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Clinical Decision Support Systems

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Medical practice is decision making!

Types of decisions in medicine:

Diagnosis

Diagnostic process

Management of treatment

Resource management in a hospital administration

Requirements for decision making

Accurate data: adequate and correct, but not excessive

Pertinent knowledge: accurate, up-to-date, critical reasoning

Appropriate problem solving skills: deciding goals, reason for goals, personal experience

Role of computers in decision support

Clinical decision support system: three types

Tools for information management, e.g. health care information systems, information retrieval systems

Tools for focusing attention, e.g. clinical laboratory systems flagging abnormal values

Tools for providing patient- specific recommendations, e.g. differential diagnosis prompters, treatment recommendations

History

1950s: first theoretical articles dealing with decision support

1960s: first experimental prototypes

1970s: three advisory systems:

- Leeds abdominal pain system (deDombal 1972)
- MYCIN for selection of antibiotic therapy (Shortliffe 1976)
- HELP for inpatient medical alerts (Warner 1979)

1990s: Creation of special programming language: Arden syntax

Initially largely ignored by medical community, until microcomputers spread, understanding for technology grew, incorporation of large data amounts became standard, fiscal pressure to exercise cost- conscious medicine

Dimensions of decision support systems

The system's intended function

Mode by which advice is offered

Consultation style

Underlying decision making process

Human- computer interaction

System function

Two basic categories:

Decision of what is **true** about a patient

Decision of what to **do** about a patient

Mode of advice

Passive support: practitioner must come to computer

Active support: computer alerts practitioner

Style of communication

Consulting model: system works as advisor to physician

Critiquing model: physician makes plan, system judges

Underlying decision making process

Simplest form: flowcharts

Rarely used techniques: mathematical modeling; pattern recognition, statistical analysis of databases

Common methods based on Bayesian modeling, decision analysis, artificial neural networks, and artificial intelligence.

Human- computer interaction

Quality of interface decides whether system is accepted by user or not!

User should be able to predict the outcome of his interactions, and must be able to undo them

Ideally, decision support should be embedded in larger system that is already in use, e.g. lab data viewer

Must be easily and quickly accessible

Must be connected to other patient related databases

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Construction of decision support tools

Acquisition and validation of patient data: very demanding task! Input techniques have specific limitations, no standardized form to describe most clinical situations in a computer- understandable way, and data may be incomplete.

Modeling of medical knowledge: input relevance, concept identification and interrelationship, identify correct problem solving technique

Elicitation of clinical knowledge: knowledge base maintenance directly interacting with specialists or automatic, of high importance.

Representation of and reasoning about medical knowledge: encoding of medical knowledge a major problem, interpretation so far not matching human qualification.

Validation of system performance: Problem of updating databases, who takes responsibility, expert disagreement.

Integration of decision support tools: decides on success of decision support.

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In house example: the EDTU project

Setting: nurse run ward, catering for patient with predefined symptom complexes or diseases.

Task: integrate incoming patient data with treatment algorithms based on best- practice guidelines, provide decision support for nurses, give easy monitoring capacity to doctors.

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Expert System @ EDTU

Bed 1 | Bed 2 | Bed 3 | Bed 4 | Bed 5 | Bed 6 | Bed 7 | Bed 8 | Patient History Review

NRIC | Registration No. | Date

Name | Age | Gender | Diagnosis

History | Lab Results | BP/HR/SpO2 | ECG | Load | Print

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Legal and regulatory questions

In the US, question whether decision support covered by negligence law (“reasonable safety”) or liability law (“must not be harmful”).

Who is liable for quality of guidelines? Creators of resources, or doctors using them?

How to evaluate quality of of decision support systems?

How to guarantee patient privacy when transferring data?

Trends in decision modeling

Advent of treatment guidelines motivates use of decision support systems.

Component libraries for diagnosis tools, treatment guidelines will be created using unified language.

WWW allows knowledge distribution at growing speed.

Education via computing allows decision making based on increased knowledge.

Questions you should know to answer

What types of decisions are to be considered in a medical setting?

What are requirements for a decision- making systems?

What are the decision- support roles for computers in medicine?

What is a knowledge based system?

What influences account for the gradual acceptance of decision support systems by clinicians?

What legal and regulatory barriers can affect distribution of decision support systems?