MEDICAL INFORMATICS AND BIOSTATISRICS

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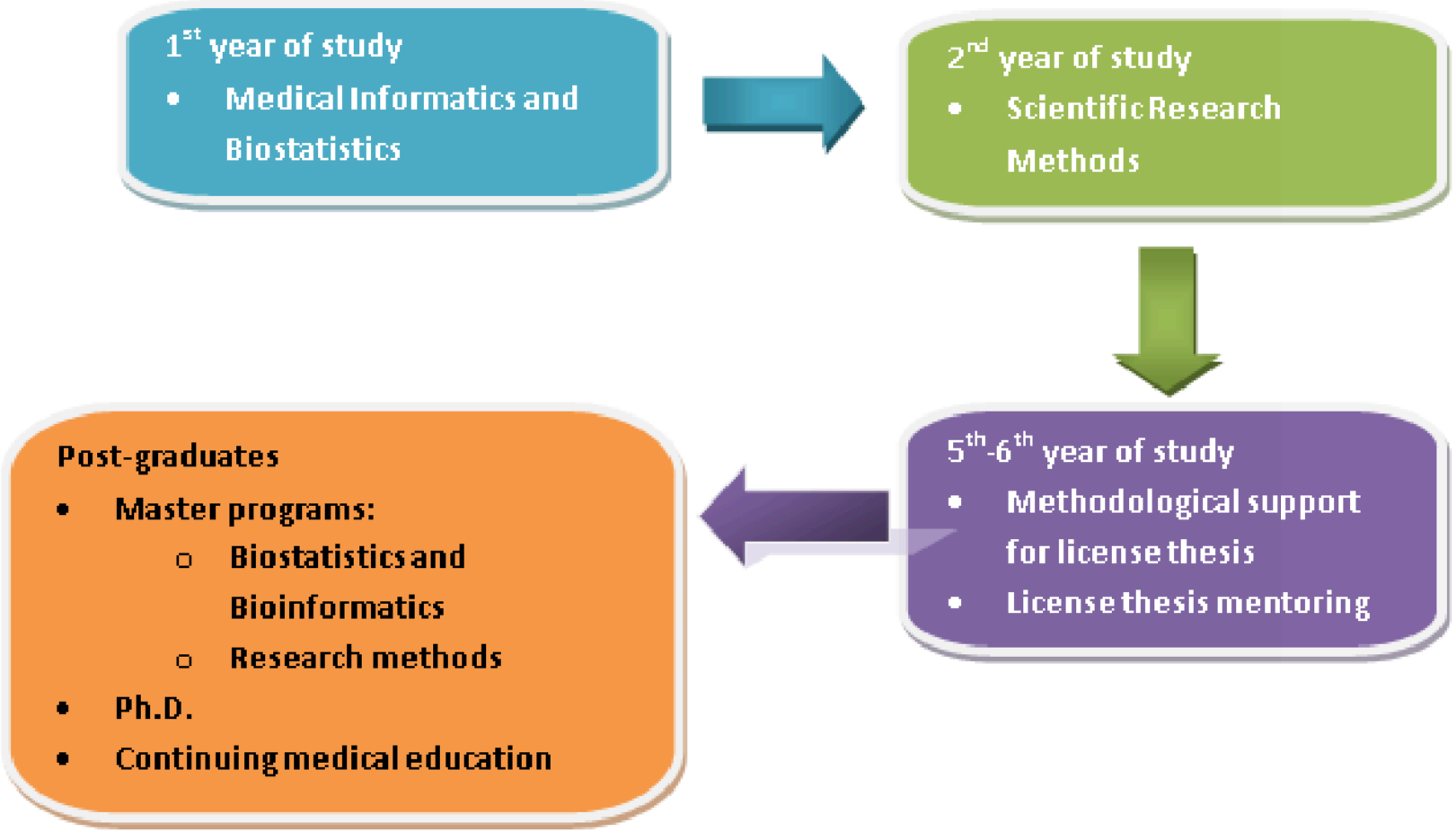
OUTLINE

- Rules and Regulations
- Objectives of the course
- Data – Information - Knowledge
- Computers & Coding information
- International systems used to measure quantities and speeds and their applications

RULES AND REGULATION

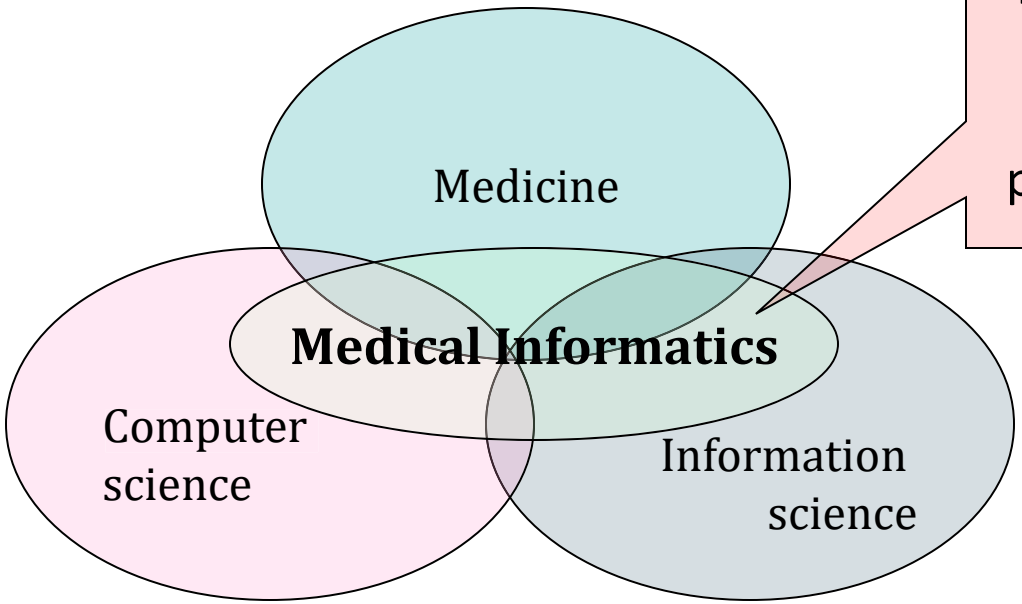
- **Attendance:**
  - Practical activities: 100% - you could recuperate maximum 3 practical activities
  - Lectures: 70% attendance – be present at least 10 lectures!!!
- **Exams:**
  - Practical: last week of the semester (January 2016)
  - Theoretical: 35 MCQs
- **Final Mark:**
  - (points of practical exam (with bonus)*0.3) + (points of theoretical exam (with bonus)*0.7)
  - Up to 2.5 extra points to the theoretical exam – for homework's
  - Up to 1.5 points to the practical exam

Academic Pathway



Medical Informatics ...

- ✓ The information is doubling in less than 5 years
- ✓ Information = power
- ✓ The development of communications technology solves a number of problems in health care



Management and processing of medical data, information and knowledge needed for medical practice, education and researcg

Medial practice
Medical education
Research
Management

Informatica = Medicul + Informaţia + Tehnologia

Education assisted by computers

Distance learning

Desktop

Smartphone

PDA (Personal Digital Assistant)

Laptop

Etc ...

An Innovative Smartphone-Based Otorhinoendoscope and Its Application in Mobile Health and Teleotolaryngology

Cheng-Jung Wu, Sheng-Yu Wu, Po-Chun Chen, Yaoh-Shiang Lin

J Med Internet Res 2014 (Mar 03); 16(3):e71

Download Citation: END BibTex RIS

Share

Using a Mobile App for Monitoring Post-Operative Quality of Recovery of Patients at Home: A Feasibility Study

John L Semple, Sarah Sharpe, M Lucas Murnaghan, John Theodoropoulos, Kelly A Metcalfe

JMIR mHealth uHealth 2015 (Feb 12); 3(1):e18

Download Citation: END BibTex RIS

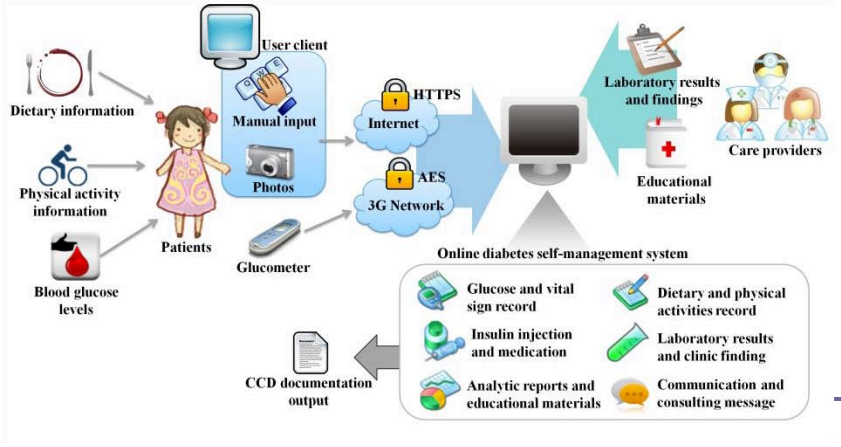
Share

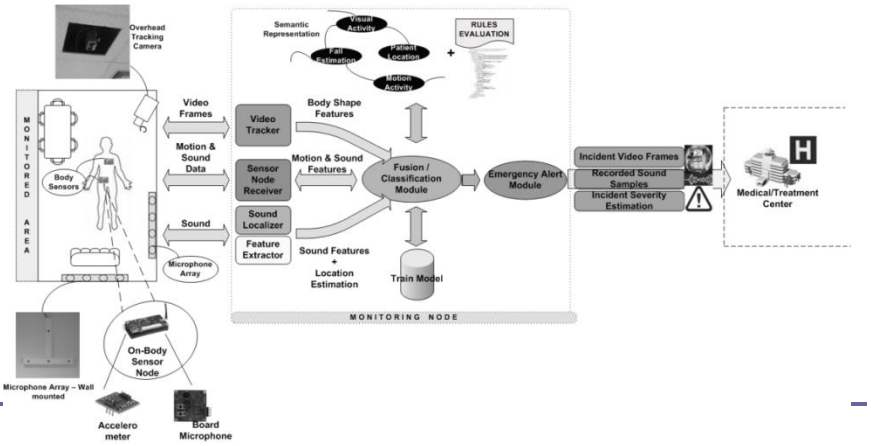
The MOnitoring Resynchronization dEvices and CARdiac patiEnts (MORE-CARE) Randomized Controlled Trial: Phase 1 Results on Dynamics of Early Intervention With Remote Monitoring

Giuseppe Boriani, Antoine Da Costa, Renato Pietro Ricci, Aurelio Quesada, Stefano Favale, Saverio Iacopino, Francesco Romeo, Arnaldo Risi, Lorenza Mangoni di S Stefano, Xavier Navarro, Mauro Biffi, Massimo Santini, Haran Burri, On Behalf Of The MORE-CARE Investigators

J Med Internet Res 2013 (Aug 21); 15(8):e167

Download Citation: END BibTex RIS

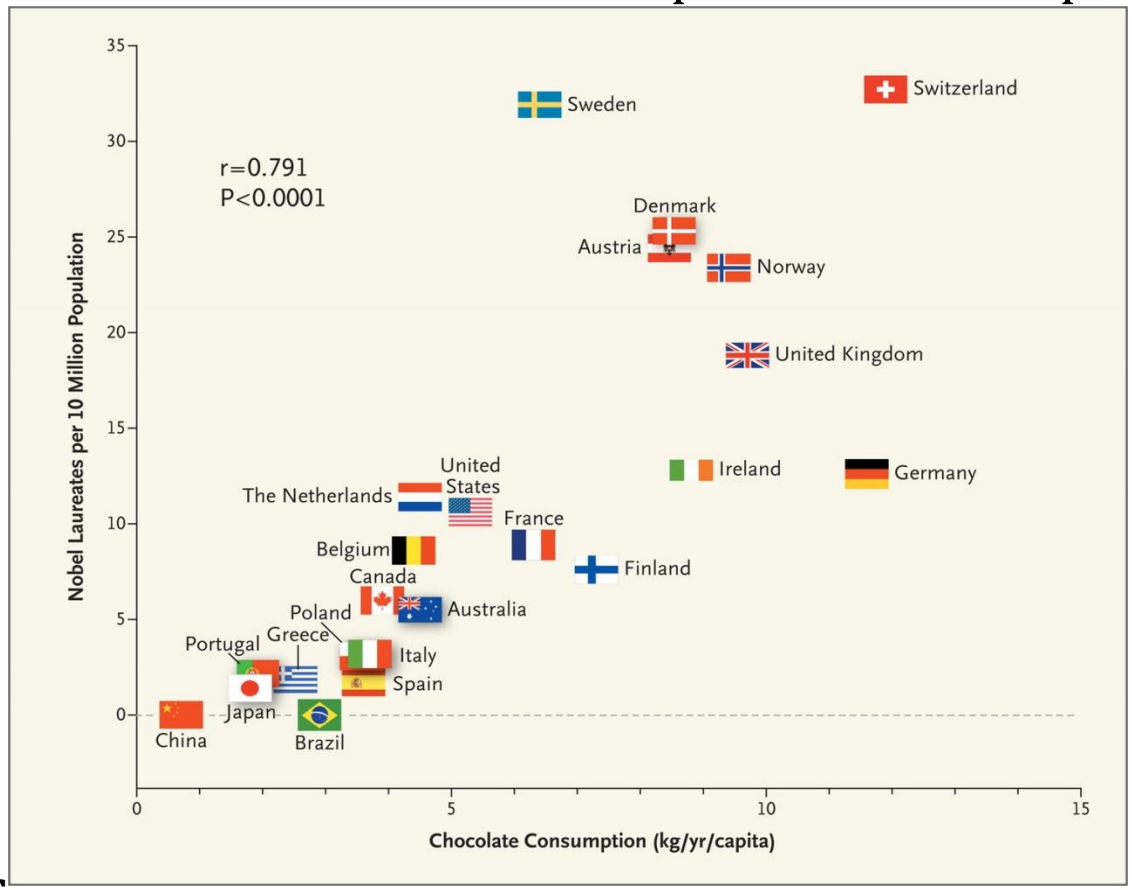




"*The purpose of statistical science is to provide an objective basis for the analysis of problems in which the data depart from the laws of exact causality. A general logical system of inductive reasoning has been devised that is applicable to data of this kind, and is now widely used in scientific research.*"

D. J. Finney

Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population



CONCLUSIONS

"Chocolate consumption enhances cognitive function, which is a sine qua non for winning the Nobel Prize, and it closely correlates with the number of Nobel laureates in each country."

Messerli FH. N Engl J Med 2012;367:1562-1564.

MEDICAL STATISTICS

- Definition: it is a mathematical science pertaining to the collection, analysis, interpretation or explanation, and presentation of ***data***
  - improve the quality of data
    - with the design of experiments
    - survey sampling
  - provides tools for prediction and forecasting using data and statistical models
- Branches:
  - Descriptive statistics
  - Inferential statistics

MEDICAL STATISTICS

- Descriptive statistics:
  - Summarize or describe a collection of data
- Inferential statistics:
  - Used to draw inferences about a population from a sample:
    - Estimation: parameter and confidence interval
    - Hypothesis testing (null and alternative hypothesises): determine whether the data are strong enough to reject the null hypothesis

BITS AND BYTES

- A bit (b) is the smallest unit of data comprised of just {0,1}
- 1 nibble (-) = 4 bits (cutesy term with limited usage; mostly bitfields)
- 1 byte (B) = 8 bits (you could also say 2 nibbles)

QUANTITY OF INFORMATION

- Used to express storage capacity:

1. International Electrotechnical Commission (binary system)
   - 1 kibibyte (KiB) = 1,024 B = 1,024^1 B = 1,024 B
   - 1 mebibyte (MiB) = 1,024 KB = 1,024^2 B = 1,048,576 B
   - 1 gibibyte (GiB) = 1,024 MB = 1,024^3 B = 1,073,741,824 B
   - 1 kibibit (Kib) = 1,024 b = 1,024^1 b = 1,024 b
   - 1 mebibit (Mib) = 1,024 Kb = 1,024^2 b = 1,048,576 b
   - 1 gibibit (Gib) = 1,024 Mb = 1,024^3 b = 1,073,741,824 b…

QUANTITY OF INFORMATION

- Used to express commercial storage capacity:

2. International System of Units (decimal system)
  - 1 kilobyte (KB) = 1,000 B = 1,000^1 B 1,000 B
  - 1 megabyte (MB) = 1,000 KB = 1,000^2 B = 1,000,000 B
  - 1 gigabyte (GB) = 1,000 MB = 1,000^3 B = 1,000,000,000 B
  - 1 kilobit (Kb) = 1,000 b = 1,000^1 b 1,000 b
  - 1 megabit (Mb) = 1,000 Kb = 1,000^2 b = 1,000,000 b
  - 1 gigabit (Gb) = 1,000 Mb = 1,000^3 b = 1,000,000,000 b
- *kbps* = kilobits per second → data rates

QUANTITY OF INFORMATION

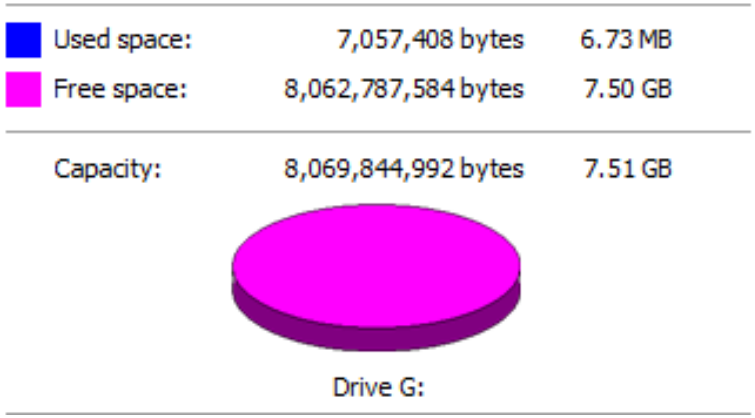
- GB: hardware, memory stick, etc.
- GiB: CD, DVD, etc.
- Commercial: bit
- Internal representation: Byte
- Speed of download/upload: … Mbps
- Speed of data processing:
  - MIPS = millions of instructions per second
  - FLOPS = FLoating-point Operations Per Second
    - Microprocessors had 4 FLOPS/cycles ⟶ 2.5GHz = 10 billion FLOPS = 10 GFLOPS

- 1 byte = one letter
- 1 KB = 1000 letters
- 1 CD = 650 MB / 700 MB
- Flash memory GB: 2GB – 128GB

8069844992 + 7057408 = 8076902400

GiB: $8076902400/(2^{30}) = 7{,}52$ GiB

GB: $8076902400/(10^{9}) = 8{,}08$ GB

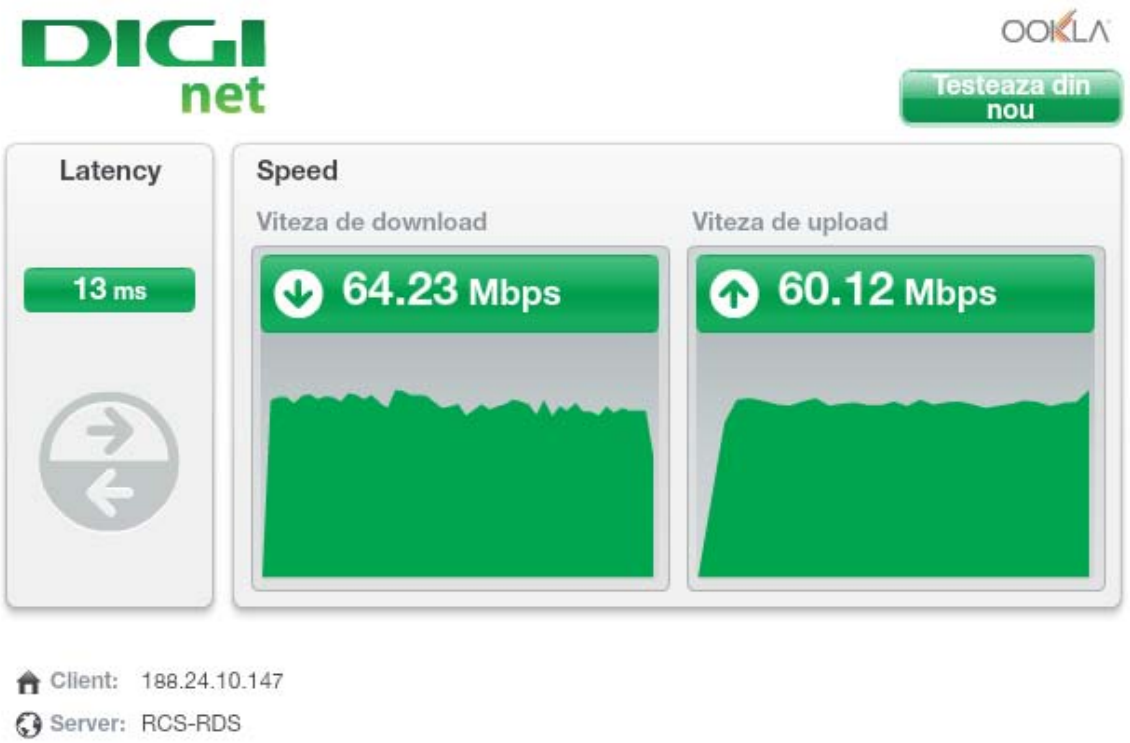


- Data transfer rate: the amount of data transferred over a period of time through a transfer medium (cablu, optic fiber, etc.)

B/s	Bytes per second
KB/s	Kiloyte pe secundă
MB/s	Megabyte pe secundă
GB/s	Gigabyte pe secundă
TB/s	Terabyte pe secundă

» bandwidth*:* **bit/s**

Speed



Last Result:
Download Speed: **64231** kbps (8028.9 KB/sec transfer rate)
Upload Speed: **60115** kbps (7514.4 KB/sec transfer rate)
Latency: **13** ms
Jitter: **3** ms
3/10/2015, 9:33:13 PM

Speed of image processing

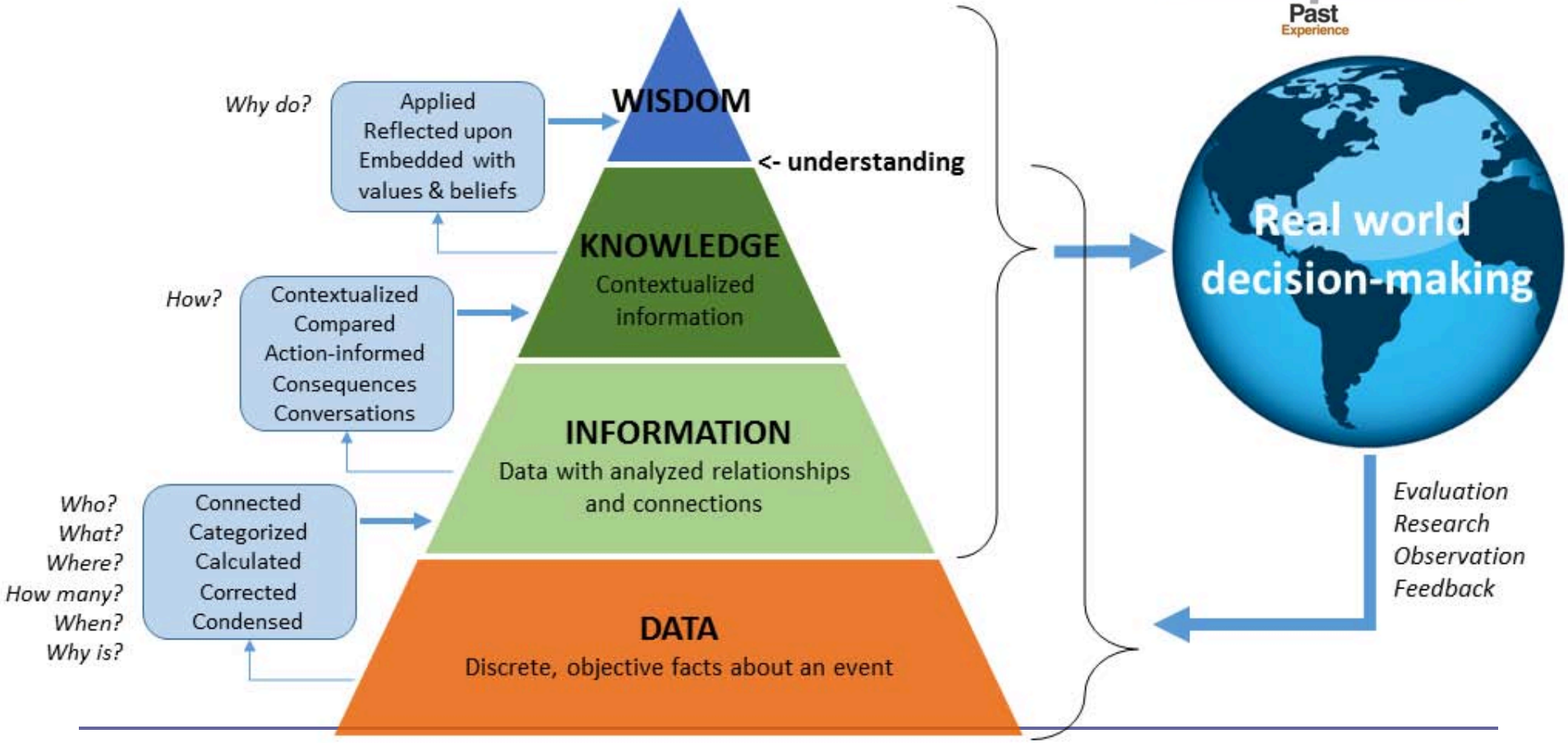
- Image:
  - 4.31 MB (dimension) = 4.31*1024 KiB = 4413.44 KiB
  - Speed of data transfer 50 Mibps = 6.25 MiBps = 6.25*1024 KiBps = 6400 KiBps
  - Image download time = 4413.44 / 6400 = 0.6896 s
- Video:
  - 175080 KiB (dimension)
  - Download time: 175080/6400 = 37.36 s

BASIC CONCEPTS

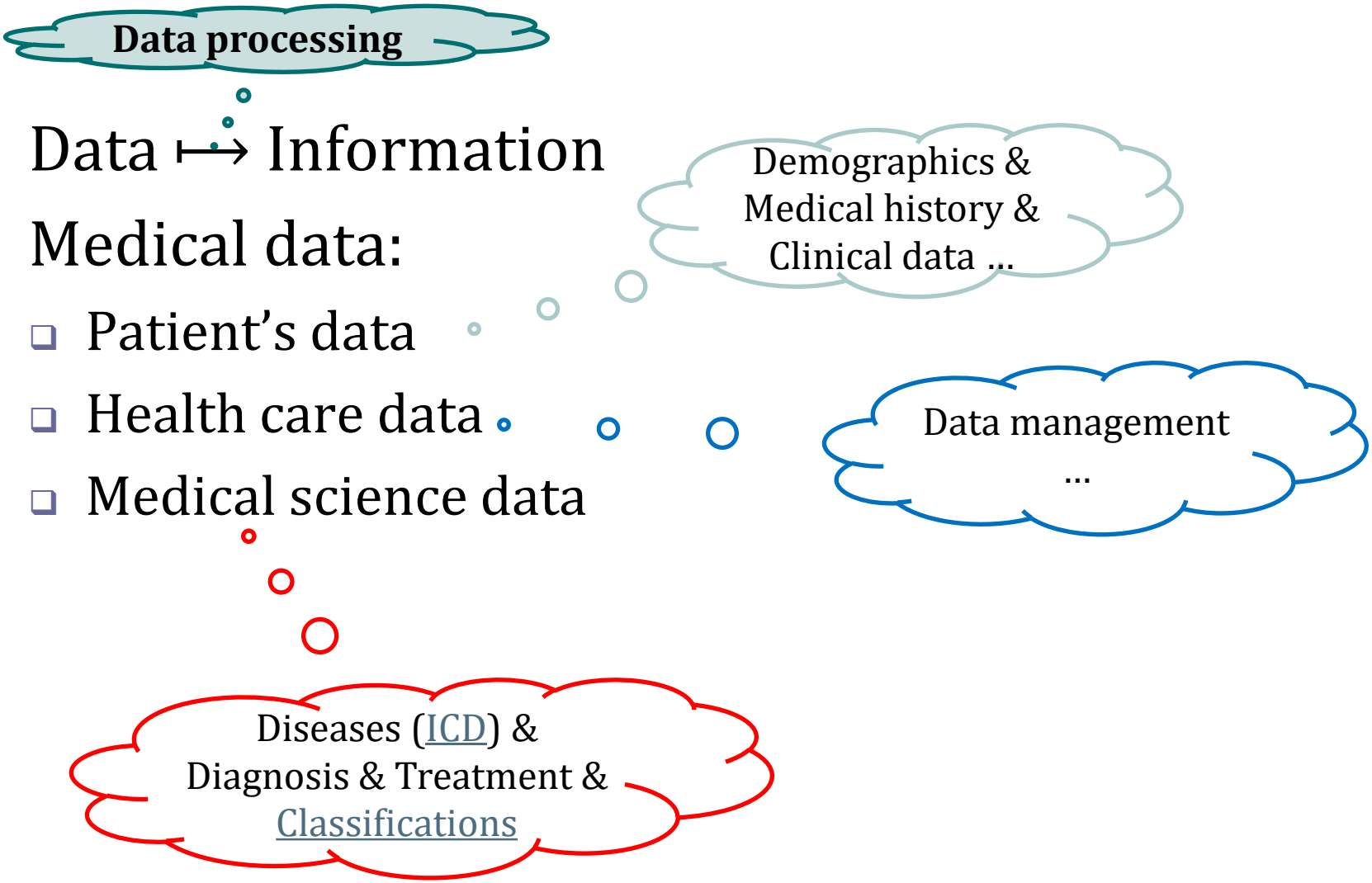
- Data (datum) = a single piece of information, as a fact, statistic, or code; an item of data.
  - When data are processed, organized, structured or presented in a given context so as to make them useful, they are called **Information.**
- Information = consists of facts and data organized to describe a particular situation or condition

  "who", "what", "where", and "when"
- Knowledge = consists of facts, truths, and beliefs, perspectives and concepts, judgments and expectations, methodologies and know-how ("how")
  - Knowledge is accumulated and integrated and held over time to handle specific situations and challenges.

DATA – INFORMATION – …



INFOTMATION ≠ DATA



DATA

- Symbol set that is quantified and/or qualified.
- It simply exists and has no significance beyond its existence (in and of itself).
- It can exist in any form, usable or not.
- It does not have meaning of itself.
  - Example:
    - a spreadsheet generally starts out by holding data
    - data are the coded invariance

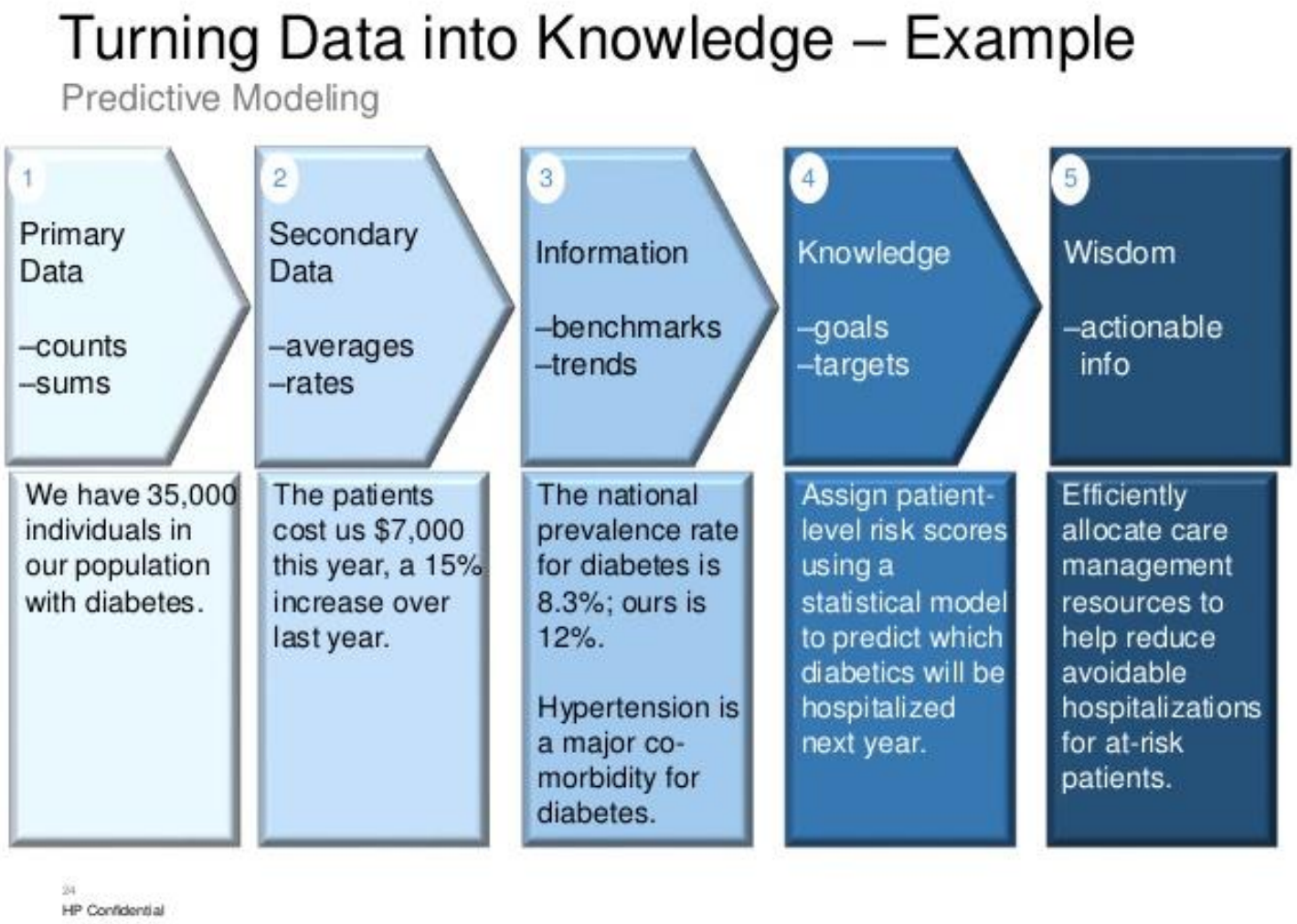
INFORMATION

- Data that are processed to be useful
- Provides answers to "who", "what", "where", and "when"
- Data that has been given meaning by way of relational connection. This "meaning" can be useful, but does not have to be.
- Is related to meaning or human intention
  - Example:
    - a relational database makes information from the data stored within it
    - the contents of databases, the web etc.

KNOWLEDGE

- application of data and information
- answers "how" questions
- is the appropriate collection of information, such that it's intent is to be useful.
  - Knowledge is a deterministic process.
  - **Knowledge** is embodied in humans as the capacity to understand, explain and negotiate concepts, actions and intentions.

FROM DATA TO KNOWLEDGE IN MEDICINE



Data, Constant, Information, Knowledge?

- Constant = something that does not or cannot change or vary

AIDS Res Treat. 2012;2012:940580. Epub 2012 Sep 17.

Morbidity and Mortality Patterns of Hospitalised Adult HIV/AIDS Patients in the Era of Highly Active Antiretroviral Therapy: A 4-year Retrospective Review from Zaria, Northern Nigeria.

Ogoina D, Obiako RO, Muktar HM, Adeiza M, Babadoko A, Hassan A, Bansi I, Iheonye H, Iyanda M, Tabi-Ajayi E.

Department of Medicine, Niger Delta University, PMB 071, Amassoma, Bayelsa State, Nigeria ; Department of Medicine, Ahmadu Bello University Teaching Hospital, PMB 06, Zaria, Kaduna State, Nigeria.

Abstract

Background. This study, undertaken in major tertiary hospital in northern Nigeria, examined the morbidity and mortality patterns of hospitalised adult HIV/AIDS patients in the HAART era. Methods. Between January 2006 and December 2009, admission records and causes of deaths of hospitalised medical HIV-infected patients were retrieved and analysed according to antiretroviral (ART) status. Results. Of the 207 HIV/AIDS patients reviewed, majority were newly diagnosed (73.4%), and most were hospitalised and died from various AIDS-defining illnesses, mainly disseminated tuberculosis and sepsis. Immune-inflammatory-reconstitution-syndrome, ART-toxicity and ART-failure, contributed to morbidity and mortality in patients receiving ART. Sixty six (31.9%) patients died, with higher mortality in males and in those with lower CD4-cell count, lower PCV, and shorter hospital stay. However, hospital stay ≤3 days and severe anaemia (PCV < 24%) were independent predictors of mortality. Conclusion. In the current HAART era, late presentation and tuberculosis continue to fuel the HIV/AIDS pandemic in Africa, with emerging challenges due to ART-related complications.

Data
= one patient

The rate of incidence of a disease

death

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highly active antiretroviral therapy

Information

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Knowledge

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DATA OR INFORMATION ?

- http://www.nature.com/ebd/journal/v12/n1/pdf/6400780a.pdf

Question: Is there a relationship between coffee and tea intake and head and neck cancers?

Results Caffeinated coffee intake was inversely associated with the risk of cancer of the oral cavity and pharynx: the ORs were 0.96 (95% CI, 0.94–0.98) for an increment of one cup per day and 0.61 (95% CI, 0.47–0.80) in drinkers of >4 cups per day versus non-drinkers. This latter estimate was consistent for different anatomic sites (OR, 0.46; 95% CI, 0.30–0.71 for oral cavity; OR, 0.58; 95% CI, 0.41–0.82 for oropharynx/hypopharynx; and OR, 0.61; 95% CI, 0.37–1.01 for oral cavity/pharynx not otherwise specified) and across strata of selected covariates. No association of caffeinated coffee drinking was found with laryngeal cancer (OR, 0.96; 95% CI, 0.64–1.45 in drinkers of >4 cups per day versus non-drinkers). Data on decaffeinated coffee were too sparse for detailed analysis, but indicated no increased risk. Tea intake was not associated with head and neck cancer risk (OR, 0.99; 95% CI, 0.89–1.11 for drinkers versus non-drinkers).

Data representation

- Number:
  - Integer: …
  - With decimals: …
- Dichotomial: …
- Text: diagnosis, indications, protocols
- Data and time: mm/dd/yy
- Image: **dicom**
- Video: avi, wmf,

TASK

- Look at the following 3 abstracts:
  - http://www.ncbi.nlm.nih.gov/pubmed/24069382
  - http://www.ncbi.nlm.nih.gov/pubmed/24049294
  - http://www.ncbi.nlm.nih.gov/pubmed/23956899

- and identify:
  - Variable
  - Data
  - Information
  - Knowledge

Thank you for your attention!