Health Informatics Basics

Foundational Curriculum:

Cluster 4: Informatics

Module 7: The Informatics Process and Principles of Health Informatics

Unit 1: Health Informatics Basics

FC-C4M7U1

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Unit Objectives

- Define health informatics
- Describe the two sub-disciplines of health informatics
- Identify nine different types of related informatics disciplines used in healthcare and state the various definitions of informatics within the health sector
- Identify key informatics concepts, models and theories
- Describe the importance of informatics in active and healthy ageing

Health Informatics

- **Informatics** is the union of information, people and science/process/technology

- **Health informatics** is the interdisciplinary study of the design, development, adoption, and application of information and technology-based innovations in public health and healthcare services delivery, management, and planning

- Health informatics is often used to describe the full range of application and research topics for which biomedical informatics is the pertinent underlying scientific discipline
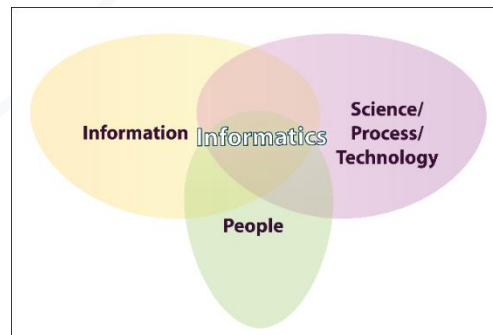
Health Informatics Subsets

- **Health Informatics** is the overarching theme for all informatics used in healthcare. The two main sub-disciplines are:
  - **Clinical Informatics**
  - **Population Health Informatics**

Other subsets of **Health Informatics** include:
  - *Medical informatics (MI)*
  - **Public Health informatics**
  - **Consumer health informatics**
  - **Nursing informatics (NI)**
  - **Dental Informatics**
  - **Nutrition Informatics**
  - **Pharmacy Informatics**
  - **Biomedical informatics**
  - **Translational bioinformatics**
  - **Computational health informatics (CHI)**
  - **Clinical research informatics (CRI)**
  - **Informatics in Active and Healthy Ageing**

All informatics definitions in this unit have been developed and validated in conjunction with the HIMSS TIGER Committee and its Informatics Definitions Document

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Clinical Informatics

- ***Clinical informatics*** is a subset of health informatics used by clinicians in the application deliver healthcare services

- It blends information technology into clinical care processes, usually within a health system

- It is also referred to as applied clinical informatics and operational informatics
    - Clinical informatics includes a wide range of topics ranging from clinical decision support to visual images (e.g., radiological, pathological, dermatological, ophthalmological, etc.); from clinical documentation to provider order entry systems; and from system design to system implementation and adoption issues

HEALTH SYSTEM

CLINICAL INFORMATICS

CLINICAL CARE

INFORMATION TECHNOLOGY

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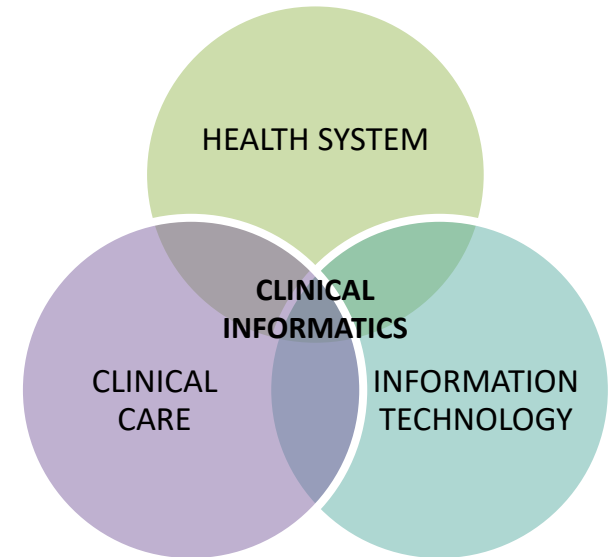
Public, Consumer and Population Health Informatics
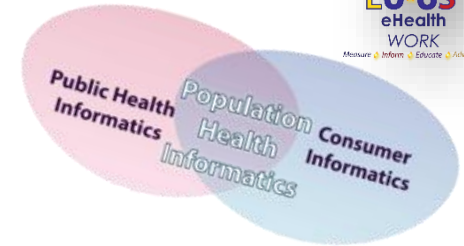
- **Public Health informatics** is the field that optimizes the use of information to improve individual health, health care, public health practice, biomedical and health services research, and health policy.
  - PHI operates at the intersection of public health and computer science. It relies on information technology (IT) systems to help address the core functions of public health as defined by the Institute of Medicine: assessment of population health, policy development, and assurance of the availability of high-quality public health services. It is thus related to but distinct from biomedical and clinical informatics, which seek to improve the health of individuals within the health care system.

- **Consumer health informatics** analyses consumers' needs for information; studies and implements methods of making information accessible to consumers; and models and integrates consumers' preferences into medical information systems.
  - Consumer informatics stands at the crossroads of other disciplines, such as nursing informatics, public health, health promotion, health education, library science, and communication science…it is paving the way for health care in the information age. It helps bridge the gap between patients and health resources. It looks at informatics from multiple consumer or patient views.

Public, Consumer and Population Health Informatics
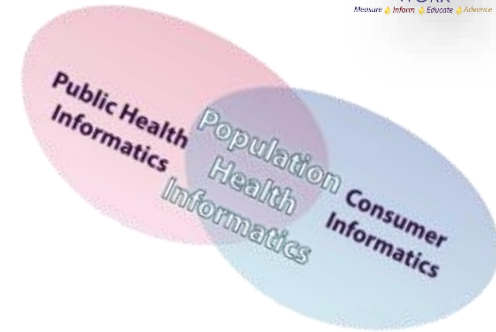
- Population health is defined as **the health outcomes of a group of individuals, including the distribution of such outcomes within the group.** Therefore, *Population Health Informatics* is the intersection of public health informatics and consumer informatics. It is the systematic study of populations via secondary analysis of massive data collections (called "**big data**") about people.

- Population informatics applies data science to social genome data to answer fundamental questions about human society and population
  - It is an emerging research area at the intersection of SBEH (Social, Behavioral, Economic and Health) sciences, computer science, and statistics
  - It involves using quantitative methods and computational tools to answer fundamental questions about populations
  - These groups are often geographic populations such as nations or communities, but can also be other groups such as employees, ethnic groups, disabled persons, prisoners, or any other defined group. The health outcomes of such groups are of relevance to policy makers in both the public and private sectors.

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Public, Consumer and Population Health Informatics
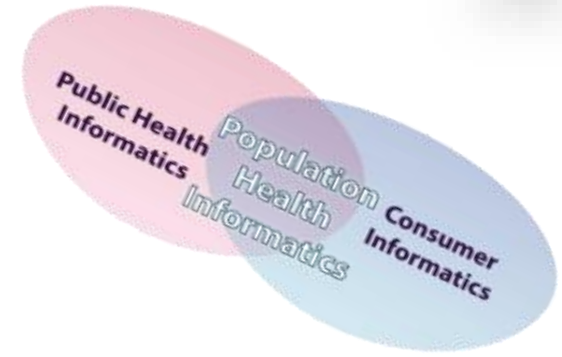
- Note that population health is not just the overall health of a population but also includes the distribution of health.

- Overall health could be quite high if the majority of the population is relatively healthy—even though a minority of the population is much less healthy.

- Ideally such differences would be eliminated or at least substantially reduced.

Medical Informatics

In addition to clinical informatics and public health informatics, the following disciplines of informatics are related to healthcare:

- **Medical informatics (MI)** is the interdisciplinary study of the design, development, adoption and application of IT-based innovations in healthcare services delivery, management and planning
  - It can also be described as the field of information science concerned with the analysis, use and dissemination of medical data and information through the application of computers to various aspects of health care and medicine.
  - Medical informatics is also frequently used to describe the informatics field in which physicians specialize

Nursing Informatics

- **Nursing informatics (NI)** is the specialty that integrates nursing science with multiple information management and analytical sciences to identify, define, manage, and communicate data, information, knowledge, and wisdom in nursing practice

  – NI supports nurses, consumers, patients, the interprofessional healthcare team, and other stakeholders in their decision-making in all roles and settings to achieve desired outcomes. This support is accomplished through the use of information structures, information processes, and information technology

Dental, Nutrition and Pharmacy Informatics

- **Dental informatics** is the application of computer and information science to improve dental practice, research, education and management. The field of dental informatics is concerned with the intersection of health informatics and dentistry as a whole

- **Nutrition informatics** is the effective retrieval, organization, storage and optimum use of information, data and knowledge for food and nutrition-related problem solving and decision-making

- **Pharmacy informatics** the scientific field that focuses on medication-related data and knowledge within the continuum of healthcare systems - including its acquisition, storage, analysis, use and dissemination - in the delivery of optimal medication-related patient care and health outcomes

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Biomedical and Translational Informatics

- **Biomedicine** is medicine based on the application of the principles of the natural sciences, especially biology and biochemistry

- **Biomedical informatics** is the interdisciplinary field that studies and pursues the effective uses of biomedical (relating to biomedicine) data, information, and knowledge for scientific inquiry, problem solving, and decision-making, driven by efforts to improve human health[1]

  - Bioinformatics:

    - is used to develop tools and methods (usually software) for understanding biological data

    - is related to research in molecular biology

    - can include fields from signal processing to biology, combining statistical and mathematical techniques to compute results

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Biomedical and Translational Informatics

- **Translational Bioinformatics** is the development of storage, analytic, and interpretive methods to optimize the transformation of increasingly voluminous biomedical data, and genomic data, into proactive, predictive, preventive, and participatory health.

- Translational bioinformatics includes research on the development of novel techniques for the integration of biological and clinical data and the evolution of clinical informatics methodology to encompass biological observations.

- The end product of translational bioinformatics is newly found knowledge from these integrative efforts that can be disseminated to a variety of stakeholders, including biomedical scientists, clinicians, and patients.

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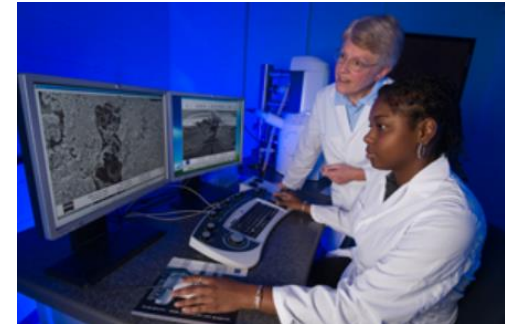
Computational Health Informatics

- **Computational health informatics (CHI)** specifically integrates computer science techniques that are relevant in healthcare. Healthcare provides an extremely wide variety of problems that can be tackled using computational techniques. Informaticists in this area study the underlying principles of computer science that allow for medically related algorithms and systems to be developed. This subspecialty of health informatics frequently analyse "big data". It involves health and computer scientists working in unison to develop the next generation of healthcare technologies through computational informatics
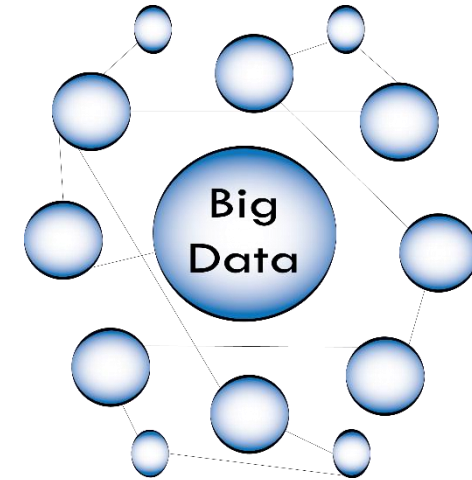
Clinical Research Informatics

- **Clinical research informatics (CRI)** is an amalgamation of clinical and research informatics, plays an important role in clinical research, patient care, and the building of healthcare system. It is one of the rapidly growing subdivisions of biomedical informatics. It plays an important role in developing new informatics theories, tools and solutions. Clinical research informatics applies the core foundations, principles, and technologies of health informatics to clinical research
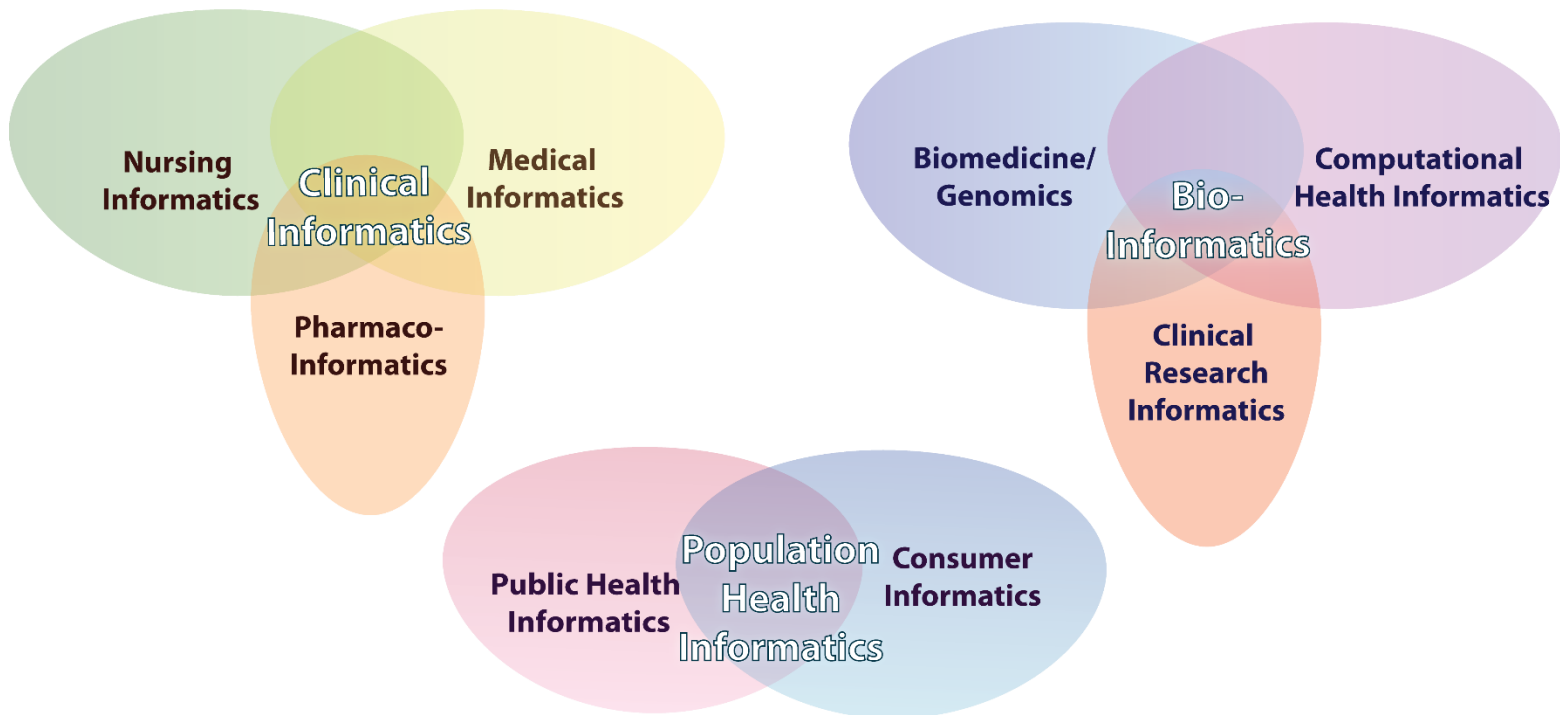
Health Informatics Visualized

Health Informatics

Nursing Informatics — Clinical Informatics — Medical Informatics — Pharmaco-Informatics

Biomedicine/Genomics — Bio-Informatics — Computational Health Informatics — Clinical Research Informatics

Public Health Informatics — Population Health Informatics — Consumer Informatics

Informatics Concepts

- **Information Architecture (IA)** is the structural design of shared information environments. It is a crucial component in the development of healthcare technology systems, applications and interfaces.

  - Informaticists play a part in helping to structure the underlying information and its presentation in a logical and intuitive way so that people can put information to use. They build frameworks to effectively collect, store and deliver information, and drive the navigation, content layout, personalization, and transactional features of the systems and technology.

Information Architecture

health data — end users

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Informatics Concepts (cont'd)

- **Human–Computer Interaction** (commonly referred to as HCI) researches the design and use of computer technology, focused on the interfaces between people (users) and computers.

  – Health informaticists use HCI to both observe the ways in which humans interact with computers and technology in the healthcare setting, and design technologies that let humans interact more effectively for healthcare in novel ways
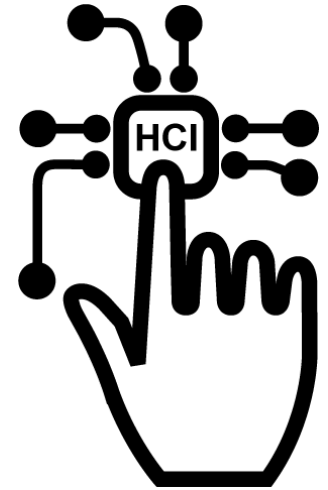
Informatics Concepts (cont'd)

- **Information Assurance and Cybersecurity** is the practice of creating and managing safe and secure systems. It is crucial for healthcare organizations public and private, large and small.

  – Informaticists use this component to build, integrate and maintain individual and organizational privacy and security in the creation, deployment, use, and management of health information, systems and technology

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Key Models in Health Informatics

- There are several key models in health informatics that approach how to effectively integrate technology systems and people

- These include:

  - **Technology Acceptance Model**

  - **Disruptive Innovation**

  - **Diffusion of Innovation**

  - **Sociotechnical Theory Model**

- **Technology Acceptance Model (TAM)** is an information systems' theory that models how users come to accept and use a new technology when presented. Because new technologies are constantly introduced to healthcare, the rate of user acceptance depends heavily on perceived purpose and accessibility of the technology
  - Developed by Fred Davis & Richard Bagozzi

- **Disruptive Innovation** is an information systems' theory that realizes how a groundbreaking innovation can disrupt the current standard and eventually become the new industrial norm. Healthcare technologies can be introduced that become so popular as to change the current model.
  - Developed by Clayton M. Christensen

Disruptive Innovation

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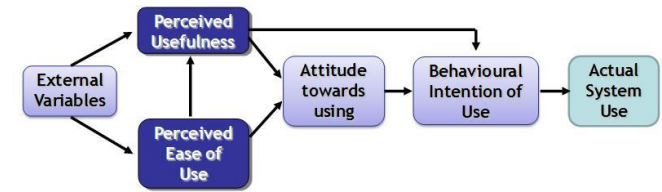
Key Models in Health Informatics (cont'd)

- **Diffusion of Innovation** is an information systems' model that seeks to explain a decision process of innovation adoption with five stages: awareness, interest, evaluation, trial & adoption. Communication influences the go or no-go decisions at different stages of the process, or whether or not the innovation can move on to the next step
  – Developed by Bryee Ruan & Neal C. Gross

Go   No-Go

- **Sociotechnical Theory Model** is an information systems' model that recognizes the interaction between social and technical sub-systems. These two factors are then compared and used together to form the design of a technology
  – Developed by Tavistock Institute, London
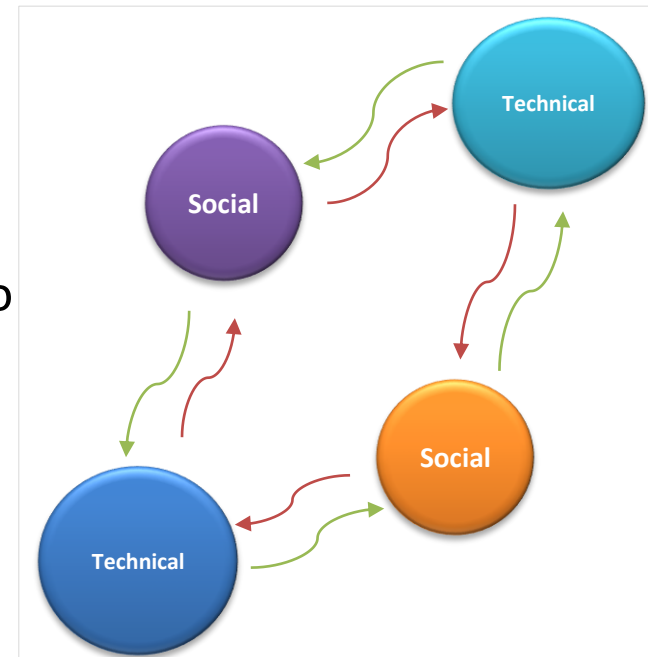
Informatics in Active and Healthy Ageing

- **Healthy ageing** (HA) refers to active engagement with life, optimal cognitive and physical functioning and low risk of disease that enables older people to participate within their limitations and continue to be physically, cognitively, socially and spiritually active

- As the use of information and communication technologies increases among older adults, eHealth potentially represents an effective means to promote HA

- Informatics can also be used in ambient intelligent environments (AmIE) to contribute to active and healthy ageing

- An **ambient intelligence environment** refers to an electronic environment that is sensitive and responsive to the presence of people. It is often described in the form of scenarios.

- Technology and aging as an area of research has expanded during the 2000s, engaging researchers from different scientific fields that can only be adequately tackled by a cross-disciplinary research approach

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Informatics in Active and Healthy Ageing (cont'd)

- Health technologies have the potential to support the growing number of older adults who are aging in place. Tools include visualizations (data visualisations and visualisations of physical representations).

  - **Data visualisation** involves the creation and study of the visual representation of data, such as statistical graphics, plots, information graphics and other tools

  - **Visualisation of physical representations, or data physicalisation,** refers to encoding data in physical artefacts, allowing for new ways to represent and communicate data and, as a process, can make the principles of data representation more "graspable"

- However, the role of visualisations in supporting aging in place remains largely unexplored

- Informatics tools are being used to support healthy aging, by synthesizing and identifying gaps in the literature evaluating visualisations

Unit Review Checklist

- ❑ Defined health informatics (CCL01)
- ❑ Described the two sub-disciplines of health informatics
- ❑ Identified nine different types of related informatics disciplines used in healthcare and stated the various definitions of informatics within the health sector (FFB04)
- ❑ Identified key informatics concepts, models and theories (FFB03)
- ❑ Described the importance of informatics in active and healthy ageing

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Unit 20 Review Exercise/Activity

Match the informatics term on the left with its definition on the right

1. biomedical informatics
2. clinical informatics
3. nursing informatics
4. population health informatics
5. dental informatics
6. public health informatics
7. medical informatics
8. translational bioinformatics
9. clinical research informatics
10. computational health informatics

a. the intersection of health informatics and dentistry as a whole
b. blends information technology into clinical care processes, usually within a health system
c. the evolution of clinical informatics methodology to encompass biological observations
d. the intersection of public health informatics and consumer informatics
e. the interdisciplinary field that studies the effective uses of biomedical data and knowledge for scientific inquiry
f. applies the core foundations, principles, and technologies of health informatics to clinical research
g. the systematic application of knowledge about systems that capture, manage, analyze and use information to improve population health
h. integrates nursing science with information management and analytical sciences to enhance data and knowledge
i. study of the underlying principles of computer science that allow for medically related algorithms and systems to be developed
j. the interdisciplinary study of the design, development, adoption and application of IT-based innovations in healthcare services

Unit 20 Exam

1. Informatics is the intersection of which of the following?
   a. Science and process improvement
   b. Technology and change management
   c. Processes, information and people
   d. Tools, research and technology
2. Health informatics comprises which two main sub-disciplines?
   a. clinical informatics and biomedical informatics
   b. clinical informatics and population health informatics
   c. medical informatics and nursing informatics
   d. biomedical informatics and population health informatics

3. "The scientific field that focuses on medication-related data and knowledge within the continuum of healthcare systems " best describes which of the following:

   a. pharmacy informatics
   b. dental informatics
   c. medical informatics
   d. clinical research informatics

4. What can be used to observe the ways in which humans interact with computers and technology in the healthcare setting?

   a. Information Architecture
   b. Graphical User Interfaces
   c. Population health informatics
   d. Human-Computer Interaction

5. "New technologies are constantly introduced to healthcare, but it may be difficult for the users to understand everything" describes which of the following key health informatics models:

    a. Diffusion of Innovation

    b. Technology Acceptance

    c. Disruptive Innovation

    d. Sociotechnical Theory