Population health, need for hospital care & implications for hospital planning

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&

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How can we measure/express population health?

- Disease onset
- Death among these patients
- Premature mortality

Birth ➔ Full Health ➔ Partial Health ➔ Disease (Stage and Severity) ➔ Premature mortality

(max./avg.)

Life expectancy

Life expectancy 1541 1891 1991
How can we measure/ express population health?

= Health-Adjusted Life Expectancy

Birth → Full Health

Disease onset → Partial Health

Death among these patients

Disease (Stage and Severity)

Premature mortality → (max./ avg.) Life expectancy

Years lived with Disease/Disability (YLD)

Years of Life Lost due to premature mortality (YLL)

= Disability-Adjusted Life Years (YLD + YLL)
Concept of Disability-adjusted Life Years (DALYs)

- Take a societal perspective
- Aim to measure the burden of disease
- Integrate both mortality and morbidity
- Years of Life of Life (YLL) lost are determined in relation to the calculated maximum life expectancy (currently 86.6 years)
- Disability weights were originally determined by experts – but 2010 Global Burden of Disease (GBD) study updated weights to include surveys about 220 health states
- Based on assumption that one year in full health is as good as two years in a health state with a weight of 0.5
- Disability weights are multiplied with prevalence → YLD
Global Burden of Disease: YLL, 2016, % by cause

http://vizhub.healthdata.org/gbd-compare/
Global Burden of Disease: YLD, 2016, % by cause

http://vizhub.healthdata.org/gbd-compare/
Global Burden of Disease: DALYs, 2016, % by cause

http://vizhub.healthdata.org/gbd-compare/
Development of DALYs/100,000 over time

All causes
Both sexes, All ages

Global -30%
DE -10%
DK -20%
NO -30%

Western Europe
High-income
Global
Germany
Denmark
Norway

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But 100 DALYs could mean
- 1,000 persons with 0.1 DALY each
- 100 persons with 1 DALY each
- 10 persons with 10 DALYs each

→ same overall burden of disease in population
but very different severity per person (medical view)
Another way of looking at population health (and associated costs)

- 23% of the population uses 81% of the resources of the Regional Health System.

- 1% of the population uses advanced chronicity, with care burden 12.9.
- 3% use complex chronicity, with care burden 6.2.
- 19% have multiple non-complex pathologies, with care burden 2.3.
- 20% have a single pathology or non-complex condition, with care burden 0.7.
- 36% have costs without diagnosis detected in the system, with care burden 0.2.
- 21% neither have a diagnosis nor costs detected in the system.
But neither high burden of disease (DALYs) nor severity mean that health system/ care can make a difference … need to look for something more specific

Environment, e.g. occupational work

Lifestyle, risk factor prevalence

Socio-economic status/ health literacy

Overall mortality/Deaths
Life expectancy

Health care delivery
... diagnoses where health system/ care makes a difference: “avoidable mortality”

Environment,  
e.g. occupational work

Lifestyle,  
risk factor prevalence

Socio-economic status/    
health literacy

Health care delivery

Overall mortality/Deaths  
Life expectancy

Avoidable/Amenable mortality
Concept of Avoidable Mortality

- Mortality from certain causes of death, where death is avoidable according to current medical knowledge, practice and public health interventions in a defined age/sex group of the population, developed by Rutstein et al. 1976, Charlton 1983

- List of avoidable deaths based on expert opinion and consensus

- Used as a measure of health system performance

- These deaths are interchangeably referred to as “avoidable” or “amenable to health care” in the literature.
But how does the health system make a difference? The performance assessment framework

→ Both population health outcomes and responsiveness are the multiplicative effect of accessibility and quality: High accessibility but bad quality as well as low accessibility but high quality lead, on the population level, to inferior outcomes.
The performance assessment framework

Access(ibility) incl. financial protection

Quality (for those who receive services)

Population health outcomes (system-wide effectiveness)

Responsiveness
The performance assessment framework

**Access(ibility)**
incl. financial protection

**Quality**
(for those who receive services)

**Responsiveness**

**Population health outcomes**
(system-wide effectiveness)

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Behavioural/ Metabolic/ Environmental
Non-health care determinants of health

Burden of Disease (YLL + YLD = DALY)

Amenable to health care = “Need”

Not (yet) amenable to health care

Need reduction through successfully addressing amenable causes

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Access(ibility)

**Need** (by socio-economic status, ethnicity/ migration status etc.)

- Coverage (financial issues)
- Availability of care
- Waiting, acceptability etc.

Unmet need → Realised access → Unmet need

\[ \text{x Quality} = \text{Outcomes} \]
HOW CAN WE ASSESS THE QUALITY OF AMBULATORY CARE?
A major patient-relevant outcome: Not being hospitalised in case of chronic conditions ("avoidable hospital admissions", here: diabetes)

7x rate in Italy
HOW CAN WE ASSESS THE QUALITY OF INPATIENT CARE?
AMI lethality of inpatients ... during hospitalisation only

To get a sense of dimensions: DE has 200.000 AMI hospitalisations / year → 8.000 more deaths compared to NO

... and including the more relevant first 30 days

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Extending the time horizon to 5 years for cancer patients

6.34. Breast cancer five-year net survival, 2000-2004 and 2010-2014

Note: 95% confidence intervals have been calculated for all countries, represented by grey areas. Expected updates in the data may reduce the survival estimate for Costa Rica.

1. Data with 100% coverage of the national population.

Source: CONCORD programme, London School of Hygiene and Tropical Medicine.

10.9% die within 5 years

26.5% die within 5 years
Why does quality differ between countries?
An important factor is clinical personnell, in numbers … (2006)
Why does quality differ between countries?
An important factor is clinical personnel, in numbers ... (2015)
Hospital mortality for STEMI patients with PCI, differentiated for patients with and without physician-escorted EMS in %

- STEMI patients with PCI (p=0.020) + 60%
- With physician-escorted EMS (p=0.128) + 40%
- Without physician-escorted EMS (p=0.066) + 90%

Hospital size (or rather: number of patients treated with a certain condition) also makes a big difference

Implication for hospital planning:
- 500 patients/day in Germany (1/160.000 pop.)
  --> 330 to 500 hospitals (1-1.5 pat./day) would be optimal for quality

Implication for hospital planning:
- 55.000 patients/year (1/1.500 pop.)
  --> 370-550 hospitals (100-150 pat./year) would be optimal

The performance assessment framework

Trade-off between access(ibility) and quality...
leading to very different hospital structures
In 2000, 56 acute care hospitals (1/100,000 pop.), currently 26 (1/220,000) – goal: 21, i.e. 1 per 270,000 (in Germany: 1/70,000)!