments.

Clinical Decision Support Systems (CDSS)

- CDS analyzes data from clinical and administrative systems.
- The aim is to assist healthcare providers in making informed clinical decisions.
- Data available can provide information to medical professions who are preparing diagnoses or predicting medical conditions like drug interactions and reactions.



Patient portals

- A patient portal provides online access to the patient's personal information, including previous appointments, medical history, diagnoses, and more.
- In most cases, a patient portal can be accessed through any device, which includes mobile, desktop, laptop, or tablet with internet connection on a 24-7 basis. Patients can also book appointments and contact their healthcare team directly.

Practice Management Softwares (PMS)

- Also called HealthCare Information Systems
- Practice Management Software is commonly used by allied healthcare professionals, such as psychologists, or physiotherapists.
- PMS helps to manage the day-to-day operations of a clinic, such as online booking, billing, patient reminders, and other administrative tasks.
- Practice management systems offer a diverse range of features - which usually varies depending on the type of health practice the software specializes in.

Nurses' Role in Technology Selection, Design & Implementation

- Nurse informaticists as part of the development process
- Better evaluator to judge about the usefulness of a software
- Help address common problems arising due to ill-designed software
- Help ensuring better allocation of healthcare resources
- So, nurses need to be involved in selection, development and implementation of any system.

Glancey TS, Brooks GM, Vaughan VS. Hospital information systems. Nursing's integral role. Comput Nurs. 1990;8(2):55-59.

Competent Informatics Nurse Specialists

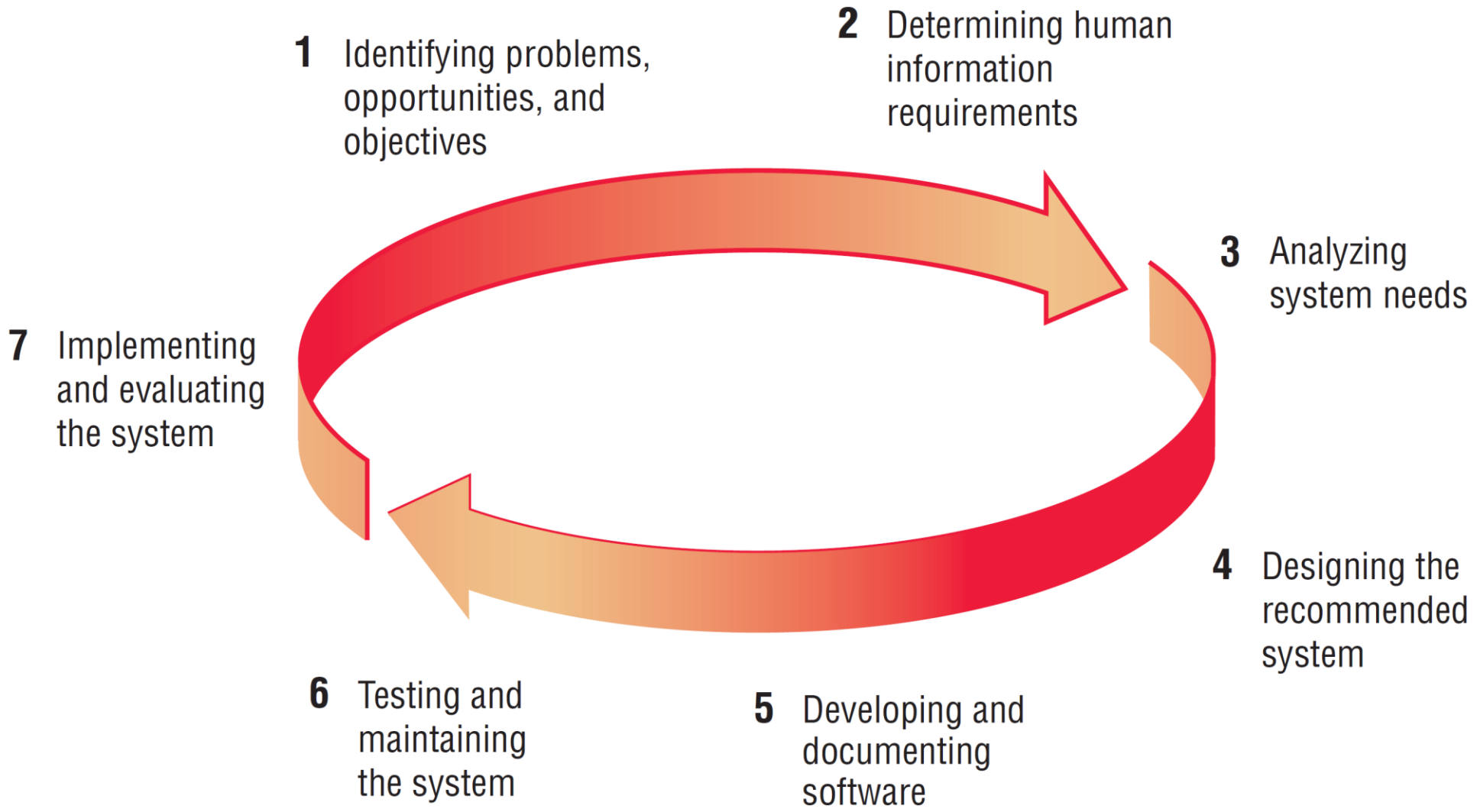
- American Association of Colleges of Nursing (AACN)
  - Re-Envisioned Essentials (10 Domains)
  - https://www.aacnnursing.org/Education-Resources/AACN-Essentials
- American Medical Informatics Association (AMIA)
  - Advanced Health Informatics Competencies
  - https://www.amia.org/sites/default/files/AMIA-Health-Informatics-Core-Competencies-for-CAHIIM.PDF
- Public Health Forum
  - Population Health Forum
  - http://www.phf.org/resourcestools/Documents/Population_Health_Competencies_2019Mar.pdf

Nurses' Role in Technology Selection, Design & Implementation (Cont'd)

- Nurse informaticists play a significant role throughout the entire process
- It starts with the **executive leadership** and **board approving** the capital investment in an EHR system
- And continues with participation in the **selection**, **design**, and **implementation** of different aspects of technology.
- So, Nursing Informatics Specialist (NIS) or a Nurse Informaticist (NI) could act as project managers and clinical analyst while they are involved in different activities of systems analysis and design.

Systems Development Life Cycle (SDLC)

- The systematic approach of the analysis and design of information systems.
- Software development is a step wise process, which is targeted to plan and develop a software.
- This systematic approach is referred to as Systems Development Life Cycle (SDLC).
- This approach holds this view that systems are best developed through the use of a specific cycle of analyst and user activities.



Kendall K and Kendall J. Systems Analysis and Design. Prentice Hall. 2011. 8th edition.

Phase 1: Identifying Problems, Opportunities, and Objectives

- The first phase is concerned with correctly identifying problems, opportunities, and objectives.
- Users: frontline nurses in majority as nurses coordinate and conduct a lot of patient care related activities.
- Clinical nurse leaders and managers can contribute significantly in explaining and putting the requirement in a coherent manner so that the product that comes out is not redundant. Involvement of nurses in initial phases of software development would ensure a better product which is different and more relevant clinically.
- Opportunities: situations that the analyst believes can be improved through the use of computerized information systems.
- Identifying objectives: also an important component of the first phase.

Plochg T, Hamer S. Innovation more than an artefact? Conceptualizing the effects of drawing medicine into management. International Journal of Healthcare Management. 2012; 5(4):189-192.

Phase 1: Identifying Problems, Opportunities, and Objectives (Cont'd)

- The people involved in the first phase are the users (nurses and other healthcare providers such as physicians), analysts, and systems managers coordinating the project.
- Activities in this phase consist of interviewing user management, summarizing the knowledge obtained, estimating the scope of the project, and documenting the results.
- The output of this phase is **a feasibility report** containing a problem definition and summarizing the objectives.
- Management must then make a decision on whether to proceed with the proposed project.

Phase 2: Determining Human Information Requirements

- In the information requirements phase of the SDLC, the analyst is striving to understand what information users need to perform their jobs.
- At this point the analyst is examining how to make the system useful to the people involved.
  - How can the system better support individual tasks that need doing?
  - What new tasks are enabled by the new system that users were unable to do without it?
  - How can the new system be created to extend a user's capabilities beyond what the old system provided?
  - How can the analyst create a system that is rewarding for workers to use?

Phase 2: Determining Human Information Requirements (Cont'd)

- The analyst will use these methods to pose and answer many questions concerning **Human Computer Interaction (HCI)**. Questions include:
  - What are the users' physical strengths and limitations? In other words, What needs to be done to make the system audible, legible, and safe?
  - How can the new system be designed to be easy to use, learn, and remember?
  - How can the system be made pleasing or even fun to use?
  - How can the system support a user's individual work tasks and make them more productive in new ways?

Determining Information Requirement Analysis (IRA)

- INFORMATION GATHERING: **INTERACTIVE** METHODS
  - Interviewing
  - Joint Application Design (JAD)
  - Surveying by Questionnaires
- INFORMATION GATHERING: **UNOBTRUSIVE** METHODS
  - Sampling
  - Investigation
  - Observing a Decision Maker's Behavior
  - Observing the Physical Environment
- **AGILE** MODELING AND PROTOTYPING
  - Prototyping
  - Rapid Application Development (RAD)
  - Agile Modeling

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Phase 2: Determining Human Information Requirements (Cont'd)

- People involved: analysts and users (frontline nurses), typically operations managers and operations workers (clinical nurse leaders and nurse informaticists).
- The nurse informaticist as the clinical analyst needs to know the details of current system functions:
  - the **who** (the people who are involved), **what** (the business activity), **where** (the environment in which the work takes place), **when** (the timing), and **how** (how the current procedures are performed) of the business under study.
- At the completion of this phase, the nurse informaticist should understand how the clinical staff accomplish their work when interacting with a computer and begin to know how to make the new system more useful and usable.

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Phase 3: Analyzing System Needs

- Special tools and techniques help the analyst make requirement determinations.
  - Tools such as data flow diagrams (DFD) to chart the input, processes, and output of the business's functions, or activity diagrams or sequence diagrams to show the sequence of events, illustrate systems in a structured, graphical form.
  - From data flow, sequence, or other diagrams, a data dictionary is developed that lists all the data items used in the system, as well as their specifications.
- In this phase nurse informaticists could also play a role to supervise for example use of medical terminology or patient care data relevant to acuity system which can create a false clinical picture if not put aptly.

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Phase 3: Analyzing System Needs (Cont'd)

- During this phase the systems analyst also analyzes the structured decisions made.
  - Structured decisions are those for which the conditions, condition alternatives, actions, and action rules can be determined.
  - There are major methods for analysis of structured decisions: decision tables, decision trees, etc.
- Contribution of nurse informaticists are vital in this phase as they are the only one who can contribute in analyzing clinical decisions, clinical flows and patient care processes needed for clinical decision making

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Phase 3: Analyzing System Needs (Cont'd)

- At this point in the SDLC, the systems analyst:
  - Prepares a systems proposal that summarizes what has been found out about the users, usability, and usefulness of current systems
  - Provides cost-benefit analyses of alternatives
  - Makes recommendations on what (if anything) should be done. If one of the recommendations is acceptable to management, the analyst proceeds along that course.
- Each systems problem is unique, and there is never just one correct solution.
- The manner in which a recommendation or solution is formulated depends on the individual qualities and professional training of each analyst and the analyst's interaction with users in the context of their work environment.

Phase 4: Designing the Recommended System

- The information collected earlier will be used by the system analyst to accomplish the **logical design** of the information system.
- Part of the logical design of the information system is devising the **HCI**.
- The user interface is designed with the help of users to make sure that the system is
  - Audible
  - Legible
  - Safe
  - Attractive and enjoyable to use.
- Examples of physical user interfaces include a keyboard (to type in questions and answers), onscreen menus (to elicit user commands), and a variety of graphical user interfaces (GUIs) that use a mouse or touch screen.

Phase 4: Designing the Recommended System (Cont'd)

- The design phase also includes **designing databases** that will store much of the data needed by decision makers in the organization.
- In this phase the analyst also works with users to **design output** (either onscreen or printed) that meets their information needs.
- Finally, the analyst must **design controls and backup procedures** to protect the system and the data, and to produce **program specification packets** for programmers.
  - Packets contain input and output layouts, file specifications, and processing details; decision trees or tables, UML or data flow diagrams, and the names and functions of **any prewritten code**

Phase 5: Developing and Documenting Software

- It is the phase of **coding the program** i.e. translating it into the program language.
- Analyst works with programmers to develop **any original software** that is needed.
- Analyst also works with users to develop effective documentation for software, including procedure manuals, online help, and Web sites featuring Frequently Asked Questions (FAQs), on Read Me files.
  - Because users are involved from the beginning, phase documentation should address the questions they have raised and solved jointly with the analyst.
  - Documentation tells users how to use software and what to do if software problems occur.
- Programmers have a key role in this phase because they design, code, and remove syntactical errors from computer programs.

Phase 5: Developing and Documenting Software (Cont'd)

- Terminologies that may require the guidance of a healthcare professionals for example use of medical terminology or patient care data.
  - A standardized nursing language used in patient care systems
  - Nurses must work closely with the IT team for defining standardized nursing terminology
- Nurse informaticist can learn coding and take up the role of a coder.
  - Ehance collaboration and understanding between the software team and healthcare professionals.
  - Ensure effective integration of technology into practice.
- The people involved in this phase are the analysts, clinical analyst (nurse informaticist), coders and users (frontline nurses as well as clinical nurse leaders)

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Phase 6: Testing and Maintaining the System

- Before the information system can be used, it must be tested to catch problems before the system is signed over to users.
  - By programmers alone
  - By systems analysts in conjunction with programmers
  - With sample data and eventually with actual data from the current system
  - Test plans are created early in the SDLC and are refined as the project progresses
- Maintenance of the system and its documentation begins in this phase and is carried out routinely throughout the life of the information system.

Phase 6: Testing and Maintaining the System (Cont'd)

- Clinical nurses: the best judge to assess the positive aspects and the challenges of software
- It is important to involve nurses before a system or software is adopted as nurses remain important link to many clinical processes in healthcare.
- Testing: an important phase as a system's design can greatly influence its acceptability by the users.
- Nurse informatics can take up role of a test analyst or a tester to check the credibility of software.

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Phase 7: Implementing and Evaluating the System

- The last phase of system development; implementing the information system
- The most interesting and challenging part of the process
- The software is adopted and used by many users
- Unthinkable problems as the IT goes live
- The system may or may not produce desired results as expected
- The system can track progress of individual user and identify problems faced by them in using the system

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Phase 7: Implementing and Evaluating the System (Cont'd)

- This phase involves **training users** to handle the system.
- Vendors also provide some training, but oversight of training is the responsibility of the analyst/ nurse informaticist as the clinical analysist
- Plan for a smooth conversion from the old system to the new one
- Evaluation is included as part of this final phase
- A key criterion: whether the intended users are indeed using the system
- Systems work is often cyclical

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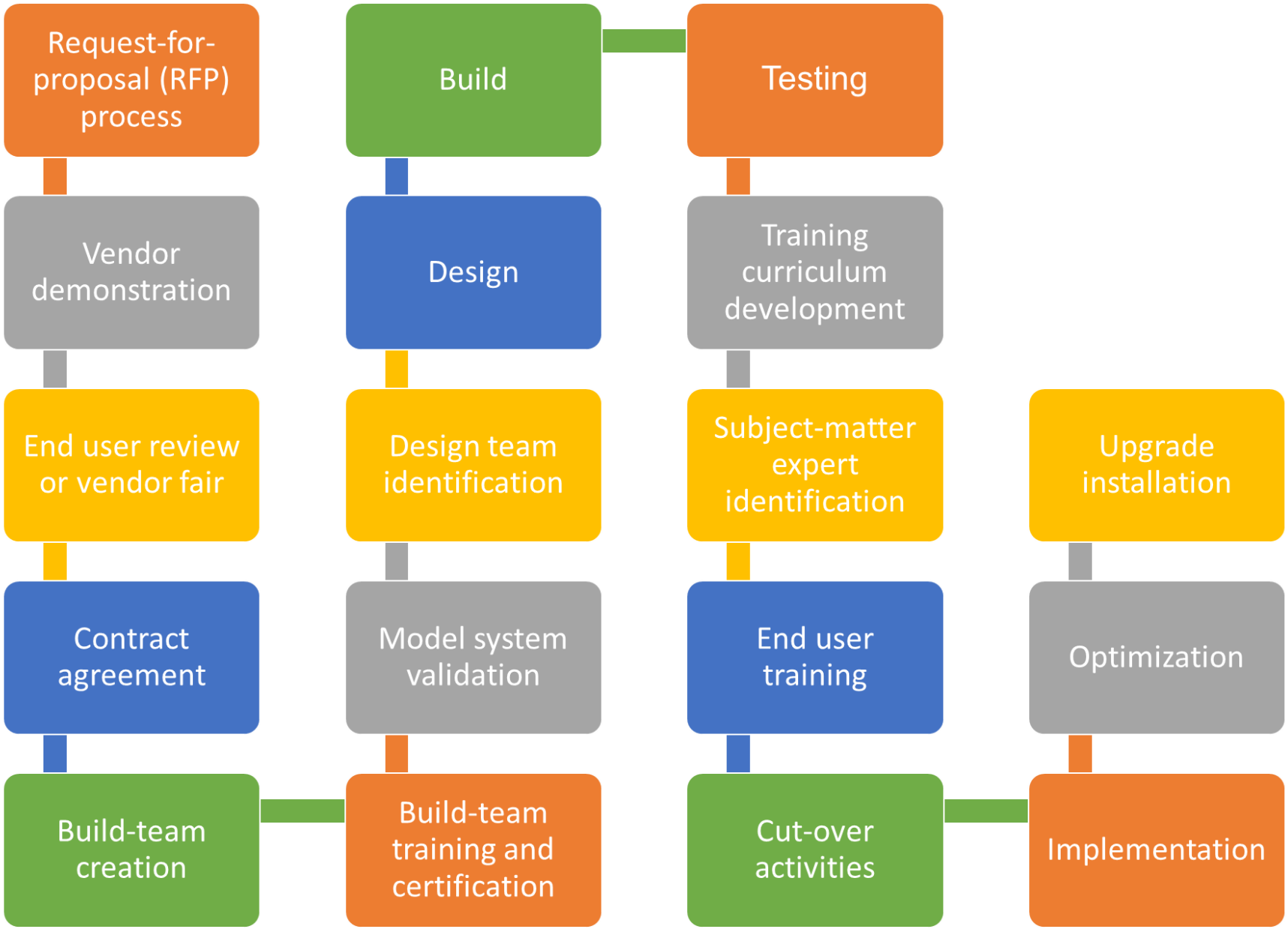
Phase 7: Implementing and Evaluating the System (Cont'd)

- After the system is installed, the computer programs must be modified and kept up to date
- Maintenance is performed for two reasons. The first of these is to correct software errors.
- The other reason is to enhance the software's capabilities in response to changing organizational needs:
  - Additional features
  - Organization change over time
  - Hardware and software improvements

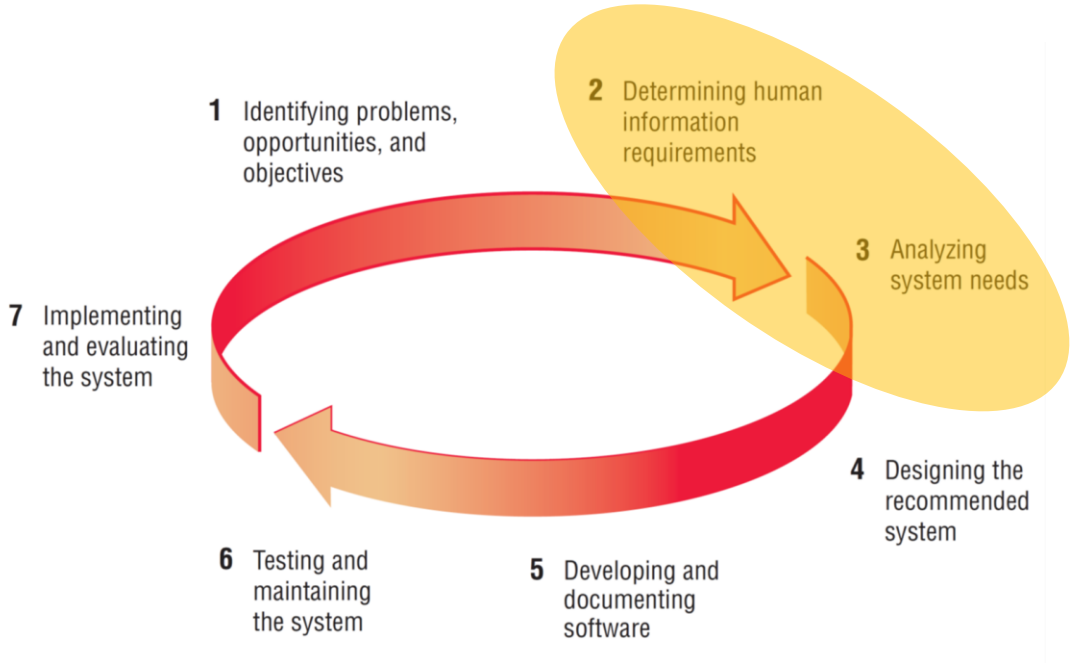
Technology Execution Steps



Susan Houston et al. An Introduction to Nursing Informatics: Evolution and Innovation. 2nd Edition

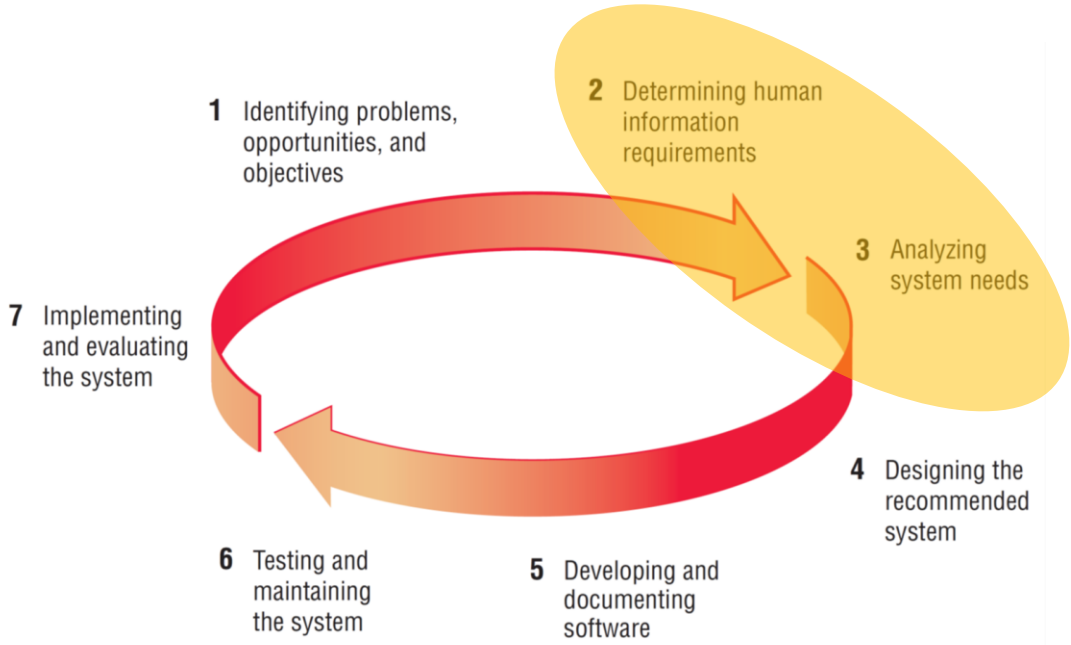
Functions of NIS (ANA, 1994)

- **Theory development:** the NIS contributes to the scientific knowledge-base of nursing informatics.
- **Analysis of information needs:** the identification of information that nurses‘ need in order to accomplish their work including client care, education, administration, and research. (*In SDLC: phase 2 & 3- determining human information requirements & system needs*)



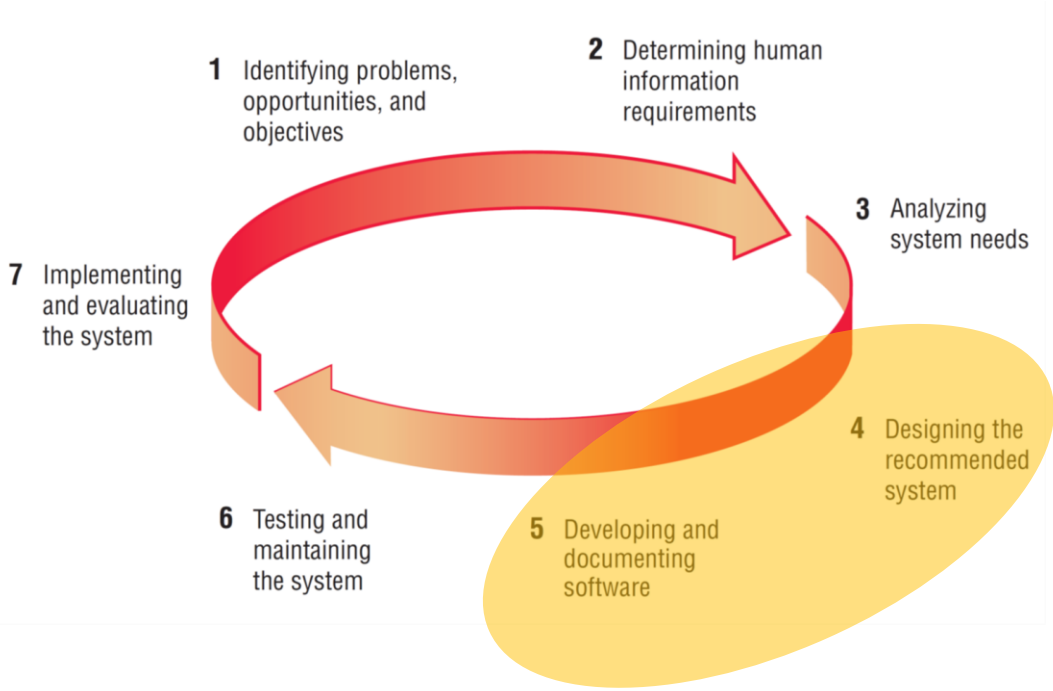
Functions of NIS (ANA, 1994)

- **Selection of computer systems:** the NIS, guides the user in making informed decisions related to the purchase of computer systems. (*In SDLC: phase 2 & 3- determining human information requirements & system needs*)



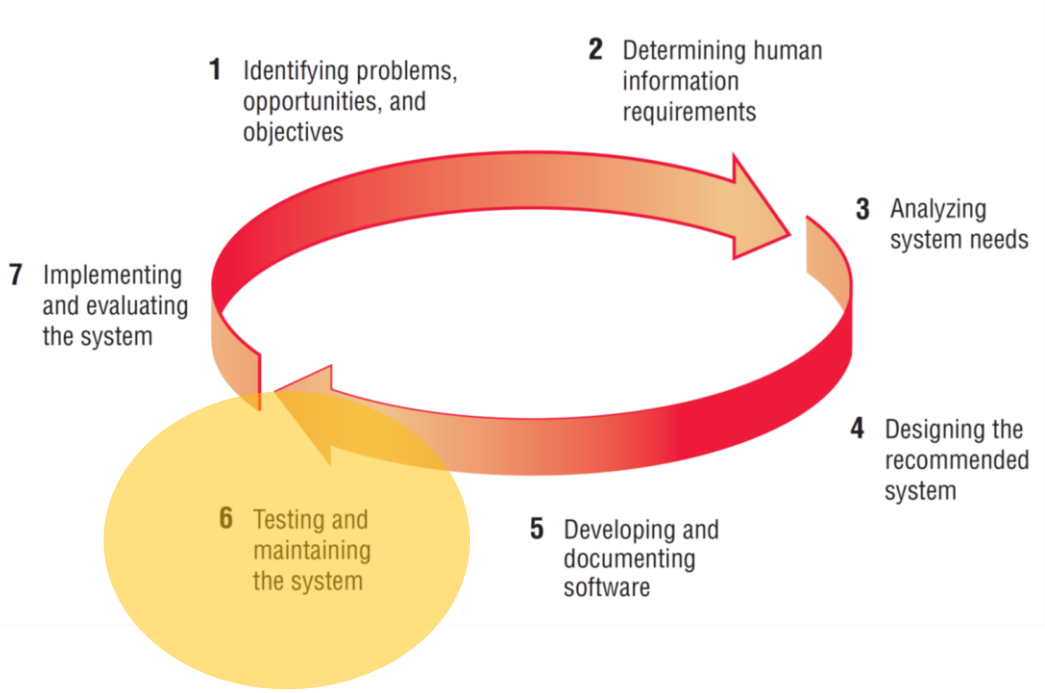
Functions of NIS (Cont.')

- **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. (*In SDLC: phase 4 & 5- designing the recommended system & developing and documenting software*)



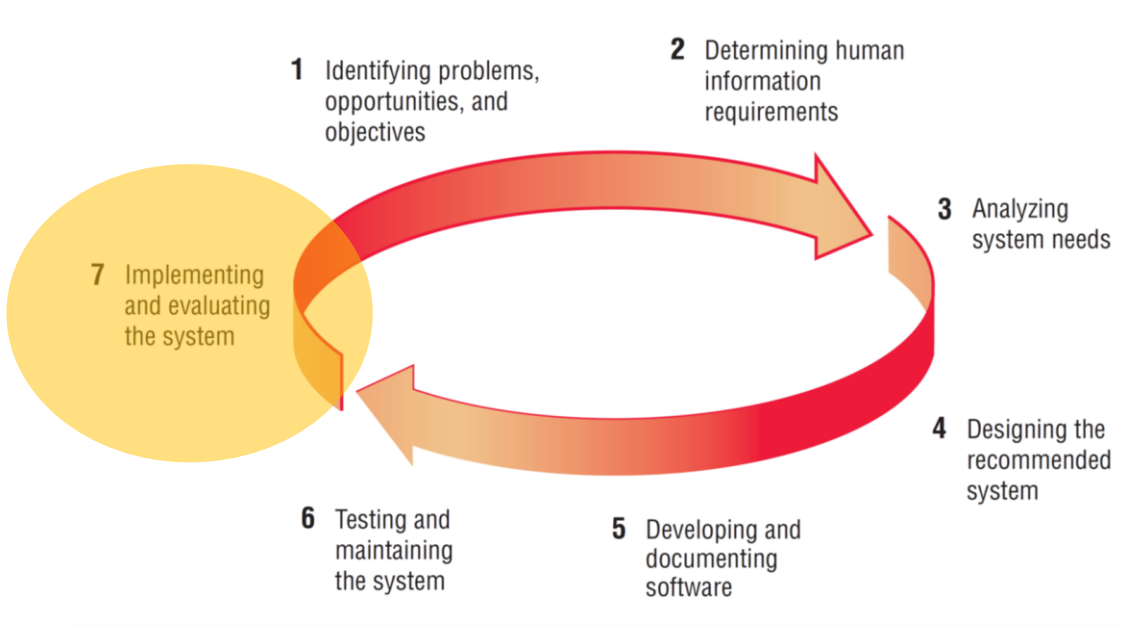
Functions of NIS (Cont.')

- **Testing of computer systems:** systems must be checked for proper functioning before they are made available for use in patient care. (*In SDLC: phase 6- testing and maintaining the system*)



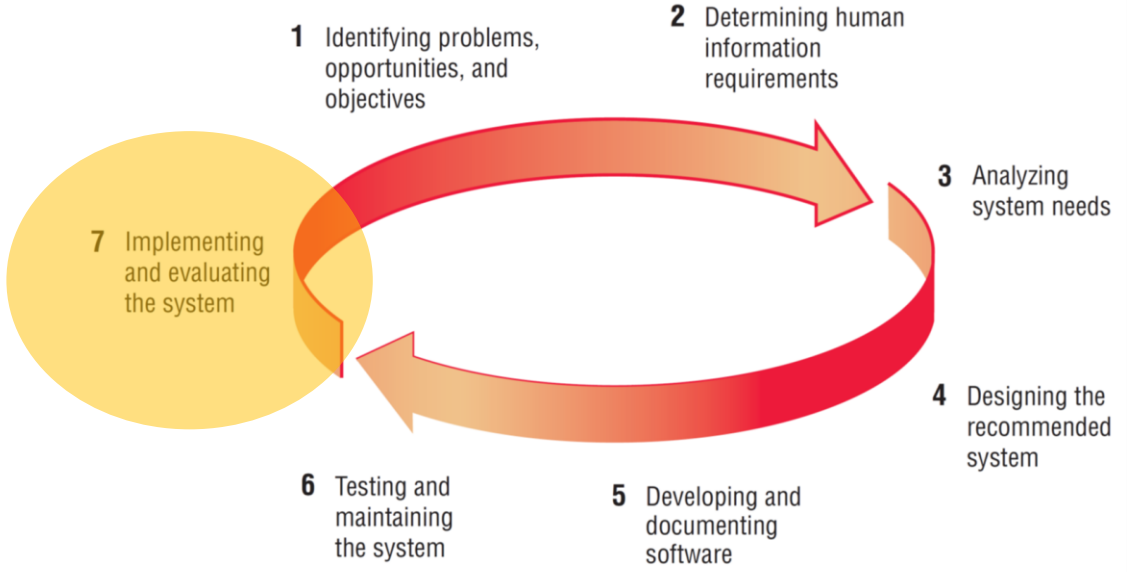
Functions of NIS (Cont.')

- **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. (*In SDLC: phase 7- implementing and evaluating the system*)



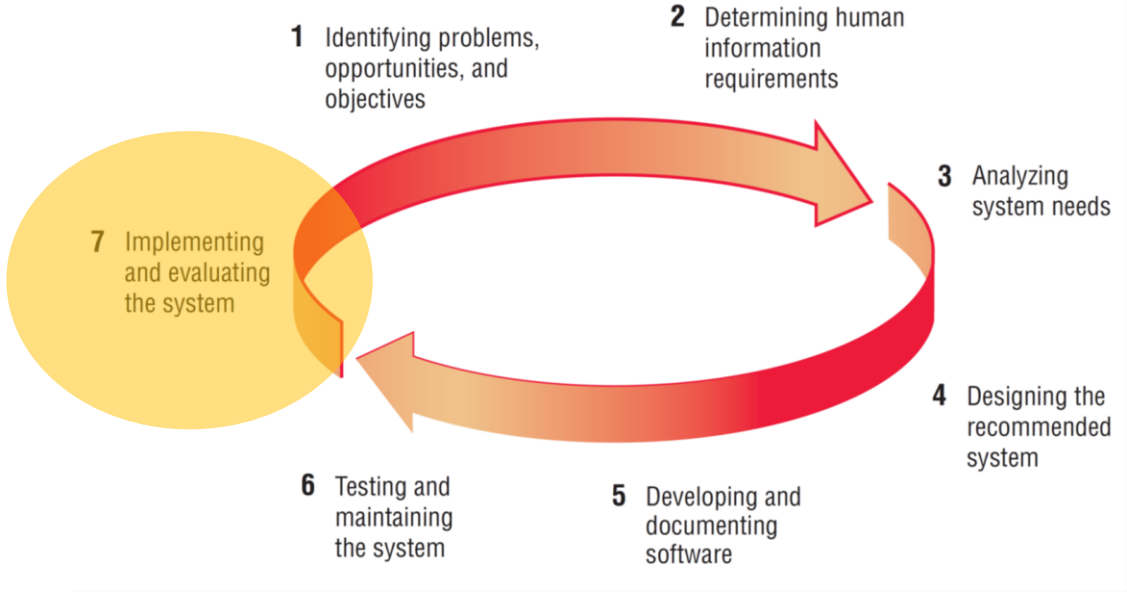
Functions of NIS (Cont.')

- **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. (*In SDLC: phase 7- implementing and evaluating the system*)



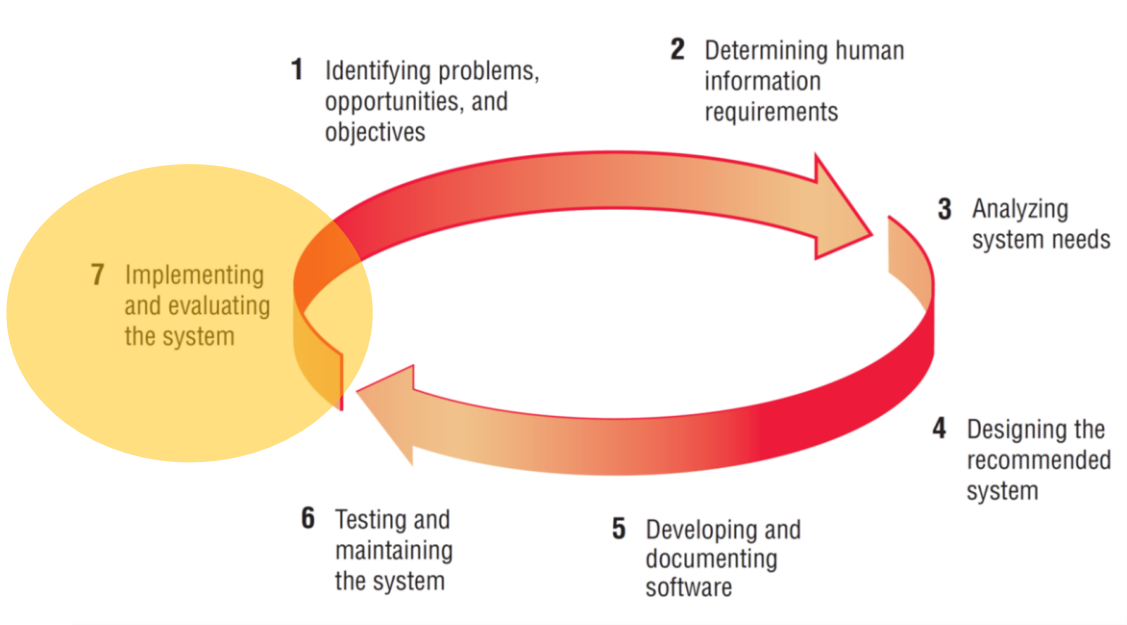
Functions of NIS (Cont.')

- **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. (*In SDLC: phase 7- implementing and evaluating the system*)



Functions of NIS (Cont.')

- **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. (*In SDLC: phase 7- implementing and evaluating the system*)



Conclusions

- A paradigm shift in how care is communicated and provided
- Improving patient care and outcomes through the continuous analysis data
- Nurses explore the newest technology, push for the interoperability of that technology, and advocate it to be incorporated into their care of the patient
- Nurses as leaders and at the forefront in the evolution of healthcare

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Questions & Comments …