

## Medical Informatics

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

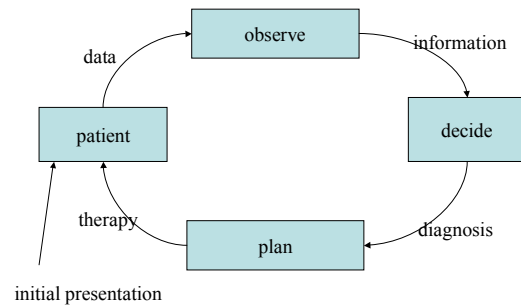
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## Outline

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

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## The Medical Cycle



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## 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

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## Meta-level processes

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

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### Time scale in medicine

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

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### 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

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### Distribution of Ages

- Life table deaths by year (Japan, 1989)

### Life table death rates by age

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### Life table cohort survival

US SSA 1997  
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### Measures of Health

- Longevity at birth (CIA World Fact Book, 2001)

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### Causes of death

(industrialized countries, 1989)

Circulatory system	48%
Malignant neoplasms	19%
Accidents	7%
Others	26%

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### 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)

$$V_N = \text{Integral}_{[t=0, T]} q(t) g(t-N) dt$$

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### Modeling life quality

Figure 5.1. Four Hypothetical Survival Scenarios Showing Survival from Death, onset of Disease, and onset of Disability.

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### Top 10 Chronic Conditions Persons aged 65

U.S. Nat'l Ctr Health Stat, *Vital and Health Statistics*, 1985 (1982 data)

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### Societal quality of life

- Aggregation of individual qualities
- + Equity (distributions)
  
- Is more better? (Population control.)
- Is less better?
- How much to spend?

## 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

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## 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

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## Determining Factors:

\$ £ € ¥ R

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## 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

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## Managed Care

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