Introduction to Medical Informatics

Medical Informatics comprises the theoretical and practical aspects of information processing and communication, based on knowledge and experience derived from processes in medicine.

Other definition of Medical informatics is the application of computer technology and systems to all fields of medicine - medical care, medical education and medical research.

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

Health Informatics deals with resources and devices for (storage, retrieval of information) to optimize the health care delivery.

Health Informatics is the understanding, skills, and tools that enable the sharing and use of information to deliver healthcare and promote health.

Health informatics tools:

1) Clinical guidelines .2) formal medical terminologies. 3) information & communication systems

Biomedical Informatics (BMI): is the interdisciplinary field that studies the effective uses of biomedical data , information, and knowledge for scientific inquiry, problem solving , and decision making to improve human health.

Telemedicine: it is the use of modern telecommunication and information technologies for the provision of clinical care to individuals located at a distance.

Telehealth is: The delivery of health related services by the use of technology, such as videoconferencing, without the need for travel.

e-health: is a healthcare practice supported by electronic processes and communication.

* some people 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.

Evidence Based Medicine: system that provides information on appropriate treatment under certain patient conditions. The advantage is that the practice can be kept up-to-date with published knowledge.

Bioinformatics: The collection, organization, and analysis of large amounts of biological data, using computers and databases.

Dental informatics: application of information technology to dentistry. It is often considered a subset of Medical Informatics and Biomedical Informatics.

Nursing informatics: is a specialty of Health Informatics "like medical informatics" 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:

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.

Distance Learning:

It is now possible to earn university degrees from home, at every level from bachelor's to doctorate.

E-Health components:

- 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

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.

Clinical data

Data: “data are numbers, words or images that have yet to be organized or analyzed to answer a specific question.

Information: is the result of processing, manipulating and/or organizing data or combinations of data to answer question

Knowledge: is the full utilization of information and data.

Why do we need knowledge In health care?

Because we have a huge gap in data acquisition and information and knowledge capacity.

The under-utilization of healthcare data- information and knowledge contributes to improper clinical decisions, medical errors, under-utilization of resources and raise in healthcare delivery costs.

File Organization concepts:

– Database: A set of related files

– File: Collection of records of same type

– Record: A set of related field

– Field: Words and numbers

Relational model links records to tables:

- One-time information (e.g., demographics) stored only once.

- Complex queries easier to construct and carry out.

*** Allows efficiencies***

Use of clinical data:

- Form basis of historical record
- Support communication among providers
- Anticipate future health problems
- Record standard preventive measures
- Identify deviations from expected trends example
- Coding and billing

- Provide a legal record
- Support clinical research

Types of clinical data:

- Narrative: recording by clinician, e.g. maternity history
- Numerical measurements: blood pressure, temperature
- Coded data: selection from a controlled terminology system example :MI that may mean myocardial infarction
- Textual data: other results reported as tex
- Recorded signals: EKG, EEG
- Pictures: radiographs, photographs, and other images

Clinical data: a collection of observations about a patient.

datum: is a single observation of a patient

Each datum has five elements:

–The patient (Name)

– The attribute (heart rate)

– The value of the attribute (52 beats per minute)

– The time of the observation (1:00 pm on 1/1/2015)

– The method by which the attribute was obtained (heart monitor)

Some complications of data:

- Circumstances of observation (how was heart rate taken?)
- Uncertainty
- Time
- Duplication
- Outdated (missing values)
- Incorrectly formatted

Data entry:

- Free-form entry by historical methods like writing, dictation and typing
- Structured (menu-driven) data entry by mouse or pen
- Speech recognition for either of above.

Coded vs free text:

•Coded data: Documentation of discrete data from controlled vocabulary

• Free text: Alphanumeric data that are unstructured, typically in narrative form

Issues with coded data:

- pick from a list" allows wrong selection
- compliance concerns
- over documentation for care
- Cloning and limitation

Paper Medical Record and Electronic Health Record

Traditional Paper-based Medical Record:

• Purpose: to record observations and could be reminded of patients details

Disadvantages:

- Find the record
- Read the record
- Read and update the data
- Record fragmentation
- Redundancy
- Passive (no automated decision support)

Main Purpose of Documentation:

- Remembering what you did and why
- Conveying information to Medical Team members
- Coding and Billing
- Legal issues
- Anticipate future health problems
- Record standard preventive measures
- Support clinical research

Role of medical records:

For the Transcription, Coding, Quality check, Security, administration, Training and Research.

Medical records serve a variety of functions for organizations not involved directly in care such as Insurers, Quality reviews, Medical research and Education.

Electronic medical record (EMR): computer-based patient record systems that sometimes extended to include other functions like order entry for medications and tests among other functions .

EMR Components:

•Results reporting • Data repository • Decision support • Clinical messaging and communications

• Documentation • Order entry.

Computer-Based Patient Record (CPR): Comprehensive lifetime record

Functional Components of an Electronic Medical Record System:

1) Integrated view of patient data
2) Clinician order entry
3) Clinical decision support
4) Access to knowledge resources
5) Integrated communication and reporting support

Patient Benefits:

- Decreased wait time for treatment
- increased access/control over health information
- increased use of best practices/decision support
- Increased ability to ask informed questions
- Quicker turnaround time for ordered treatments

Barriers of EHR in Saudi Arabia:

- Human Barriers
- Financial Barriers
- Legal and regulatory barriers
- Organizational barriers
- Technical barriers
- Professional barriers

Data Ownership:

Paper medical records are the property of the creators with full responsibilities: storage, accuracy, however in EMR Many providers share / update the same electronic data in many sites.

Caregiver Resistance:

- Some people have been unable /unwilling to use computers
- professionals don't want to change their "familiar", "traditional" practices
- Need "incentives"
- Rather pay penalties than bear EHR implementing cost

Fundamental Issues:

1) **Data display:** Once stored in the computer, data can be presented in numerous formats for different purposes .

Dynamic Search : Search tools help the physician to locate relevant data.

2) **Data Validation**.

- Range checks (out of range value)
- Pattern checks
- Computed checks(values have the correct mathematical relationship)
- Consistency checks
- Delta checks (large and unlikely differences between the values)
- Spelling checks.

3) Query and Surveillance Systems:

- Clinical care
- Clinical research
- Quality reporting
- Retrospective studies
- Administration (e.g. resource consumption)
- Find records of patients that satisfy pre-specified criteria and export selected data.

COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE)

(**CPOE**): the process where a medical professional entering orders or instructions electronically.

Computerized Provider Order Management (CPOM): a process of electronic entry of medical practitioner instructions for the treatment of patients.

CDS (Clinical Decision Support): software that makes relevant information available for clinical decision-making.

CCR (Computerized Clinical Reminder: just-in-time reminders at the point of care that reflect evidence-based medicine guidelines.

Examples of DSS(Decision support system) in CPOE – medication prescription:

- Allergy
- Age (check drug name and dose)
- Duplicate drugs on active orders, not one-time
- Severe drug interactions
- Drug-drug, drug-food
- Dose maximum
- Drugs with opposite actions

Reasons for CPOE:

- Order Communication (Clarity of Orders and Identifying the Ordering Physician)
- Standardization of Care
- Alerts and Reminders (Drug Safety Database)

Medication Errors: Physician drug ordering errors are most often due to one of two causes :

1) Lack of knowledge about the drug
2) Incomplete patient information

COPE can help in reducing the Errors, Improve the quality of practice and improve the efficiency.

A CPOE with an advanced level of CDS is needed to prevent many of the prescribing errors with the greatest potential to lead to patient harm:

- **Basic type of COPE** = drug-allergy, drug-drug interaction & duplicate therapy checking, basic dosing guidance, formulary decision support.
- **Advanced type of COPE** = dosing for renal insufficiency and geriatric patients, guidance for medication-related lab testing, drug-pregnancy and drugdisease contraindication checking.

Challenges:

- The upfront cost of implementing CPOE is one major obstacle for hospitals
- Installation of even "off the shelf" CPOE packages requires a significant amount of customization for each hospital.
- Cultural obstacles to CPOE implementation
- Integration with other systems

Why do we need COPE?

- To improve patient safety
- To Improve the efficiency
- Reducing operating costs
- To Improve the quality

What Is Needed For Success?

- **Clinicians** must be involved in design and implementation of the system
- **Clinicians** must be flexible and willing to change workflow processes
- **IT department:** should train, educate the users and provide ongoing support and make sure that the system is fast, reliable and easily accessible.
- **Institution :**Commitment to workflow changes

Advantages of COPE:

- Improve communications
- Make knowledge more readily accessible
- Assist with calculations
- Perform checks in real time
- Assist with monitoring
- Provide decision support

Best Wishes

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