2- Clinical Data

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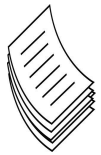
- References: 436 Doctor's Slides and notes , E.H. Shortliffe and Marsden

Objectives

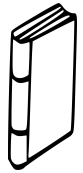
Not found ☹

Color index

- Doctor's notes
- Extra information and further explanation
- Important
- Main titles
- Subtitles



This slide from doctor's slides



This slide from the book

Clinical Data

- **Clinical data:** are a collection of observations about a patient

❖ **Datum:** A datum is a single observation of a patient, **Each datum has five elements:**

1. The patient (e.g. Amr Jamal)
2. The attribute (e.g. heart rate)
3. The value of the attribute (e.g. 52 beats per minutes)

(the value of attribute must come with a unit ,To be able to communicate . Ex: the patient's weight is 52 it can be kg or pound)

1. The time of the observation (e.g. 1:00 pm on 1/1/2015) when did you collect the data
2. The method by which the attribute was obtained (e.g. heart monitor) which device is used to take the data

''Physicians are taught to record any observations and to not trust their memory. They need to record any observations and the actions that they have taken to correct a situation, the rationales behind their actions so that they may be communicated to any other person dealing with that patient. Hence is the basis of data recording.''

Types of Clinical Data very IMP

- **Narrative:** recording by clinician- maternity history(Narrative – Patient's description to his/her illness and responses to focused questions.)
- **Numerical measurements:** e.g. blood pressure, temperature
- **Coded data:** selection from a controlled terminology system example being the term MI that may mean myocardial infarction or mitral insufficiency (Coded data – Abbreviated terms for describing a patient's medical situation.)
- (for ex MI means myocardial infarction for female .the doctor will use a code to mean something .but its not good for patients safety if its unknown)
- **Textual data:** other results reported as text
- **Recorded signals:** e.g. EKG, EEG) coming from devices that can be visualized and printed
- **Pictures:** e.g. radiographs, photographs, and other images like picture taken for dermatology , histology slides , pie chart , growth chart

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Narrative vs textual data

- **Narrative:**

is a combination of textual data. When you read it, it's like **a story** that has a beginning and ending

ex:

1-(the patient came to the ER complaining of chest pain..etc).
2-Radiological report
3- Sociodemographic history

- **Textual data :**

Clear direct text, One word to describe something that has no continuation to it

Ex:

1-(Female or male)
2-(yes or no).

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Use of Clinical Data

- Form basis of historical record
- Support communication among providers
- Anticipate future health problem (ex: to know the trends and patterns of patients in oncology to predict the future problems)
- Record standard preventive measures (ex: how many children are vaccinated in the primary care to make a record)
- Identify deviations from expected trends example being a growth chart
- Coding and billing

Coding: each diseases has its own code so the hospital can know If there is a high prevalence of certain diseases.
Billing: in private hospitals every treatment has a code that is used to know the total charge on the patient

- Provide a legal record
- Support clinical research

-Reasons for which data is recorded:
(To help care for patient To help the society at large by reporting data from populations of patients)

(Patient could have two or more doctors treating a condition or could have switched doctors. Developing routine examinations such as mammogram, cholesterol, bp, etc. can screen patients for future problems. Recorded interventions include counseling or educational programs, vaccinations, etc. For example, the doctor will screen a patient if they had a tetanus shot. If they did, unnecessary treatment could be avoided. Physicians can't use their memory of an action in court. The recorded data serve as a legal record for courts to decide if there was malpractice. By looking over time of what medical intervention was and how patient improved provides manner of improving)

Clinical Data

❖ **Types of clinical data documents:**

1. **History and physical examination:** by clinician
2. **Progress notes:** update of progress by primary, consulting, and ancillary providers
3. **Reports:** by specialists, ancillary providers

We put the raw data into more systematic way to make documents.
Data Without data we don't have document

- Typical paper chart maintains all patient notes in chronological order, sometimes separated into different components

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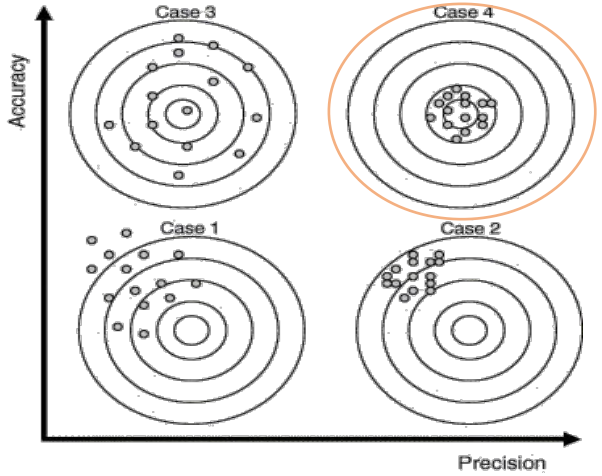
Complications of Data

- **Circumstances of observation:** e.g. how was heart rate taken? Pulse? EKG ? (the way the data is taken can affect its quality)
- **Uncertainty:** how accurate is patient reporting, measurement, device?
- **Time:** what level of specificity do we need? (Some cases we need to know the minutes and seconds)
- **Duplication:** e.g. multiple records in different departments
- **Outdated:** e.g. missing values
- **Incorrectly formatted:** does not follow standards e.g: using different unit for the same patient . Or different measurement for different patients so I can't compare between them.

Imprecision vs. Inaccuracy



1-All the dots are different attributes .
2-On the y-axis we have accuracy.
3-On x-axis we have precisions.
4- The smallest circle inside is the truth.

-Accuracy : how close your data point to the **truth**
Ex: measuring weight
If I get the perfect scale that is 100% right and it give me a weight (truth).
And I have many scales and I measures the weight if its near the truth then its accurate.

-Precision :how many time I repeat and get the same number ”reliability”

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Structure of Clinical Data

- Medicine lacks uniform structured vocabulary and nomenclature as does physics and chemistry
- Standardization and computerization of data is benefited by standard representation (Cimino, 2007)
- Counter-arguments are “freedom of expression” and “art of medicine”
- Narrative information when expressed in many ways can be ambiguous

(One physician may refer to upper respiratory infection as infection of the trachea and the other to the main stem bronchi. Medicine is humane and can’t be precise like the hard sciences.)

Structured data vs unstructured data

-Narrative data are unstructured .
-Coded data are structured .

Once we have a coded data and a standard we will benefit a lot and reduce the likelihood of error.
However, this will lead to the loss of the art of expression.
So as much as we want structured data , we have to balance between them.

We need better access to clinical data

- ❖ Missing clinical information during primary care visits (Smith, 2005)
- ❖ Information reported missing in 13.6% of clinical visits
  - Available but outside system in 52% of instances
  - Estimated to adversely effect patients 44% of time
  - Unsuccessful searching for it took >5 minutes 35% of time
- ❖ Physicians have two unmet information needs for every three patients (Gorman, 1995; Ely, 1999)
- ❖ Secondary use of clinical data (Safran, 2007)

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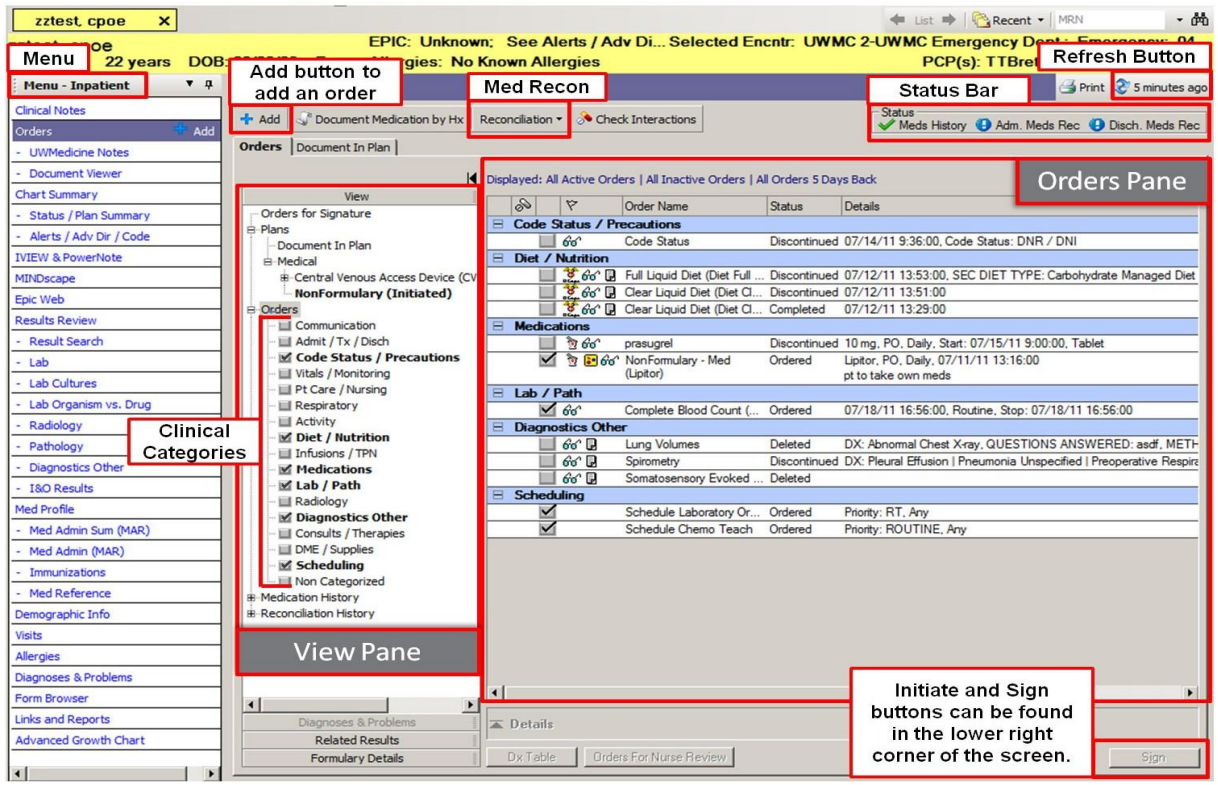
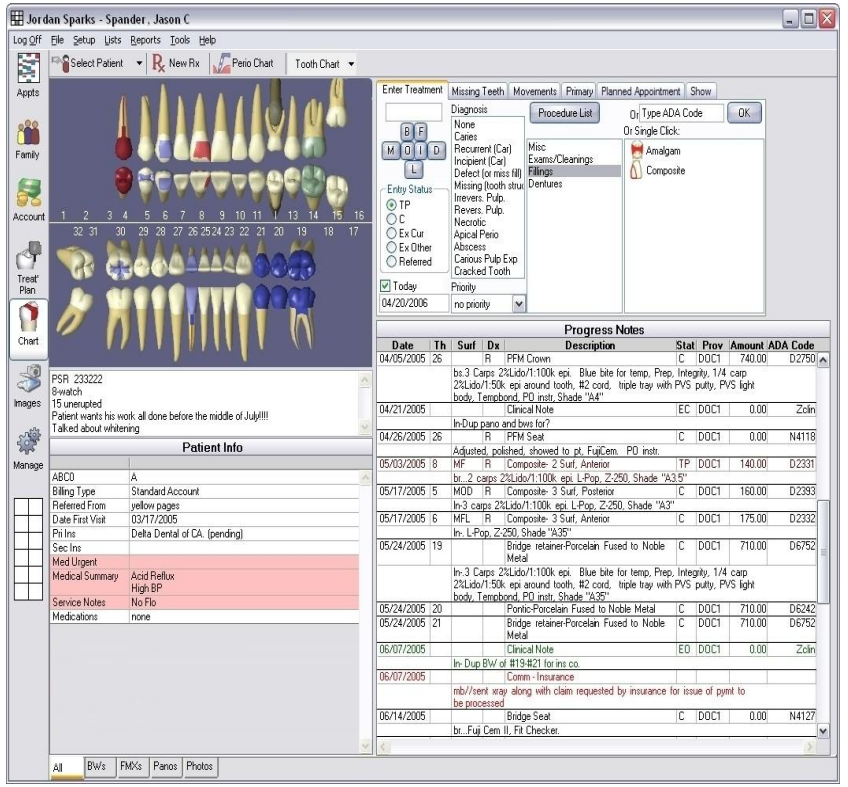
Data Entry

- **General categories of data entry:**

1. **Free-form:** entry by historical methods (writing, dictation, typing)
2. **Structured (menu-driven):** data entry by mouse or pen
3. **Speech:** recognition for either of above

ORCA CPOE order screen





Data Entry

Structured or menu-driven data entry

- Many attempts from old (Greens, 1970: Cimino, 19787: Bell, 1994) to new (Oceania: OpenSDE – Los, 2005)
- Can be done via mouse or pen, with typing
- **Benefits:** 1- data codified for easier retrieval and analysis 2- reduce ambiguity if language used consistently
- **Drawback:** 1- in general, more time-consuming 2- requires exhaustive vocabulary 3- requires dedication to use by clinicians
- **Alternative:** processing free text with natural language processing and tagging text (in XML) (Johnson, 2008)

Speech recognition for data entry

- Most common use is for narration , e.g. computer dictation of clinical notes
- An advantage in instant availability of dictated content
- Continuous speech recognition now is commercial reality; speaker-dependent system require user training, speaker-independent are systems less accurate
- many established systems on the market that operate on: front-end (used by clinician) or back-end (process dictations) (Brown, 2008)

Speaker-dependent Vs Speaker-independent systems

-Speaker-dependent systems recognize characteristics in speaker's voice and are trained to readjust themselves.

- Speaker-independent systems are ones installed in various industries having automated reply system.

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Coded vs. free-text data

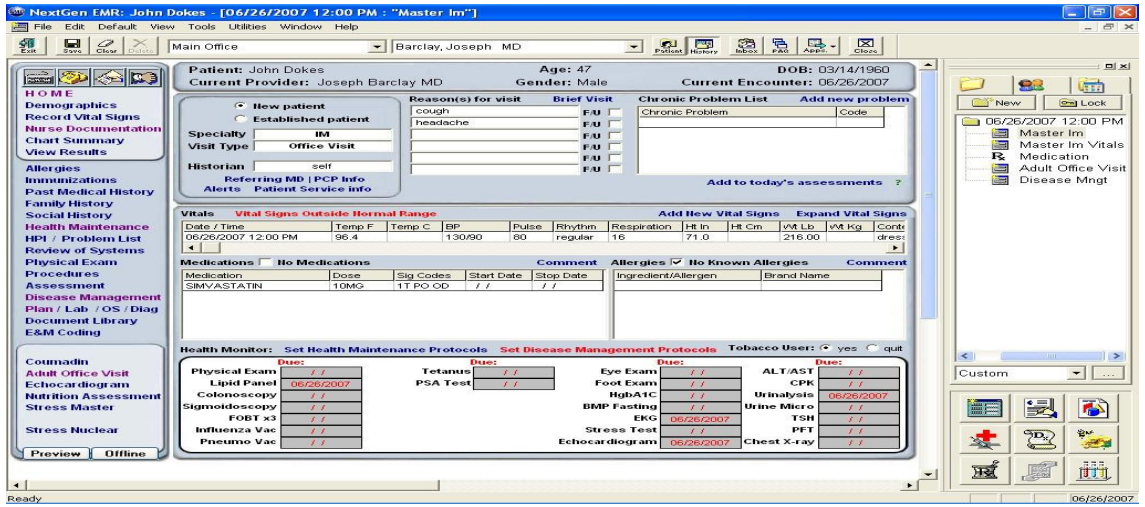
- **Coded data:** documentation of discrete data from controlled vocabulary
- **Free text:** alphanumeric data that are unstructured, typical in narrative form

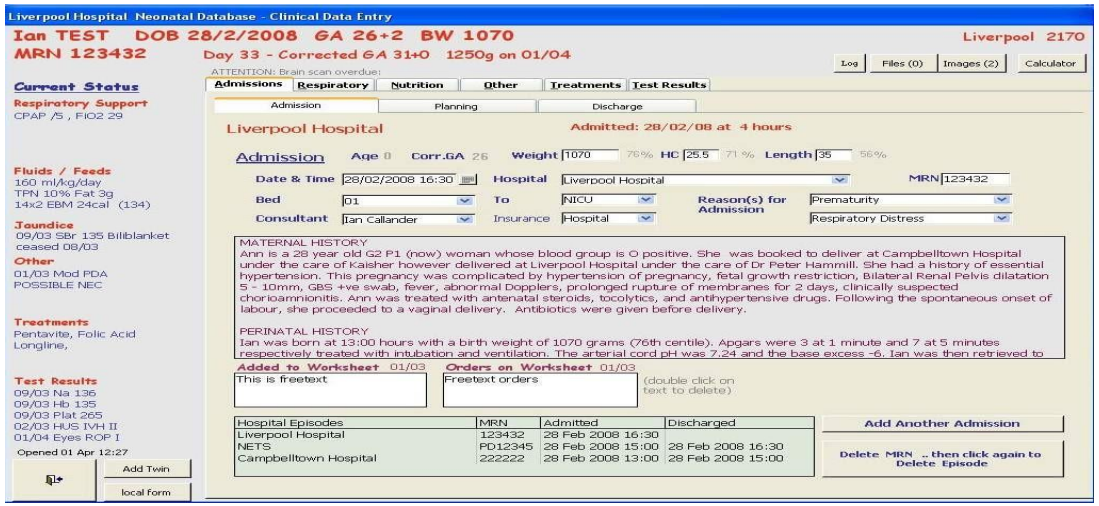
(- Coding is an analytical process in which data, in both quantitative form (such as questionnaires results) or qualitative (such as interview transcripts) is categorised to facilitate analysis.)
(- Coding means the transformation of data into a form understandable by computer software.)

Electronic health records (EHRs) that use structured data elements are documenting patient information using controlled vocabulary rather than narrative text.
- The historic lack of structured data and standardization in the healthcare industry today causes problems when sharing EHR content between providers.
- Currently, the healthcare industry is far from the desired state where patients have one complete, accurate EHR from which the quality of their individual health care can be monitored and maintained.

Narratives Tell a Story

- **A narrative tells a story:** see the patient through a description, complicated events are easier to describe in text
- **Undifferentiated problems:** interpretation, “only a human can prioritize and determine what the chief complaint really is”





Coded Data

Issues with coded data:

- "Pick from a list" allow wrong selection
- Compliance concerns

- Coding compliance refers to the process of insuring that the coding of diagnoses and procedures complies with all coding rules and guidelines. Detection, correction, prevention, verification and comparison constitute the five essential components of coding compliance. This article will examine the operational issues associated with each of these five components of coding compliance. Alternative workflows and issues related to the computerization of the coding compliance function will be discussed.

- Over documentation

  Physician may be tired of selecting a series of structured menus (over-documentation) instead of a simpler free-text program.

- Cloning

  Cloning is when patients info from a previous visit is copied and pasted into the same field in the next visit. The patient's condition may have altered but the physician might have entered codes for diagnosis for a a previous visit. Cloning might occur between two different patients. When medical records have nearly identical documentation, it may bring into question the necessity of medical services. It could lead to billing at the higher end prices.

- A coding compliance program to ensure that the claims submitted to Medicare are accurate and complete should encompass five essential components:
  - Detection—identifying records with potential coding compliance problems
  - Correction—performing chart audits and making necessary corrections
  - Prevention—educating coders in order to prevent coding compliance problems from occurring in the future
  - Verification—providing an audit trail of all coding compliance actions
  - Comparison—comparing coding patterns over time and to external norms A comprehensive coding compliance program must address all five of these components.

Coded clinical data enables EHR advanced functionality

- Alerts
- Clinical decision support
- Best documentation practices
- Multi media reporting
- Multiple output formats
- Data mining

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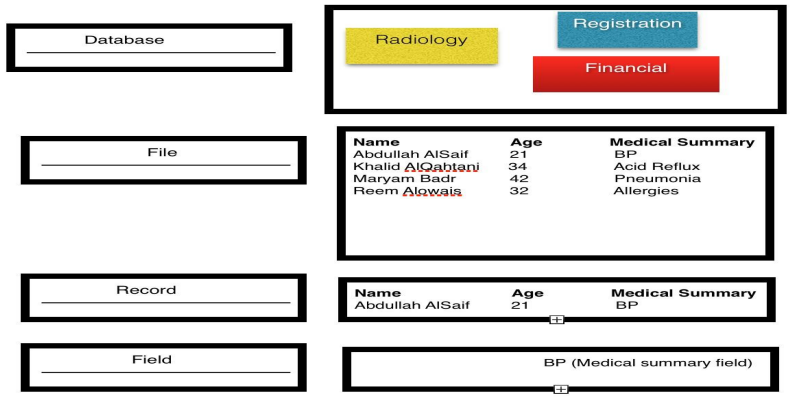
Data Management

- **File organization concepts:**
  - **Database:** a set of related files
  - **File:** collection of records of same type
  - **Records:** a set of related field
  - **Filed:** words and numbers

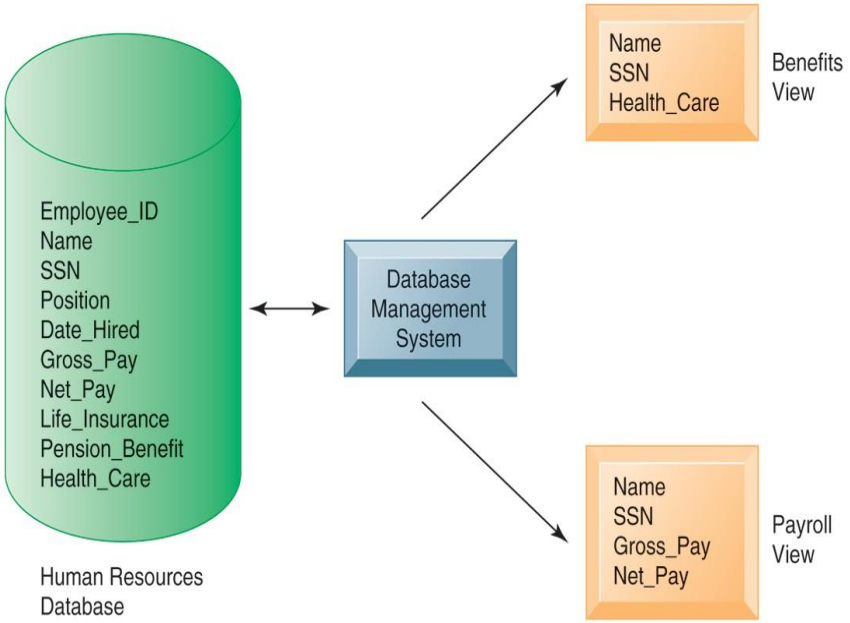


Relational DBMS

A relational database management system (RDBMS) is a program that lets you create, update, and administer a relational database. Most commercial RDBMS's use the Structured Query Language (SQL) to access the database, although SQL was invented after the development of the relational model and is not necessary for its use.

A relational database is a collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables. The relational database was invented by E. F. Codd at IBM in 1970.

- Relational model links records to table
- Allow efficiencies:
  - one-time information (e.g. demographics) stored only once
  - complex queries easier to construct and carry out
- Most query capabilities are based on Structured Query Language (SQL): special language in relational database



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Big Data

- Science of data management & analysis
- “to convert Vast information and knowledge in organization to achieve their objective” (Murdoch et al, 2013*)
- **What is BIG/VAST?** Zettabytes (10^{21} gigabytes) to Yottabytes (10^{24} gigabytes)
- Used in Astronomy, Search Engines, Financial, politics and now in biomedicine
- **Example of big data** is Bioinformatics (genome, proteomic)

*Murdoch, T. , Detsky, A. (2013) The Inevitable Application of Big Data to Health Care *JAMA.* 2013;309(13):1351-1352. doi:10.1001/jama.2013.393.

- Data is growing and moving faster than healthcare organizations can consume it; 80% of medical data is unstructured and is clinically relevant. This data resides in multiple places like individual EMRs, lab and imaging systems, physician notes, medical correspondence, claims, CRM systems and finance.Getting access to this valuable data and factoring it into clinical and advanced analytics is critical to improving care and outcomes, incentivizing the right behavior and driving efficiencies.
- Healthcare organizations are leveraging big data technology to capture all of the information about a patient to get a more complete view for insight into care coordination and outcomes-based reimbursement models, population health management, and patient engagement and outreach. Successfully harnessing big data unleashes the potential to achieve the three critical objectives for healthcare transformation:
- For instance, researchers can mine the data to see what treatments are most effective for particular conditions, identify patterns related to drug side effects or hospital readmissions, and gain other important information that can help patients and reduce costs. Fortunately, recent technologic advances in the industry have improved their ability to work with such data, even though the files are enormous and often have different database structures and technical characteristics.

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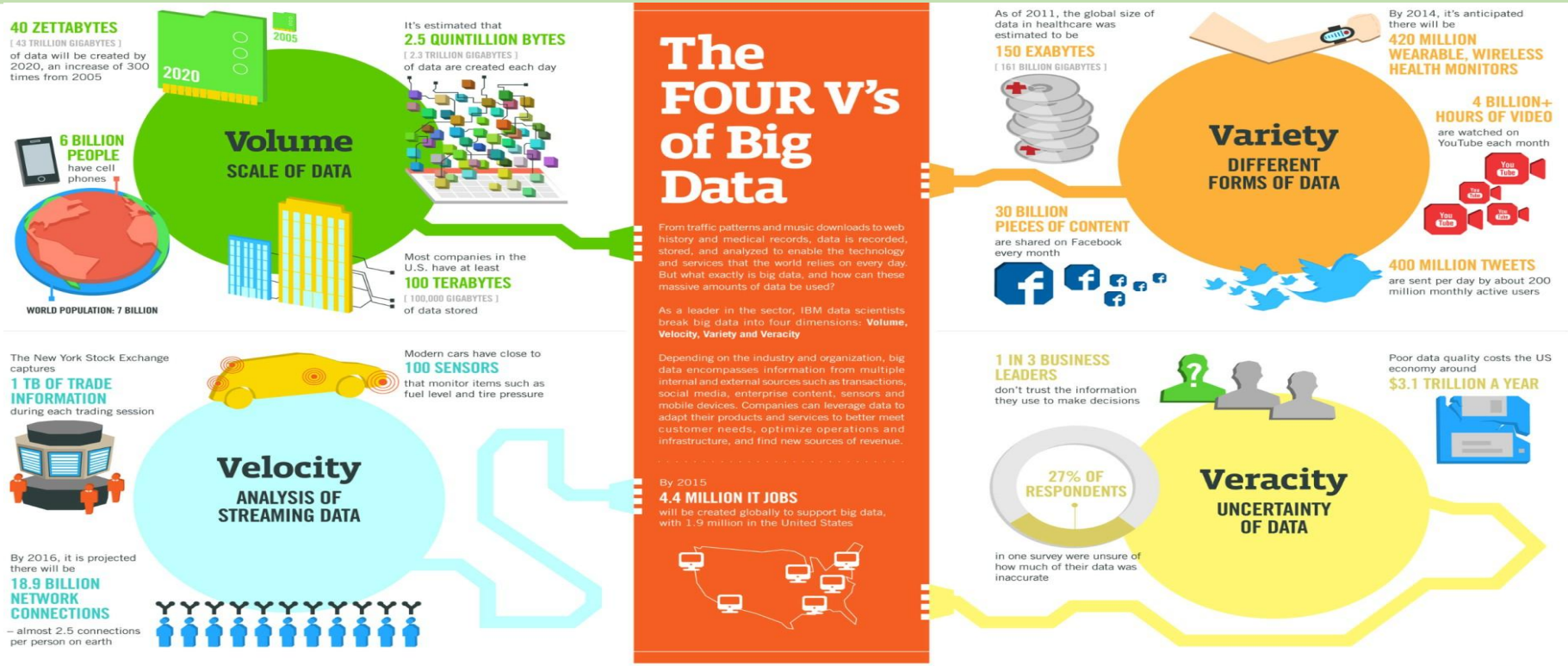
The 4 V's of Big Data



Big Data in Healthcare

Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture, data curation, search, sharing, storage, transfer, visualization, and information privacy. The term often refers simply to the use of predictive analytics or other certain advanced methods to extract value from data, and seldom to a particular size of data set. Accuracy in big data may lead to more confident decision making. And better decisions can mean greater operational efficiency, cost reduction and reduced risk.

- 80% of medical data is unstructured and is clinically relevant
- The data reside in multiple places like individual EMRs, lab and imaging systems, physician notes, medical correspondence, claims, customer relations management systems and finance

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Sources of Big Data

- Clinical data from CPOE
- Clinical decision support systems (written notes & prescriptions)
- Imaging systems: PACS, radiology information systems
- Sensor data (monitoring vital signs)
- Social media data (tweets from twitter, wall and status updates on Facebook)
- Emergency care data
- Literature from medical journal

Healthcare Big Data Problems to be Solved

1. Patient profiles and the health outcomes- identify the effective treatments
2. For public health- identify individuals who would get preventive care or lifestyle changes
3. Analysing literature on medical procedure to determining which care protocols work best
4. Creating mobile apps to manage diabetes. Via Data analytics, we are able to monitor the healthcare outcomes improvements
5. Analysing social network communication among support group members- to understand how non-profit organization can interact and provide help

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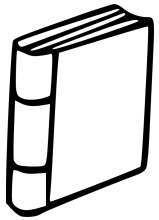

Chapter: 2

What Are Clinical Data?

clinical datum: any single observation of a patient—e.g., a temperature reading, a red blood cell count.

"a clinical datum is a single observation about a patient, clinical data are multiple observations."

A single datum generally can be viewed as defined by five elements:

1. The ***patient*** in question
2. The ***parameter*** being observed (e.g., liver size, urine sugar value, history of rheumatic fever, heart size on chest X-ray film)
3. The ***value*** of the parameter in question (e.g., weight is 70 kg, temperature is 98.6 °F, profession is steel worker)
4. The ***time*** of the observation (e.g., 2:30 A.M.on 14FEB2013 1)
5. The ***method*** by which the observation was made (e.g., patient report, thermometer, urine dipstick, laboratory instrument).

What Are the types of Clinical Data?

there is a broad range of data types in the practice of medicine and the allied health sciences. They range from **narrative**, **textual data** to **numerical measurements**, *genetic information, recorded signals, drawings, and even photographs or other images.*

- **Narrative data**: account for a large component of the information that is gathered in the care of patients.
  (For example, the patient's description of his or her present illness)
- **Textual data**
- **Numeric values:** These include such parameters as laboratory tests, vital signs

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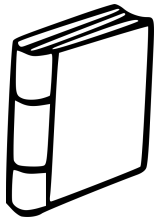

Chapter: …

Who Collects the Data?

Health data on patients and populations are gathered by a variety of health professionals. Although conventional ideas of the **healthcare team** evoke images of coworkers treating ill patients, the team has much broader responsibilities than treatment per se; data collection and recording are a central part of its task.

Uses of Health Data

- Create the Basis for the Historical Record
- Support Communication Among Providers
- Anticipate Future Health Problems
- Record Standard Preventive Measures
- Identify Deviations from Expected Trends
- Provide a Legal Record (The medical record is the foundation for determining whether proper care was delivered. Thus, a well-maintained record is a source of protection for both patients and their physicians.)
- Support Clinical Research

Weaknesses of the Traditional Medical Record System

- Pragmatic and Logistical Issues
- Redundancy and Inefficiency
- Influence on Clinical Research
- The Passive Nature of Paper Records

Questions

Q1.selection from a controlled terminology system example being the term MI that may mean myocardial infarction or mitral insufficiency, **what type of clinical data is this ?**

A. Narrative B. Coded data C. Textual data D. Numerical measurements

Answer: B

Q2."how close your data point to the truth", describe which of the following :

A.accuracy B.Narrative C.precision D. textual data

Answer: A

Q3.Which of the choices is one of the **General categories of data entry** ?

A.free-form B.structured C.speech D.all

Answer: D

Q4.**speech recognition for data entry** is the most common use for :

A.coded data B. narration C.textual data D.numerical measurement

Answer: B

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Questions

Q5.**”An analytical process in which data, in both quantitative form (such as questionnaires results) or qualitative (such as interview transcripts) is categorised to facilitate analysis”** it's a definition of which of the following :

A.coding B. narration C.recording signals D. picturing

Answer : A

Q6 **. Bioinformatics (genome, proteomic)** is example of :

A.data management B. Relational DBMS C.coded data D.big data

Answer: D

Q7.which of the following considered as **Weaknesses of the Traditional Medical Record System :**

A. Redundancy and Inefficiency
B. Create the Basis for the Historical Record
C. Pragmatic and Logistical Issues
D. A and C

Answer: D

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يتمنى لكم فريق العمل كل التوفيق و النجاح.

في الاسفل رابط التقييم للعمل ساعدنا لتطوير العمل و ايضا التقييم يعتمد عليه في اختيار افضل فريق .

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Your Opinion Matter