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N-101 Nursing Informatics
First Semester, Academic Year 2024-2024

STUDY GUIDE

Overview of Nursing Informatics
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Introduction

The complex nature of healthcare delivery created roles in biomedical and health informatics which mainly focus on supporting health processes and outcomes by managing data and information technology. According to Graves and Corcoran, Nursing Informatics is "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" (Graves & Corcoran, 1989). Theoretical foundations of nursing informatics were built on information technology, conceptual foundations, and the role of informatics nurse specialty.

Documentation in Nursing practice has been practiced historically, but are recorded into hardcopy health records. As health practices evolve and practice situations change, competencies in Nursing informatics will improve clinical decision-making skills through quicker access to patient information, thereby improving overall efficiency and reduction in potential errors. Nursing informatics influences nursing and its ability to provide high quality of care and to respond to the health needs of individuals, families, and communities.

This module contains references and activities to help you understand the scope of and factors that influence nursing informatics, the roles and competencies of nurses in improving practice through the use of technology, and identify population health needs and the role of nursing informatics in improving health service delivery toward better health outcomes.

Topics:

I. **Definition and scope of nursing informatics**

A definition for nursing informatics provides a guide for nurses interested in informatics and suggests directions for practice, education, training, and research. A definition for nursing informatics will inform others to understand the legitimacy of the practice, the roles, and competencies of a nurse specializing in informatics (Staggers & Thompson, 2002).

Information Technology-oriented definitions

This highlights the roles of technology in nursing informatics. Scholes and Barber defined nursing informatics as "the application of computer technology to all fields of nursing- nursing service, nurse education, and nursing research". Hannah then defined nursing informatics as "The use of information technologies within the purview of nursing, and that are carried out by nurses when performing their duties. Therefore, any use of information technologies by nurses in relation to the care of their parents, the administration of health care facilities, or the educational preparation of individuals to practice the discipline is considered nursing informatics", which emphasized technology and the nursing role within nursing informatics.

Conceptually-Oriented definitions

A shift from technology to conceptually-oriented definitions of nursing informatics began in the 1990s. Schwirian, in an attempt to identify nursing informatics research as a foundation of the course, mentioned that informatics research needs to be "proactive and model-driven rather than reactive and problem-driven". Meanwhile, Graves

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and Corcoran in their definition of nursing informatics downplayed the role of technology and built more on incorporating nursing concepts, defining nursing informatics as "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", firmly establishing nursing informatics within the practice of nursing (Graves & Corcoran, 1989). They discussed the need to understand how nurses in the clinical practice conceptualize and structure clinical problems and how inquiry is done in the information system. Their view accented the importance of clinical decision-making processes in designing information systems.

Role-Oriented definitions
As nursing informatics gained recognition as a nursing specialty, the Council of Computer Applications in Nursing of the American Nurses Association (ANA), expanded previous definitions by integrating the role of the informatics nurse specialty into Graves and Corcoran's definition: "A 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, and research and to expand nursing knowledge. The purpose of nursing informatics is to analyze information requirements; design, implement and evaluate information systems and data structures that support nursing; and identify and apply computer technologies for nursing". In 1994, ANA modified their definition in an effort to legitimize the specialty, included patients as the ultimate recipients of the application of nursing informatics. In 2021, ANA proposed and created the new definition of nursing informatics. Read Update on New Nursing Informatics: Scope and Standards of Practice.

The core concepts underpinning the science and practice of nursing informatics are data, information, knowledge, and wisdom, also known as the DIKW paradigm (Ronquillo, Currie, & Rodney, 2016). Blum defined data as "discrete entities that are described objectively without interpretation", information as "data that are interpreted, organized, or structured, and knowledge as "information that has been synthesized so that interrelationships are identified and formalized" (Blum, 1986). The conceptualization of DIK and the addition of wisdom became central in the attempts to better articulate and make nursing work visible, particularly in relation to the digitization of health systems. The DIKW paradigm is not exclusive to nursing and is used in other fields which work with data and information.

To understand the relationship between the concepts of the DIKW model, various levels of computer systems, please read this article: Informatics: Evolution of the Nelson Data, Information, Knowledge and Wisdom Model: Part 2.

II.   **Theories and concepts applied in Nursing Informatics**
Theories include concepts and relationships that develop the foundation of nursing informatics. Theories in nursing informatics include systems theory, cognitive theory, and change theory.

General System theory
The development of Systems Theory stemmed from discussions on the limitation of closed systems and linear cause-and-effect. The concept of the General Systems Theory is that systems cannot be reduced to a series of parts functioning in isolation, but, to be able to understand the whole, one must understand the interrelations between these parts. Application of this theory asserts that when errors occur, focus

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must be on the surrounding that allowed such events to transpire, instead of individual failings. It asserts that outcomes can be influenced by smart interventions developed after studying common patterns and behaviors across time.

Principles of this theory is relevant to healthcare professionals, explaining the importance of thinking about how each intricate organ system affects, and is affected by, its environment. According to systems theory, patient safety and quality of healthcare is an emergent property of the entire healthcare system and it follows that the improvement of health care outcomes needs to be based in a systematic appreciation of the whole system that contributes to those outcomes.

Communication Theory

Communication paradigms encompass information exchange and the process for causing change. The Shannon and Weaver Model of Communication (Al-Fedaghi, 2012) argues that human communication has six main components: sender, encoder, channel, noise, decoder, and receiver, then followed by Weiner's 7th component, feedback, transforming the model from a linear to a cyclical process. Communication is important as it directly impacts all facets of life including human and technology interactions and control.

Poor communication among healthcare professionals is a pressing problem, contributing to widespread barriers to patient safety. For example, poor communication between nurses and physicians can lead to adverse events for hospitalized patients and a major root cause of sentinel events. Through interaction, groups of individuals develop a social reality which is an ongoing, dynamic process with individual acting on their interpretation of the perceived social reality. In a social constructionist point of view, the environment or social context is incorporated into knowledge building and that the group's attention is on knowledge which is jointly created (Manojlovich, Squires, Davies, & Graham, 2015). Communication is not a one way process. It provides a method to analyze key events and processes to develop understanding essential in decision-making processes as what is practiced in the clinical setting.

Change theories

Change theories comprise of the study of change in individuals and organizations. Lewin's change theory is a planned change guide that consists of three stages, namely that unfreezing, moving or change, and refreezing. Unfreezing encompasses the desire for a change to occur. During this stage, the actors find a method of letting go of an old pattern or habit that proves to be counterproductive. An example is moving from a paper-based documentation system to an electronic system. The second stage involves implementing a process of change in thoughts, feelings, or behavior, and convincing the group involved that the new way is better as compared to the previous one. New processes are established to be able to achieve desired outcomes. The third and final stage is about establishing and reinforcing the changed behavior or process. This stage allows for the change to be status quo in the desire to achieve set outcomes. The goal of the change agent is to support the driving forces and outweigh any impact of restraining forces. Despite reported advantages of information systems and technology in improving healthcare delivery, shifting for conventional ways to the use of technology in nursing practice may pose as a challenge considering several factors that interplay for the change to occur.

The Diffusion of Innovation Theory is often regarded as a valuable change model for guiding technological innovations where the innovation itself is modified and presented in ways that meet the needs across all levels of adopters. It also involves the concepts of communication and peer networking within the adoption process. The diffu-

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sion of innovation refers to the process that occurs as people adopt a new idea, product, practice, philosophy, etc. There are five categories of adopters in the context of technological innovation adoption and their influence on the innovative and adoption processes. In most cases, a few allow for the new idea to happen and adopt its use. These are known as innovators. The require the shortest adoption period out of the five categories. This category comprise of those who understand and apply complex knowledge and are motivated to become a change agent. The second category, the early adopters, are working toward revolutionizing competitive ideas in the industry. They are easily attracted to high-reward projects and the change to be implemented is viewed as something that is rewarding, thus after a few inquiries, they adopt easily. The early majority, the third category, interact with peers and welcome change if they see it as a cause to gain productivity and enhancements. Though open to change, individuals that belong in this category avoid complexities and lean towards processes that are already a proven solution. Those belonging to the late majority (fourth category) generally are skeptical about the introduction of change and are sensitive to costs and logistical issues. Motivation stems from peer pressure and to keep up with competitors. The fifth category, the laggards, are often isolated from others' opinions and are set in their ways. They prefer status quo and is suspicious of innovations. They believe that technology is a hindrance to operations.

III. **Disciplines and factors related to nursing informatics**
1. Nursing science pertains to the development of scientific bases (development of theories) for the improvement of clinical practice. It integrates the basic sciences to explore innovative ways to deliver healthcare services.

2. Computer science facilitates the acquisition and manipulation of data and information by nurses, who can then synthesize into a knowledge and wisdom base. This process allows for professional development and the ability to apply evidence-based practice decisions within nursing care.

3. Cognitive science studies the mind, intelligence, and behavior from an information-processing perspective. The interdisciplinary base arises from several disciplines (hard and soft sciences) and covers intellectual faculties and cognitive processes. Cognitive science is the study of the mind and how information is processed in the mind.

4. Information science is concerned with the application and usage of information and knowledge in organizations and the interface of interaction between people, organizations, and information systems. Information science is primarily concerned with the input, processing, output, and feedback of data and information through technology integration with a focus on comprehending the perspective of the stakeholders.

IV. **Roles and competencies of nurses in health and nursing informatics**
The four levels of nursing practice, namely the beginning nurse, experienced nurse, informatics specialist, and informatics innovator (McGonigle & Mastrian, 2017).

1. The beginning nurse has basic computer technology skills and information management skills. They use the institution's information systems and the contained information to manage patients.

2. The experienced nurse is highly skilled in using computer technology skills and information management skills to support his or her specialty area of practice.

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Current systems are utilized and collaborates with informatics nurse specialist regarding concerns or suggestions provided by staff.

3. The informatics nurse specialist completed an advanced education and possesses additional knowledge and skills specific to computer technology and information management. They apply the core informatics sciences, namely information, computer, and nursing science. Uses critical thinking, process skills, data management skills, systems life cycle development, and computer skills. Nursing information needs such as education, administration, research and clinical practice are highlighted in their work.

4. The informatics innovator conducts informatics research and generates informatics theory. They are creative in developing solutions and leads the advancement of informatics practice and research. They possess sophisticated level of skills and understanding in computer technology and information management.

Nursing informatics competencies encompass all skills, not only computer-related skills, as well as knowledge and attitudes needed by nurses. Components of competencies in nursing informatics are the following: (Darvish, Bahramnezhad, Keyhanian, & Navidhamidi, 2014; Staggers, Gassert, & Curran, 2001)

1. Computer skills contain computerized searches and retrieve patient demographics data, the use of telecommunication devices, the documentation of patient care, and the use of information technologies for improving nursing care.

2. Informatics knowledge include recognizing the importance of nursing data for improving practice. The role of human functions are also recognized in a point of view that computers could not facilitate nursing care without it. Covers the ethical decisions in computing, recognizing the role of clinicians' involvement in developing systems in health care, and identifying limitation of computerized patient monitoring systems.

3. Information skills includes the interpretation of information flow within the organization, the planning of clinical systems, and development of standards and database structures to facilitate all aspects of nursing. Development of innovative and analytic techniques for scientific inquiry in nursing informatics and data organizing methods to examine the impact of computer technology on nursing is included. Information literacy skills, competencies, and knowledge are investigated among educators, administrators and clinicians of nursing groups.

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Learning activities:

1. Discussion forum: Post at least one answer on all the discussion forum. Reply to at least one post of your classmate on each of the forum.

> DF1: Cite an example of applications of nursing informatics in nursing education, nursing practice, and nursing research.

> DF2: Provide an example of the application of nursing informatics in either education, practice, or research and explain how the data transforms using the DIKW model.

> DF3: Identify roles that nurse informaticists assume in nursing education, practice, and research.

> DF4: Identify a priority healthcare need of your community or a specific group (pregnant, individuals suffering from mental disorders, etc.). What are factors that influence the application of nursing informatics in delivery of healthcare services in your identified target group?

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