INTRODUCTION TO MEDICAL INFORMATICS

Summary of the Book

Color index:
- **Important**
- 🌟 **Golden notes**
- Doctors notes

This work is heavily based on the work of 437, and adjusted in accordance to this years lecture notes

Editing File

Medical Informatics

Informatics

- 🌟 The science concerned with gathering, manipulating, storing, retrieving and classifying recorded **information** (How to deal with data)
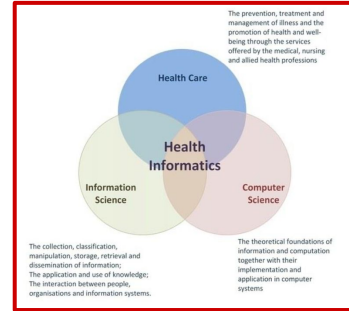
Medical informatics

- 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.

- "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 AMAC

- 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

- "Medical Informatics is the interdisciplinary study of the design, development, adoption and application of IT-based innovations in healthcare services delivery, management and planning." HIMSS Feb. 2019

- 🌟 Is a rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information,data (raw material, unprocessed), and knowledge for problem solving and decision making.

- 🌟 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.

Medical Informatics

Health informatics

⭐ **Health informatics:** is the intersection of *information science*, *computer science* and *health care*.

- resources, devices, & methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine

- **Should 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.

Biomedical Informatics

- Is the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry research, problem solving , and decision making, driven by efforts to improve human health.
E.H. Shortliffe and Marsden S. Blois 2014

- **Scope & breadth:** 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.

- **Theory & 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 emphasizing their applications in biomed

- **Applications areas:** Range from bioinformatics to clinical and public health informatics and span the spectrum from the molecular to population levels of health and biomedicine def. By AMIA

Biomedical informatics in perspective

Health informatics

1- Basic Research	– Applied Research and Practice. – Biomedical Informatics Methods, Techniques, and Theories.	2- Applied Research:	Bioinformatic	Imaging Informatics	Clinical Informatics	Public Health Informatics
		Example:	Molecular and Cellular Processes	Tissues and Organs	Individuals (Patients)	Populations And Society

An example of Modeling: an experiment they did with the breast mammography to compare the results with the physician, at the end the device's accuracy was 100% while the physicians 70% which means informatics is really useful.

Intro to Informatics

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.

- It includes the integration and "mining" of the ever-expanding databases of information from these disciplines

ORIGIN

Russian 🇷🇺	French 🇫🇷	English 🏴
informatika 1968 by AI Mikhailov, "Osnovy Informatika" (Foundation of Informatics) structure and properties of scientific information.	" informatique de medecine" 1968 university departments established with this title	first appeared in 1970s Columbia University changed its name from Medical Information Science to medical informatics. Columbia university is a pioneer in the education of informatics for medical graduates.

HISTORY
don't memorize the dates but it may come in the question in exams so it gives you a hint

1950	1970	1996
The earliest use of computation for medicine was in dental projects in the 1950's at the National Bureau of Standards by Robert Ledley. In the mid 1950s was the development of expert systems such as MYCIN (first medical informatics system) and INTERNEST-I.	The international medical informatics association was founded. In the same year the MUMPS language and operating system was developed and used for clinical applications.	In the United States in 1996, HIPAA (Health Insurance Portability and Accountability Act) regulations concerning privacy and medical record transmission created the impetus for large numbers of physicians to move towards using EMR (Electronic Medical Record) software, primarily for the purpose of secure medical billing.

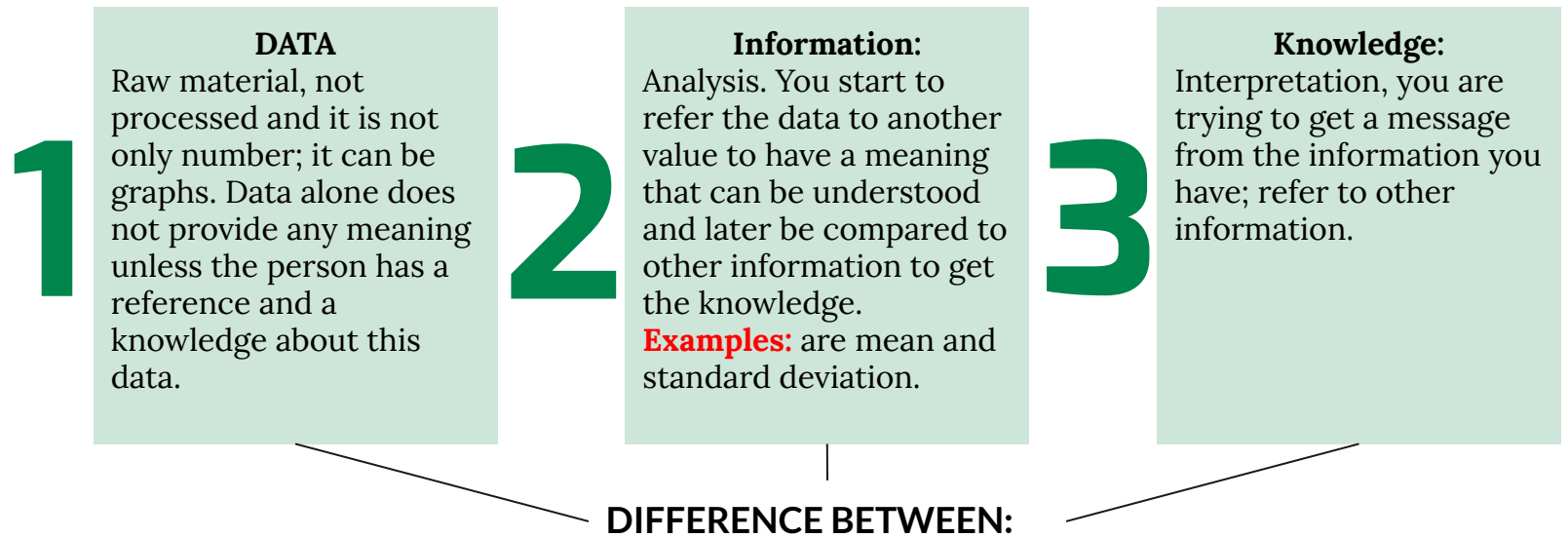| Nov. 1999	Mar. 2001
Nov 1999, TO ERR IS HUMAN: BUILDING A SAFER HEALTH SYSTEM, by the institute of Medicine - bssed or retrospective studies in new york & pittsburg, that alarmed the medical community about increased mortalities due to medical errors	March 2001, CROSSING THE QUALITY CHASM: A NEW HEALTH SYSTEM FOR THE 21ST CENTURY - analysis of previous report (to err is human) found that more than 50% of medical errors due to mishandling with patient information. - high recommendation to implement EMR for safety of patient not for automation

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.

NOTES

1

DATA
Raw material, not processed and it is not only number; it can be graphs. Data alone does not provide any meaning unless the person has a reference and a knowledge about this data.

2

Information:
Analysis. You start to refer the data to another value to have a meaning that can be understood and later be compared to other information to get the knowledge.
Examples: are mean and standard deviation.

3

Knowledge:
Interpretation, you are trying to get a message from the information you have; refer to other information.

DIFFERENCE BETWEEN:

In a **research**, data is what you collect, your target population. Information is the analysis. Knowledge is the discussion.

01 Medical informatics is found to be an important field in medical practice in improving the delivered healthcare and also for the enhancement of patient engagement with the healthcare organizations. **It is to support clinicians not to replace them with robots!** A human can't remember everything because they are influenced by many factors and having a supporting system with them is important to reduce errors.

02 Informatics main focus is **not technology** as implicated by many (very common misconception) but it primarily focuses on information. Technology is used to **process the information** which is the focus of this science.

03 Medical informatics is **not only** theoretical but also include practical part.

04 In clinics, medical informatics is used for decision support by which we know as "Telemedicine"

Informatics has been used in many areas in medical practice for the purpose of improving healthcare; examples of such applications;

- **OVR**: this system of reporting errors is advanced to achieve better errors reporting and get the solutions. This application is a clinical informatics.
- **Radiology:** Telemedicine, to have consultations from experts around the world when needed, using technology to obtain better images and still your focus as a physician is the information in which you will be able to write a report about it accurately because your image was good and a teleconsultation with an expert was done.

Application of Medical Informatics

1- Telemedicine

- It is composed of the Greek word τελε (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 modern 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.

- Examples of telemedicine:
  1. Teleconsultation (this requires the consultant to have an access to the patient information so he/she can do the consultation)
  2. Teleradiology

Telemedicine vs Telehealth:
Telehealth is not a bigger umbrella than telemedicine, they're different and not correlated to each other.
telemedicine = clinical services (doc-patient)
telehealth = related health services (everything else)

2- Telehealth

- 🌟 The delivery of health related services, enabled by the innovative use of technology, such as videoconferencing, without the need for travel.
- Telehealth was established because of the aging age group who need a support especially those who are lonely to provide support at home and also for home monitoring.

3- E-health

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

- **Four essential components** make the e-health:
  1. Medical knowledge (data, information, knowledge) that lends itself to being stored in computer files (digital format)
  2. People who are willing/able to share, apply and use this knowledge
  3. Data processing equipment to record, store and process this data
  4. Telecommunication facilities to transfer (exchange) this data electronically between remote locations.

- **E-health** was used for business reasons (selling and buying medical devices and drugs). Nowadays is used for all applications used for healthcare such as heartbeat monitors .. etc

Application of Medical Informatics cont.

4- Electronic medical records

🌟 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.

- EMR is important for decision support.
- if a patient had a pacemaker and you wanted to do an MRI, this system will prevent the MRI from taking place avoided the complications.
- Another example is drug-drug interaction and allergies.

5- 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.
- Dental practice use medical informatics more than medical practice because these practitioners take the case from A to Z alone.

6- 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, communication, documentation, administration and evaluation of patient care and prevention of diseases.
- Nursing depend on informatics a lot because they do a lot of documentations.
- Another example, a nurse can't give a patient a medication until they check the patient code with a device that has all patients information about the drugs.

7- Continuing Medical Education (CME)

- **Definition:** 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.
- The cost of web-based or **online** CME is much lower than the cost of traditional CME.
- **Blackboard used in our college is an example and also DXR.**

8- 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."
- 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 latest (up to date) scientific research findings.
- The advantage is that the practice can be kept **up-to-date** with published knowledge.
- 🌟 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:**
  1. **Best evidence (Relevant Scientific Evidence):** clinical research that has been conducted using rigorous methodology
  2. **Clinical expertise (judgment)** refers to the clinician's cumulated education, experience and clinical skills
  3. **Patients preferences, values and concerns** which patient brings to a clinical encounter.

- 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 patent values component could improve the clinical practice outcome and patients' satisfactions.
- **Why EBM is part of informatics?** Because all knowledge must be up to date and get these we need a medium for that in which all can reach and also a fast one.
- **What is the difference between evidence based practice and none?** Latest knowledge!
- EBM is found to reduce errors. The knowledge has to be structured.
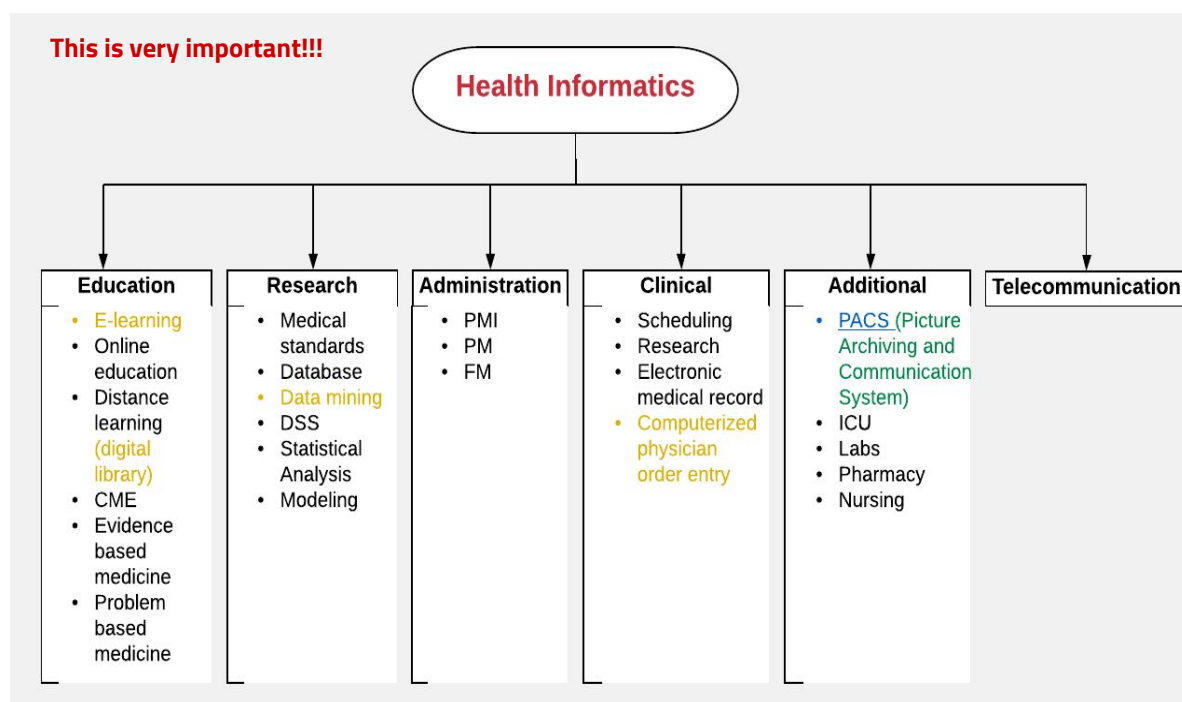
9- Distance learning

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

Telehealth Vs E-health?

1. 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.
2. The practice of telemedicine will become more prominent and will be part of the mainstream of Healthcare.
3. It will become increasingly difficult to differentiate telemedicine from many other uses of technology in the delivery of healthcare.
4. 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**.
5. 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.

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.
- ⭐ Enhance quality assurance.
- Enhance outcome researches and studying programs.
- Sharing medical data.
- Reduce duplication of efforts.
- Provide unified access to all existing data.
- 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.

This is very important!!!

Health Informatics

Education	Research	Administration	Clinical	Additional	Telecommunication
• E-learning	• Medical standards	• PMI	• Scheduling	• PACS (Picture Archiving and Communication System)	
• Online education	• Database	• PM	• Research	• ICU	
• Distance learning (digital library)	• Data mining	• FM	• Electronic medical record	• Labs	
• CME	• DSS		• Computerized physician order entry	• Pharmacy	
• Evidence based medicine	• Statistical Analysis			• Nursing	
• Problem based medicine	• Modeling				

Quiz

Q1:Which of the following represents this definition "the theoretical and practical aspects of information processing and communication,based on knowledge and experience derived from processes in medicine"?
A- Medical informatics
B- Bioinformatics
C- Telemedicine
D- Big data

Q2 :which of the following terms is interchangeable with Health Informatics?
A- E-health
B- Medicine
C- Bioinformatics
D- Information Science

Q3: The delivery of health related services ,enabled by innovative use of technology without the need for travel , refers to which of the following?
A- Telecommuting.
B- Telehealth
C- Telemedicine
D- Telecardiology

Q4: The collection,organization and analysis of large amounts of biological data, using computers and databases, is the definition which of the following?
A- Bioinformatics
B- Chemoinformatics
C- Medical informatics
D- Nursing informatics

Q5: Which one is pillar for evidence based medicine?
A- Bioinformatics
B- E-health
C- Clinical judgments
D- Telehealth

Q6: " The patient in the ER is diabetic" this statement represents which of the following
A- data
B- information
C- knowledge
D- faith

Q7: " 7 out of every 10 patients in the ER is diabetic" this statement represents which of the following
A- data
B- information
C- knowledge
D- average

Q8: " Diabetes is the strongest risk factor for STEMI" this statement represents which of the following
A- data
B- information
C- knowledge
D- informatics

Good Luck!

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