Medical Informatics

- Intersection of medicine and computing
- Plus theory and experience specific to this combination
- =Medical Computing, ~Health Informatics
- Science
- Applied science
- Engineering

Outline

- MI defined by goals and methods of health care
- Medical data: essential
- Expertise (methods)
  - Procedural
  - Inferential
  - Causal
  - Probabilistic

The Medical Cycle

Care Processes

- Data: instrumentation, monitoring, telemetry
- Information: interpretation, filtering, sampling, smoothing, clustering
- Diagnosis: inference, model-based reasoning, classification
- Prognosis: prediction, natural course, experience
- Therapy: planning, predicting effects, anticipating

Meta-level processes

- Acquisition and application of knowledge
- Education
- Quality control and process improvement
- Cost containment
- Reference (library)
Time scale in medicine

- Cure—usually acute illness
- Manage—long-term, chronic illness
- Prevent
- Predict (especially based on genetics)

WHO Constitution defines “health”

“a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”

- Physical
- Mental
- Social
  —very hard to measure

Distribution of Ages

- Life table deaths by year
  (Japan, 1989)

Life table death rates by age

Life table cohort survival

Measures of Health

- Longevity at birth (CIA World Fact Book, 2001)
Intro to Medical Informatics

Causes of death
(industrialized countries, 1989)

<table>
<thead>
<tr>
<th>Causes of Death</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory system</td>
<td>48%</td>
</tr>
<tr>
<td>Malignant neoplasms</td>
<td>19%</td>
</tr>
<tr>
<td>Accidents</td>
<td>7%</td>
</tr>
<tr>
<td>Others</td>
<td>26%</td>
</tr>
</tbody>
</table>

Quality of life

- Value of a total life depends on
  - Length (assume now is \(N\))
  - Quality (\(q\)) over time
  - Discounts (\(g\)) for future or past (depends very much on what the value is to be used for)

\[ V_N = \int_{t=0}^{T} q(t) g(t-N) \, dt \]

Modeling life quality

- Aggregation of individual qualities
  + Equity (distributions)

- Is more better? (Population control.)
- Is less better?
- How much to spend?

Top 10 Chronic Conditions
Persons aged 65


Societal quality of life

- Aggregation of individual qualities
  + Equity (distributions)
Aggregation

- Trend: social aggregation leads to decisions at a larger scale
  - Multi-specialty providers
  - Government guarantees and mandates
  - Risk sharing
  - Oregon-wide spending “optimization”;
  - British NHS

Changing Context of Health Care

- Fee-for-service
- HCFA (Health Care Financing Agency) pays for Medicare
- Capitation
  - HMO’s (Health Maintenance Organizations) take overall responsibility to care for patient for fixed fee
  - Pushing risk down to the physician or group

Determining Factors:

- Exponentially growing expense of health care
  - More healthcare than steel in GM cars
  - Increased demand
    - Much more possible
    - Better tests, therapies
    - High human motivation
  - No pushback
  - Waste
    - Unnecessary procedures
    - ½ of health expenses in last year of life
    - Marginally useful procedures
    - Defensive medicine
    - Bad Medicine

Managed Care