



Introduction To Medical Informatics

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What is Informatics?

The science concerned with gathering, manipulating, storing, retrieving and classifying recorded information.



What is Medical Informatics?

- "the field that concerns itself with the cognitive, information **processing**, and communication tasks of medical practice, education, and research, including the **information science** and the **technology** to support these tasks." *Greenes & Shortliffe 1990*
- "*Medical informatics is a rapidly developing **scientific** field that deals with the storage, retrieval, and optimal use of biomedical **information, data,** and **knowledge** for **problem solving** and decision making.*" *Blois, M.S., and E.H. Shortliffe. in Medical Informatics: Computer Applications in Health Care, 1990, p. 20.*

HISTORY

- ❑ *Medical informatics began in the 1950s with the growth of devices, and computer applications in medicine.*
- ❑ *Early names of medical informatics included **medical computing**, medical computer science, computer medicine, **medical electronic data processing**, medical automatic data processing, **medical information processing**, medical information science, medical software engineering and medical computer technology.*

HISTORY

- ❑ *The earliest use of computation for medicine was in dental projects in the 1950's at the National Bureau of Standards by Robert Ledley.*
- ❑ *The next step in the mid 1950s was the development of expert systems such as MYCIN and INTEREST-I.*

HISTORY

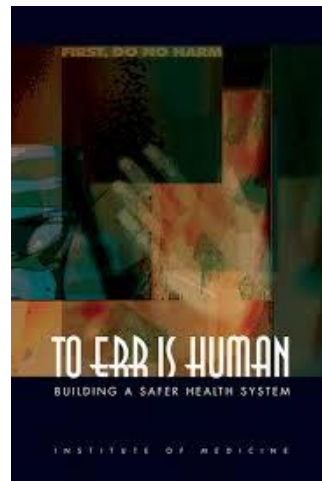
- ❑ *In France in 1968 university departments established with the title “informatique de medecine “*
- ❑ *In 1968 homer Warner, founded the department of medical informatics at the university of Utar.*
- ❑ *In 1970 the international medical informatics association was founded. In the same year the MUMPS language and operating system was developed and used for clinical applications.*

HISTORY

- ❑ *In the United States in 1996, HIPAA regulations concerning privacy and medical record transmission created the impetus for large numbers of physicians to move towards using EMR software, primarily for the purpose of secure medical billing.*

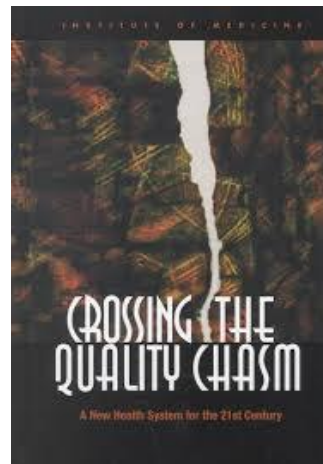
HISTORY

- ❑ **Nov 1999, *TO ERR IS HUMAN: BUILDING A SAFER HEALTH SYSTEM*, by the institute of Medicine**



HISTORY

- ❑ **March 2001, *CROSSING THE QUALITY CHASM: A NEW HEALTH SYSTEM FOR THE 21ST CENTURY***



ORIGIN OF TERM: "MEDICAL INFORMATICS"

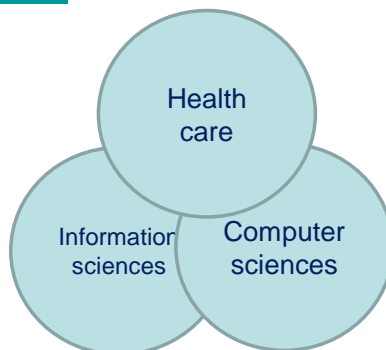
Russian = informatika 1968 by AI Mikhailov, "Oznoy Informatika" ("Foundation of Informatics")
structure and properties of scientific information

French = informatique de medecine 1968
university departments established with this title

English = first appeared in 1970s
Columbia University changed its name from Medical Information Science to medical informatics

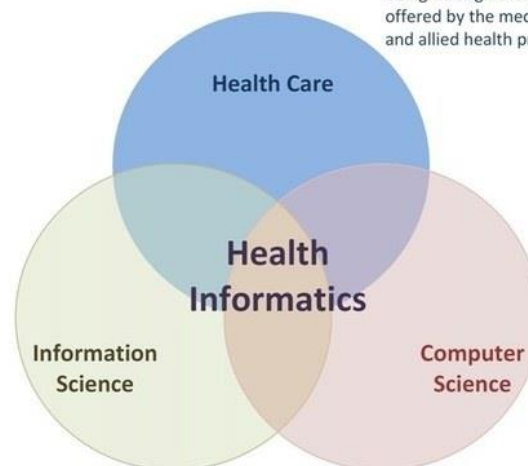


- Health Informatics *is the intersection of information science, Information Technology, and health care.*





The prevention, treatment and management of illness and the promotion of health and well-being through the services offered by the medical, nursing and allied health professions



The collection, classification, manipulation, storage, retrieval and dissemination of information;
The application and use of knowledge;
The interaction between people, organisations and information systems.

The theoretical foundations of information and computation together with their implementation and application in computer systems



- *It deals with resources, devices, & methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.*
- *Health informatics tools include clinical guidelines, formal medical terminologies, information & communication systems. It is applied to the areas of nursing, clinical care, dentistry, pharmacy, public health and (bio)medical research.*



- ***"Medical informatics attempts to provide the theoretical and scientific basis for the application of computer and automated information systems to biomedicine and health affairs . . . medical informatics studies biomedical information, data, and knowledge - their storage, retrieval, and optimal use for problem-solving and decision-making."***

Lindberg, D.A.B. NLM Long Range Plan. Report of the Board of Regents, 1987, p. 31.



- ***"Medical informatics is a developing body of knowledge and a set of techniques concerning the organizational management of information in support of medical research, education, and patient care...."***
- ***Medical informatics combines medical science with several technologies and disciplines in the information and computer sciences and provides methodologies by which these can contribute to better use of the medical knowledge base and ultimately to better medical care."* definition by **Asso. of American Medical Colleges****

(Association of American Medical Colleges(AAMC)) 1986.



- ***"Medical informatics comprises the theoretical and practical aspects of information processing and communication, based on knowledge and experience derived from processes in medical and Healthcare."***

Van Bommel, J.H. "The structure of medical informatics" *Medical Informatics*, 9(1984), p. 175.



- ***"Medical informatics is the application of computer technology to all fields of medicine - medical care, medical teaching, and medical research."***

Preliminary announcement for the Third World Conference on Medical Informatics, MEDINFO 80, 1977.



- ***"Medical informatics is a rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem solving and decision making."***

Blois, M.S., and E.H. Shortliffe. in *Medical Informatics: Computer Applications in Health Care*, 1990, p. 20.



- ***"Medical informatics is the application of computers, communications and information technology and systems to all fields of medicine - medical care, medical education and medical research."*** definition by MF Collen (MEDINFO '80, Tokyo, later extended).



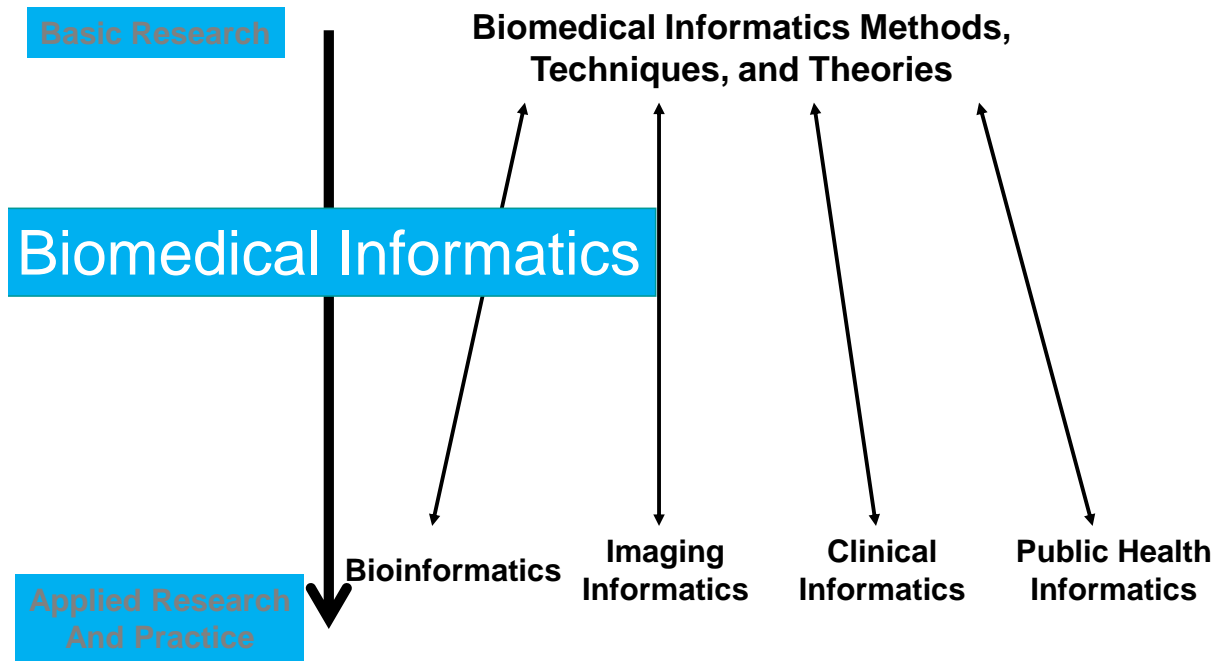
Biomedical Informatics

•Biomedical Informatics: (BMI) is the interdisciplinary field that studies and pursues the effective uses of biomedical data , information, and knowledge for scientific inquiry, problem solving , and decision making, driven by efforts to improve human health . E.H. Shortliffe and Marsden S. Blois 2014

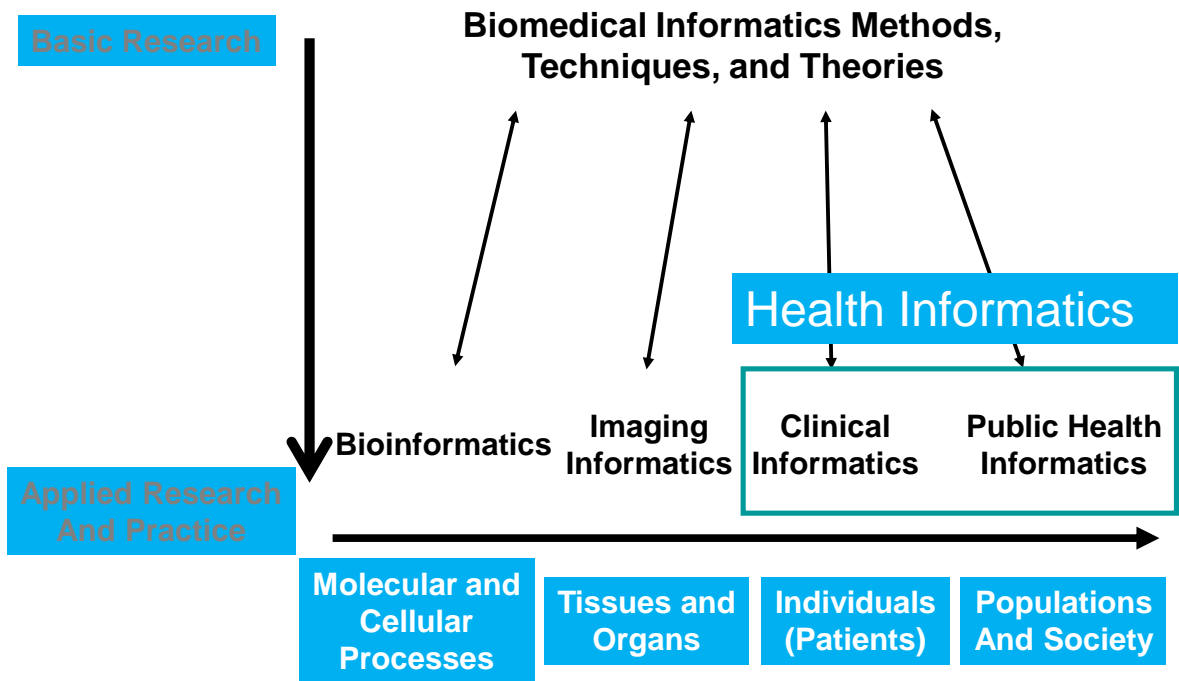


***Scope and breadth of the discipline:
BMI investigates and supports reasoning,
modeling, simulation, experimentation, and
translation across the spectrum from
molecules to individuals and to populations,
from biological to social systems, bridging
basic and clinical research and practice and
the health care enterprise.***

Biomedical Informatics in Perspective



Biomedical Informatics in Perspective





- ***Theory and methodology :***
- ***BMI develops, studies, and applies theories, methods, and processes for the generation, storage, retrieval, use, management, and sharing of biomedical data, information, and knowledge.***
- ***Technological approach : BMI builds on and contributes to computer, telecommunication, and information sciences and technologies, emphasizing their application in biomedicine.***



- ***"BMI is 'the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision making, motivated by efforts to improve human health.'***
- ***Application areas range from bioinformatics to clinical and public health informatics and span the spectrum from the molecular to population levels of health and biomedicine. ."***

AMIA amiajnl-2012-001053 1..8



- ***"Medical Informatics is the interdisciplinary study of the design, development, adoption and application of IT-based innovations in healthcare services delivery, management and planning."***

<https://www.himss.org/clinical-informatics/medical-informatics>

HIMSS

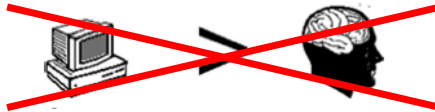
accessed Feb 2019

Background: Charles Friedman

- The Fundamental Theorem of Biomedical Informatics:
 - A person working with an information resource is better than that same person unassisted.



– **NOT!!**



Charles P. Friedman: <http://www.jamia.org/cgi/reprint/16/2/169.pdf>

TELEMEDICINE



is composed of the Greek word $\tau\epsilon\lambda\epsilon$ (tele) meaning 'far', and medicine. It is therefore the delivery of medicine at a distance. A more extensive definition is that it is the use of telecommunication and information technologies for the provision of clinical care to individuals located at a distance and to the transmission of information to provide that care.

TELEHEALTH



The delivery of health related services, enabled by the innovative use of technology, such as videoconferencing, without the need for travel.

EHEALTH



*Also written **e-health**, is a relatively recent term for healthcare practice which is supported by electronic processes and communication, some would argue the term is interchangeable with Health Informatics.*

TELE-HEALTH OR E-HEALTH

E-health is much more than tele-health as tele is a limiting factor to the form of technology in health. E-health could be at distance or local.

FROM TELEMEDICINE TO EHEALTH

- ❑ The practice of telemedicine will become more prominent and will be part of the mainstream of Healthcare;***
- ❑ It will become increasingly difficult to differentiate telemedicine from many other uses of technology in the delivery of healthcare;***

FROM TELEMEDICINE TO EHEALTH

- ❑ **E-health is all inclusive and captures the use of Internet technologies and the rise of the information economy. This includes:**
 - information technology;
 - telecommunication technology;
 - Data transmission protocols and techniques;

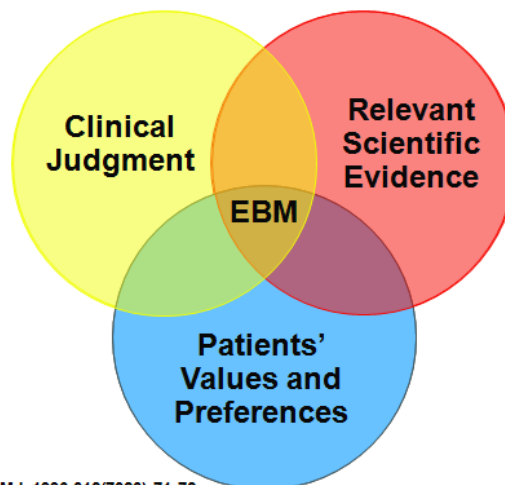
- ❑ **E-Health is all inclusive and captures all types of Healthcare and Healthcare professionals: it is not limited to medicine and not limited to doctors;**

EVIDENCE BASED MEDICINE

Entails a system that provides information on appropriate treatment under certain patient conditions. A healthcare professional can look up whether his/her diagnosis is in line with scientific research. The advantage is that the data can be kept up-to-date.

EVIDENCE BASED MEDICINE

*There are three main pillars for
EBM*



Sackett DL, et al. BMJ. 1996;312(7023):71-72.

EVIDENCE BASED MEDICINE

“is the process of systematically reviewing, appraising and using clinical research findings to aid the delivery of optimum clinical care to patients.”

Rosenberg W, Donald A. Evidence based medicine: an approach to clinical problem-solving. BMJ 1995; 310: 1122–1126.

EVIDENCE BASED MEDICINE

'the integration of best research evidence with clinical expertise and patient values' which when applied by practitioners will ultimately lead to improved patient outcome.

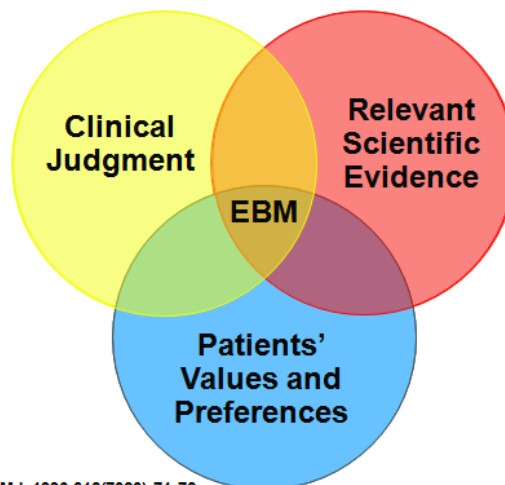
there are three main pillars or components of evidence based practice.

EVIDENCE BASED MEDICINE

- *best evidence: clinical research that has been conducted using rigorous methodology*
- *clinical expertise refers to the clinician's cumulated education, experience and clinical skills*
- *patients preferences, values and concerns which patient brings to a clinical encounter.*

EVIDENCE BASED MEDICINE

*There are three main pillars for
EBM*



Sackett DL, et al. BMJ. 1996;312(7023):71-72.

EVIDENCE BASED MEDICINE

It is clear that EBM depends on the structured knowledge databases that contains the most recent and valid clinical research output. It is the integration of best and latest evidence with clinical expertise and patient values component could improve the clinical practice outcome and patients' satisfactions.

BIOINFORMATICS



The collection, organization, and analysis of large amounts of biological data, using computers and databases. Historically, bioinformatics concerned itself with the analysis of the sequences of genes and their products (proteins), but the field has since expanded to the management, processing, analysis, and visualization of large quantities of data from genomics, proteomics, drug screening, and medicinal chemistry. Bioinformatics also includes the integration and “mining” of the ever-expanding databases of information from these disciplines.

ELECTRONIC MEDICAL RECORD (EMR)

A general term describing computer-based patient record systems. It is sometimes extended to include other functions like order entry for medications and tests, amongst other common functions.



DENTAL INFORMATICS

Is the name given to the application of information technology to dentistry. It is often considered a subset of Medical Informatics and Biomedical Informatics.

NURSING INFORMATICS

Nursing Informatics is a specialty of Health Informatics (like Medical Informatics, Consumer Health Informatics, and Telehealth) which deals with the support of nursing by information systems in delivery, documentation, administration and evaluation of patient care and prevention of diseases.

CONTINUING MEDICAL EDUCATION (CME)

- *The science of medicine advances at such a rapid rate that much of what is taught becomes outmoded, and it has become obligatory for physicians to be lifelong learners, both for their own satisfaction and, increasingly, as a formal government requirement to maintain licensure.*
- *Doctors who practice in rural areas or other more isolated locations may face considerable obstacles to obtain hours for CME.*

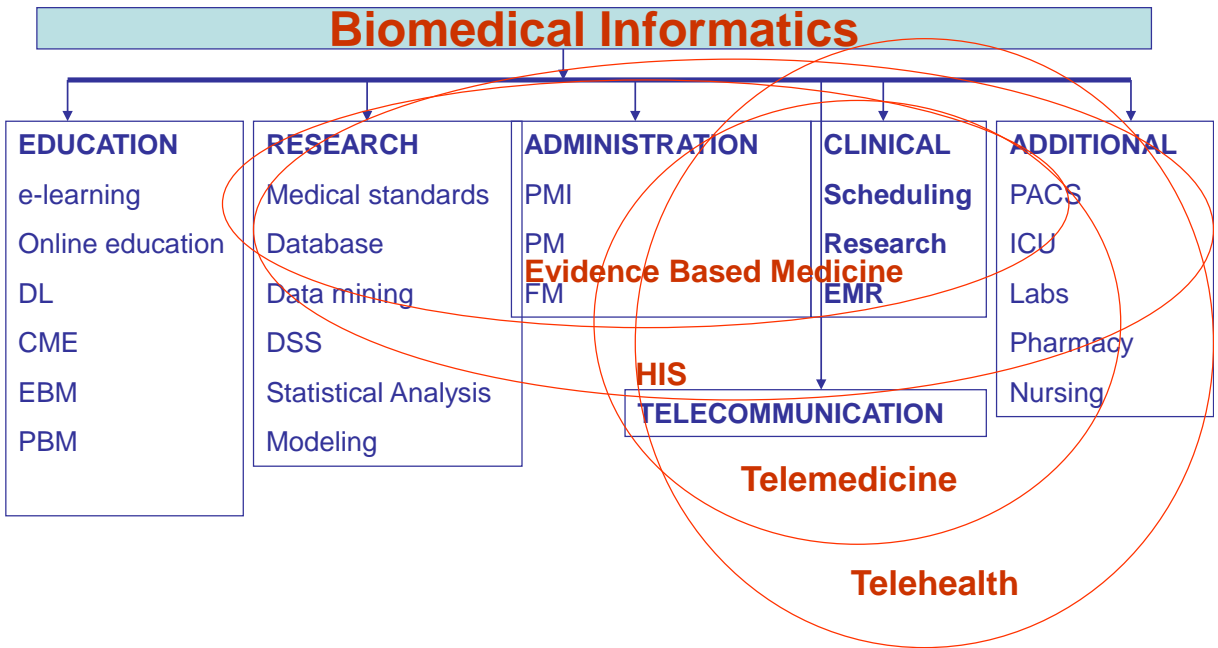
CONTINUING MEDICAL EDUCATION (CME)

- *The cost of web-based or online CME is much lower than the cost of traditional CME.*



DISTANCE LEARNING

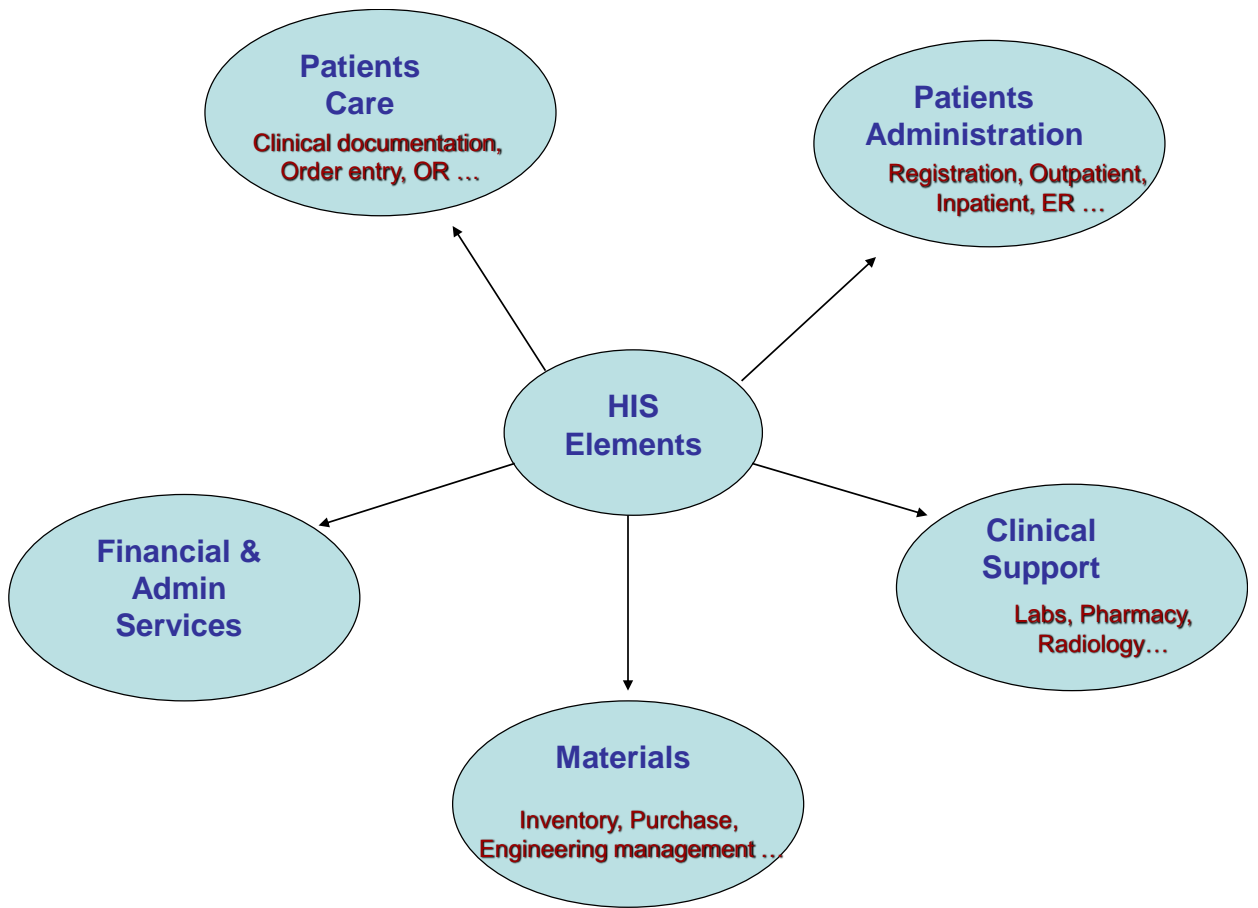
- *With aid of telecommunications technologies and internet, distance learning is now widely applied in many universities, eg Open University*
- *It is now possible to earn university degrees from home, at every level from bachelor's to doctorate.*



HOSPITAL INFORMATION SYSTEM

HIS: is a comprehensive information system dealing with all aspects of information processing in a hospital.

- ***This encompasses human information processing as well as data processing machines.***
- ***As an area of Medical Informatics the aim of HIS is to achieve the best possible support of patient care and administration by electronic data processing.***



E-HEALTH COMPONENTS

Four essential components make the e-health

- Medical knowledge (data, information, knowledge) that lends itself to being stored in computer files (digital format)
- People who are willing/able to share, apply and use this knowledge
- Data processing equipment to record, store and process this data
- Telecommunication facilities to transfer (exchange) this data electronically between remote locations.

Albarrak, A. I. E-health quality and key performance indicators. TTEM, 294

WHY MEDICAL INFORMATICS FOR HEALTHCARE?

- *Improve Healthcare quality*
- *Better data access*
- *Faster data retrieval and storage*
- *High quality data*
- *Support medical and non-medical decision-making*

WHY MEDICAL INFORMATICS FOR HEALTHCARE?

- *Enhance quality assurance*
- *Enhance out-come researches and studying programs*
- *Sharing medical data*
- *Reduce duplication of efforts*
- *Provide unified access to all existing data*

WHY MEDICAL INFORMATICS FOR HEALTHCARE?

- *Increase healthcare organization efficiency*
- *Reducing cost and achieves quality of healthcare*
- *Improve staff productivity*
- *Reduce redundant tests, services and information entry*
- *Manage billing and payment system*
- *Eliminate and reduce errors*

