A data structure for decision support systems, medical expert systems and clinical decision making

Carl-Fredrik Bassøe

The Norwegian Center for Electronic Medical Records, Institute of Neuroscience, Faculty of Medicine, University of Trondheim, the PROMED Institute, Bergen, Norway and the Department of Information Science and Media, Faculty of Social Sciences, University of Bergen, Norway.

ABSTRACT

- The International Classifications of disease (ICD10) is normalized.
- The emerging relational database containing disjunctive entities.
- The hierarchal structures of the etiology and anatomy are implemented.
- The database enables the construction of diagnoses according to the equation d:=e+o+p, where e, o and p are variables holding names of a etiology, organ and pathogenesis, respectively, and d is the emerging diagnosis.
- The data structure and d:=e+o+p implement a combinatorial classification and allow structured clinical decision making.

NORMALIZATION OF ICD10

- A text file containing the ICD10 classification was used.
- ICD10 was normalized semiautomatically.
- Normalization is based on the identified functional relationships between words in the diagnoses, prefixes and suffixes.
- Diagnoses are tagged.
- Word stems are extracted using pre- and suffixes.

CREATING ENTITIES

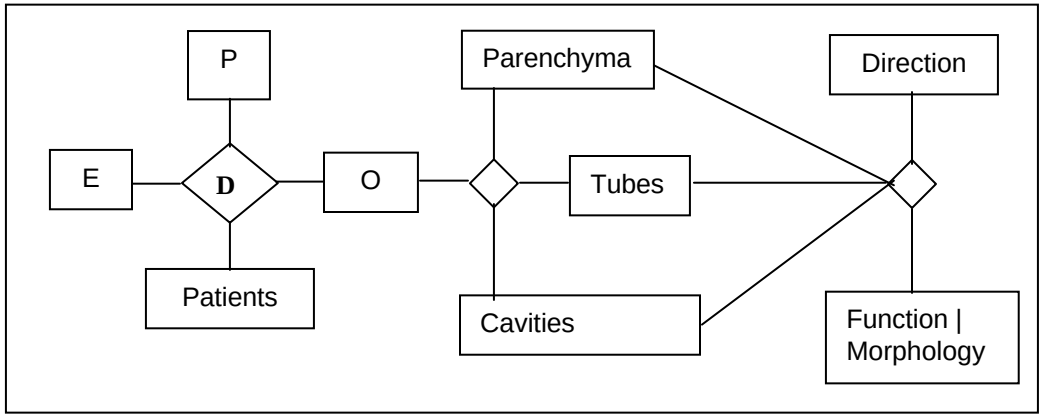
- The words are sorted onto entities related to the standard clinical curriculum: (pathological)anatomy, (patho)physiology, clinical chemistry, etc.

- This led to a database schema called a combinatorial classification which is implemented in a Microsoft Access database.

ENTITIES IN THE COMBINATORIAL CLASSIFICATION

- Etiology
- Regions
- Functions and morphology of the general organ divided on
  - parenchyma
  - tubes
  - slits and cavities
- Organs
- Pathogenesis
- Cells
- Subcellular organelles
- Direction of change
- Time course
- Degree

ENTITITY RELATIONSHIP DIAGRAM FOR THE COMBINATORIAL CLASSIFICATION



Entity-relationship (ER) diagram modeling diagnoses or diseases (D), showing the relations of d to the etiology (E), organs (O) and pathogenesis (P). Organ is decomposed into the organ parts cells, tubes and cavities. These subcategories combine with the direction and function or morphology to make out a diagnosis.

In the combinatorial classification diagnoses D are also related to patients.

THE EQUATION FOR CONSTRUCTING DIAGNOSES

- Let
  - e=“bacterial “
  - o=“myocard”
  - p=“itis”
- Then the equation d:=e+o+p gives rise to the diagnosis:

d=“Bacterial myocarditis”

USING THE COMBINATORIAL CLASSIFICATION TO CONSTRUCT DIAGNOSES

1. An application was developed to construct diagnoses.

2. The combinatorial classification gave access to the names and word stems of a wide variety of etiological agents, pathogenetic mechanisms, organs, etc.

3. Elements from the combinatorial classification were assigned to the variables in an extended version of d:=e+o+p.

4. Diagnoses were automatically constructed from elements in the entities and d:=e+o+p.

Accordingly, by steps 1-4 construction of diagnoses is algorithmic.

CLINICAL DECISION MAKING (CDM)

- Symptoms and signs from elements within each entity are (largely) disjunctive from each other (unpublished observation).

- Using d:=e+o+p to guide CDM largely eliminates the problem of overlapping sets of symptoms, signs and laboratory findings.

FUTURE OF THE COMBINATORIAL CLASSIFICATION

- Standard classifications (ICPCs, ICDs, SNOMEDs, DSMs) are steadily revised and clinical results using them are difficult to compare over years.
- The combinatorial classification is directly based on a socio-psycho-biological model of healthy and diseased individuals.
- The combinatorial classification needs no alphanumeric codes.
- A huge number of diagnoses that can be constructed by d:=e+o+p. The emerging diagnoses cover all the above mentioned classifications.
- The combinatorial classification needs to be continuously extended as medical knowledge increases, but will not require revision.
- Accordingly, the combinatorial classification is a promising tool for future clinical decision making and medical classification.