EHRs and clinical decision support through knowledge-based systems

- Patient’s medical data:
  - Symptoms
  - Signs
  - Test results
  - Clinical findings
  - Biosignals
  - Images
  - Diagnoses
  - Therapies
  - Nursing data
  - Standardization
  - Telecommunication
  - Chip cards

- Physician’s medical knowledge:
  - Anatomy
  - Biochemistry
  - Physiology
  - Pathophysiology
  - Pathology
  - Nosology
  - Therapeutic knowledge
  - Disease management

- Medical decision support:
  - Induction:
    - Many patients ➔ General knowledge
  - Deduction:
    - Single patient ➔ General knowledge

- Knowledge systems:
  - Medical statistics
  - Clustering & classification
  - Data & knowledge mining
  - Machine learning

- Integration:
  - Telemedicine

- Medical knowledge acquisition:
  - By clinicians
  - + Knowledge engineers

- Subjective experience:
  - Intuition
Clinical decision support for patient safety and quality assurance

patients’ structured medical data: EHRs (local, national), Apps, ...

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<th>Diagnostic support</th>
<th>Therapy advice</th>
<th>Hospital management and quality benchmarking</th>
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<tr>
<td>• alerts, reminders, to-do lists</td>
<td>• drug alerts, reminders, calculations</td>
<td>• evidence-based reminders and processes</td>
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<td>• clinical interpretation, (tele)monitoring</td>
<td>• indication, contraindications,</td>
<td>• computerized clinical guidelines, protocols,</td>
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<td>• differential diagnostics</td>
<td>redundant medications, substitutions</td>
<td>standard operating procedures</td>
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<td>– rare diseases, rare syndromes</td>
<td>• dosage calculations, drug-drug interactions,</td>
<td>• healthcare-associated infection surveillance</td>
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<td>– further or redundant examinations</td>
<td>adverse drug events</td>
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<td>– diagnostic completeness (multi-morbidity)</td>
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<td>• consensus-criteria-based evaluations</td>
<td>• management of antimicrobial therapies, susceptibility and resistance rates</td>
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<td>– disease classification and surveillance criteria</td>
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<td>Provided by MUV medexter clinical decision support</td>
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Hospital management and quality benchmarking

structured medical knowledge: rules, tables, trees, guidelines, scores, algorithms, ...
studies in Colorado and Utah and in New York (1997)
  - errors in the delivery of health care leading to the death of as many as 98,000 US citizens annually

causes of errors
  - error or delay in diagnosis
  - failure to employ indicated tests
  - use of outmoded tests or therapy
  - failure to act on results of testing or monitoring
  - error in the performance of a test, procedure, or operation
  - error in administering the treatment
  - error in the dose or method of using a drug
  - avoidable delay in treatment or in responding to an abnormal test
  - inappropriate (not indicated) care
  - failure of communication
  - equipment failure

prevention of errors
  - we must systematically design safety into processes of care