MPIDR-NES Training Programme

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Population and Health

Лекция 4. Таблицы, совмещающие смертность и здоровье

Lecture 4. Life tables combining health and mortality

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РЭШ
Российская экономическая школа

The life table plus health

- Approaches to measuring health: morbidity, disability, quality of life
- Health survey data on prevalence of various health states
- The Sullivan‘s health expectancy: estimation and interpretation
- Examples of substantive study results
- Cancer registers
- A simple disease model with no recovery and the corresponding increment/decrement LT

Measuring health: morbidity

Diagnosed morbidity: pathology diagnosed by medical personnel, routinely recorded or confirmed by medical documents.
Shortcomings – dependence on availability of specialized medical care, people's attention to their own health, quality of morbidity registration ...

Measured morbidity: pathology diagnosed by objective and standardized medical examination. Surveys including bio-medical measurements: the US National Health Examination Survey, National Health and Nutrition Examination Survey, health examination surveys in Canada, Germany, Finland, EU etc. Rapidly growing research area.
Shortcomings – expensive, difficult to conduct at national level. Limited to diseases that can be diagnosed by simple and noninvasive methods. Hardly applicable to mental health.

Reported morbidity: from interviewing individuals. Influenced by many subjective factors. Can be useful to learn about some easily detectable health events and diseases. Batteries of questions to detect particular symptoms (chest pain with G.Rose's angina). Valuable for detection of mental disorders (Mini-mental State Examination by Folstein).

Measuring health: disability

Disability is defined as inability or limitation in carrying out the activities and social roles related to work, the family, and an independent life.

Functional limitation – a difficulty or inability in mobilizing body functions (to walk, extend an arm, hear, remember).

Activity restrictions – individual‘s dysfunction in respect to daily activities (personal care, household activities, work).

Interview instruments: physical performance – walking 500 meters, going upstairs, seeing printed characters in a newspaper; ADLs (activities of daily living) -- feeding themselves, dressing and undressing, showering&bathing, etc.; IADLs (instrumental ADLs)—doing housework, preparing meals, keeping the accounts.

Memory tests – recalling 12 words (immediately and a few minutes later), recalling names and dates.

Simple physical performance tests – balance, grip strength, standing up without using arms, hearing tests, acuity tests.

Measuring health: perceived health and quality of life

This aspect of health measurement corresponds to the subjective perception of one‘s physical, mental, emotional, and vitality status.
Mostly addressed by standardized batteries of questions. The set of answers to these questions is to be evaluated by summary scores. General Health Questionnaire (GHQ), multi-purpose, short-form health survey (SF-36).

Main areas of quality of life:
1.Symptoms.
2.Functional status.
3.Activities related to the social role.
4.Social functioning
5.Cognition.
6.Sleep and rest
7.Energy and vitality
8.Emotional status
9.Perception of health
10.General satisfaction with life

The most used questions: general health, morbidity, disability

How is your health in general?
(Very good, Good, Fair, Bad, Very Bad)

Do you suffer from long standing illness or condition? (Yes/No)

For at least the past 6 months, have you been limited (because of some health problems) in activities people usually carry out? (Yes/No)

Potential problems with self-reported data

1. An individual's health perceptions may vary over time (and countries) whilst their objective health does not:

- there may be cultural differences in the propensity to feel oneself in good health or in bad health;
- if over the whole population health has improved people may be less likely to tolerate their health problems and report them more systematically when they would not have mentioned them in the past;
- improving the environment can help people with disability to be more active and feel and report less disability.

2. Problems related to the coverage of health surveys:

- Response rates may differ over time and countries. In some countries non-respondents may mostly be the frail and ill, in others it may be the healthy who don't have time to answer surveys.
- Many surveys *do not include* people in institutions. This is very important for old ages as there may be a high proportion in institutional care. These proportions vary from country to country, therefore international data (e.g. SHARE survey) are not always comparable.

Concept of healthy life expectancy

Conventional LT and life expectancy distinguish between two states: being alive or being dead. With general lowering of mortality and increasing numbers of survivors to old ages it becomes more important to know about health and morbidity of the survivors. Does the lengthening of life means longer period of health and activity or it just leads to longer period of disability and pain? During what time the survivors are able to think, act, take care of themselves, and to produce?

This crucial issue is addressed by a measure of expected length of life in good health, length of life free of serious illness, disability or handicap that is known as healthy expectancy.

Computation of the Sullivan's health expectancy (or health adjusted life expectancy – HALE)

A simple and elegant idea proposed by Sullivan in a working paper of 1971: to weight the LT cohort's lifetime by coefficients of prevalence of „healthy" individuals in corresponding real population.

Sullivan D.F. A single index of mortality and morbidity: HSMHA Health Reports, 86: 347-354.

$$e_x = \frac{1}{l_x}\sum_{y=x}^{\omega} L_y,$$

- conventional LE

$$eH_x = \frac{1}{l_x}\sum_{y=x}^{\omega} L_y(1-\pi_y),$$

- expected length of healthy life (healthy LE or health-adjusted LE)

π_y,

- prevalence of poor health (or disability, or bad self-reported health) in population aged *y* to *y+n*

$$eNH_x = \frac{1}{l_x}\sum_{y=x}^{\omega}(L_y \cdot \pi_y).$$

- expected length of unhealthy life

Usually, prevalence values pi_x are available only for adult people. So, calculation of healthy LE usually starts from ages 20, 30, 50 etc.

Computation of probabilities of being alive and healthy corresponding to L_x*(1-pi_x)

In the Sullivan's model, transition to the „bad" health does not change probability of death that remains the same for healthy and unhealthy individuals. So, transition to bad health and dying can be treated as two independent events. Therefore

$lH_x = (1-\pi_x)l_x$ - probability of surviving to age *x* and being healthy at this age.

In this formula π_x is the prevalence of bad health in the LT cohort at exact age *x.*

$$1-\pi_x \cong 1-({}_n\pi_{x-n}+{}_n\pi_{x+n})/2$$

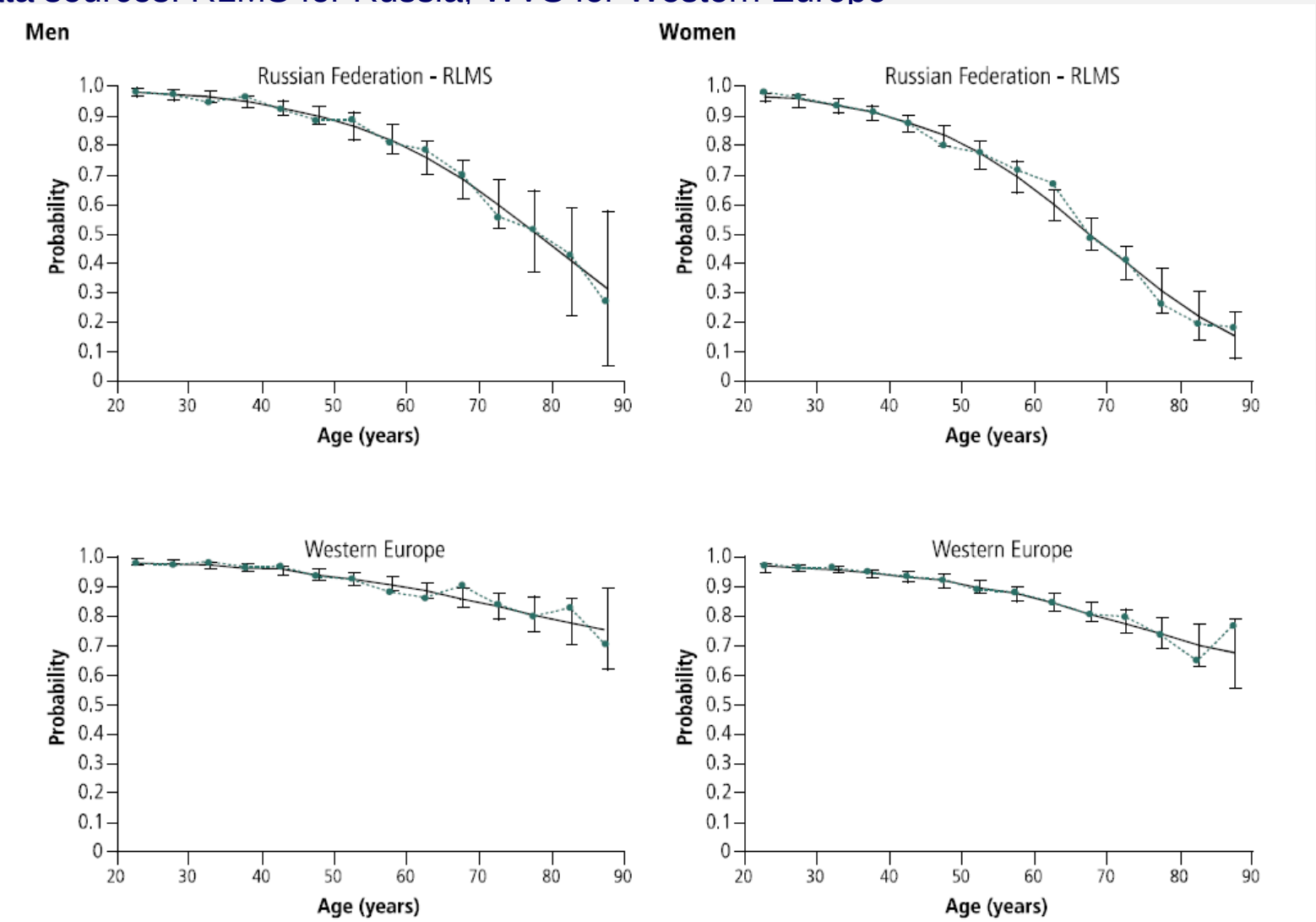
For the first age group *[x, x_0+n).*

$$1-\pi_{x0} \cong (1-{}_n\pi_{x_0})-[(1-\pi_{x_0+n})-(1-{}_n\pi_{x_0+n})]$$

HealthExpectancy.xls

Prevalence data: Russia vs. Western Europe in the mid-1990s

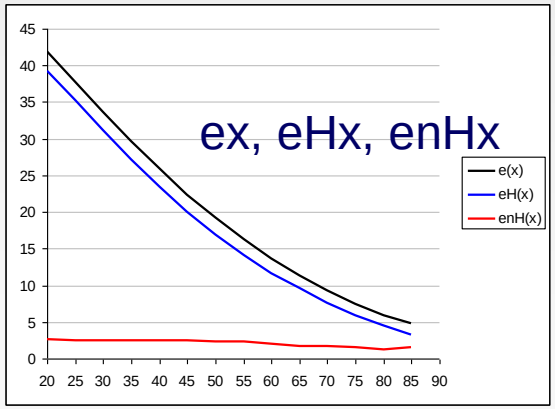
Prevalence (1-*pi*) of good self-reported health by age in Russia and Western Europe
Data sources: RLMS for Russia, WVS for Western Europe

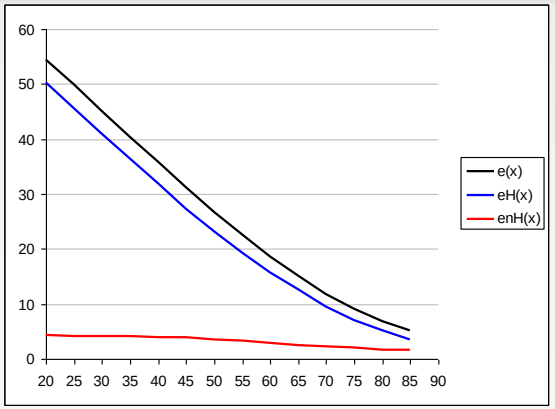


Source: Andreev, Shkolnikov, McKee, 2003

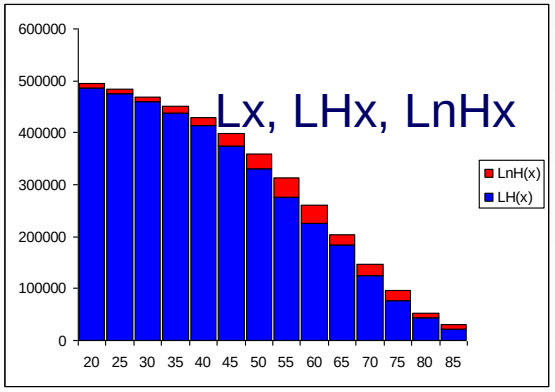
Possible outputs of healthy LE analysis: Russia vs. Western Europe in the mid-1990s

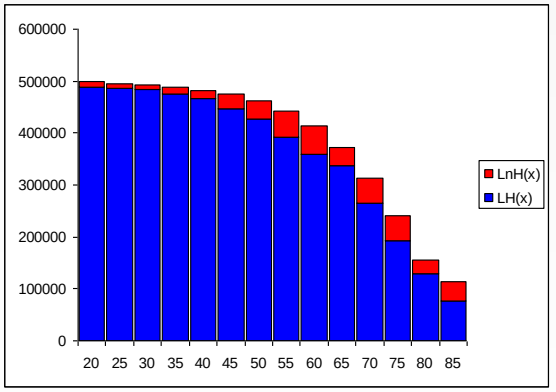
Russia, males

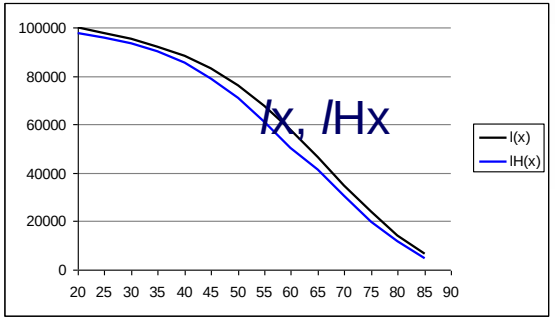


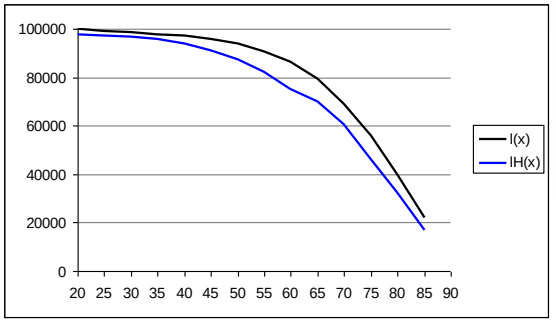


West Europe, males



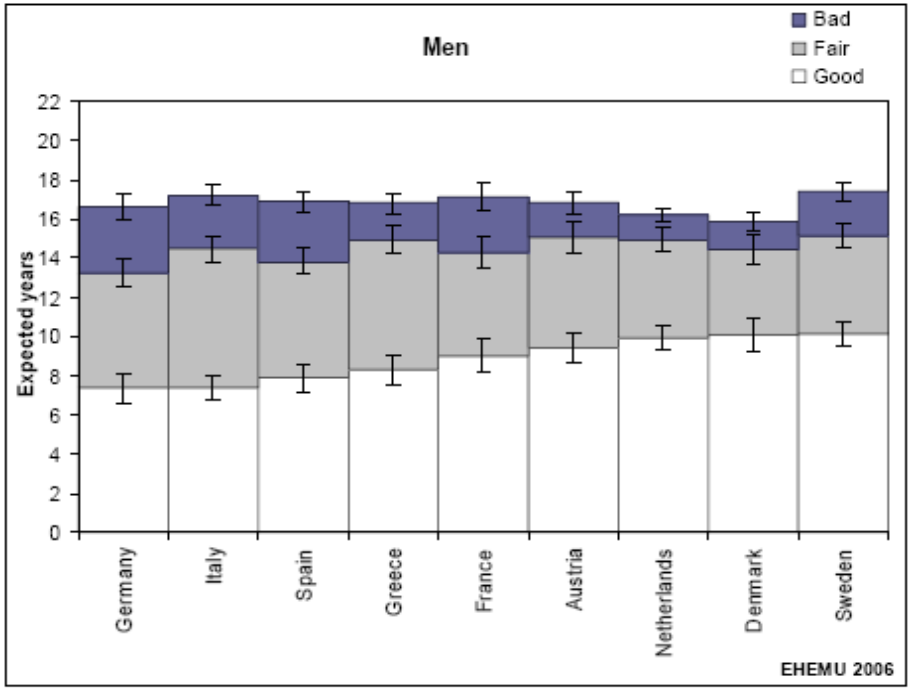


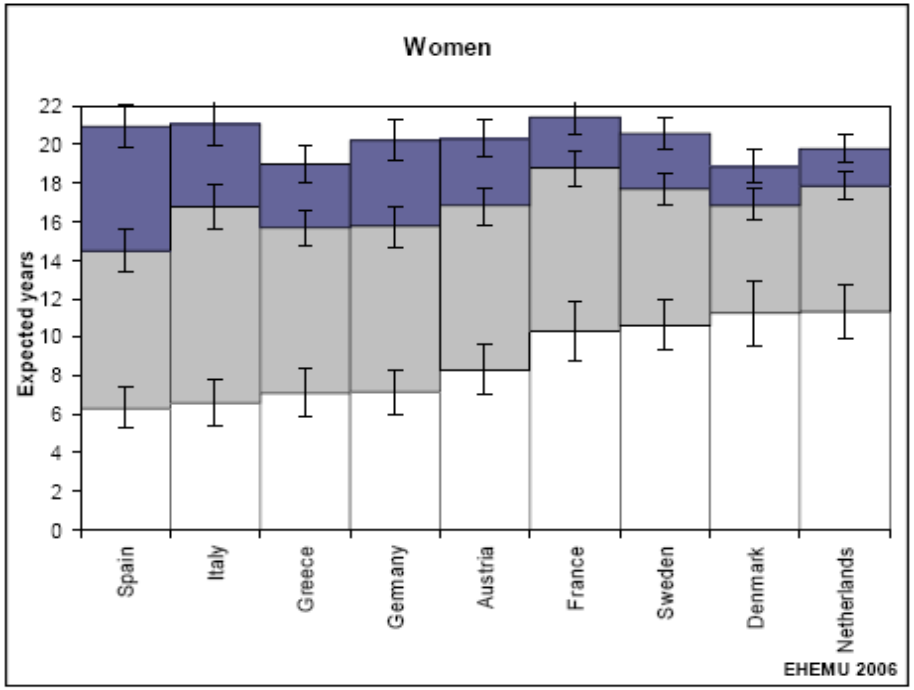




Example 1. Comparison across EU countries. Prevalence of health states is based on the SHARE data

Life expectancy and expected years in good, fair and bad perceived health at age 65 by country, men and women, 2004 (European version SHARE)

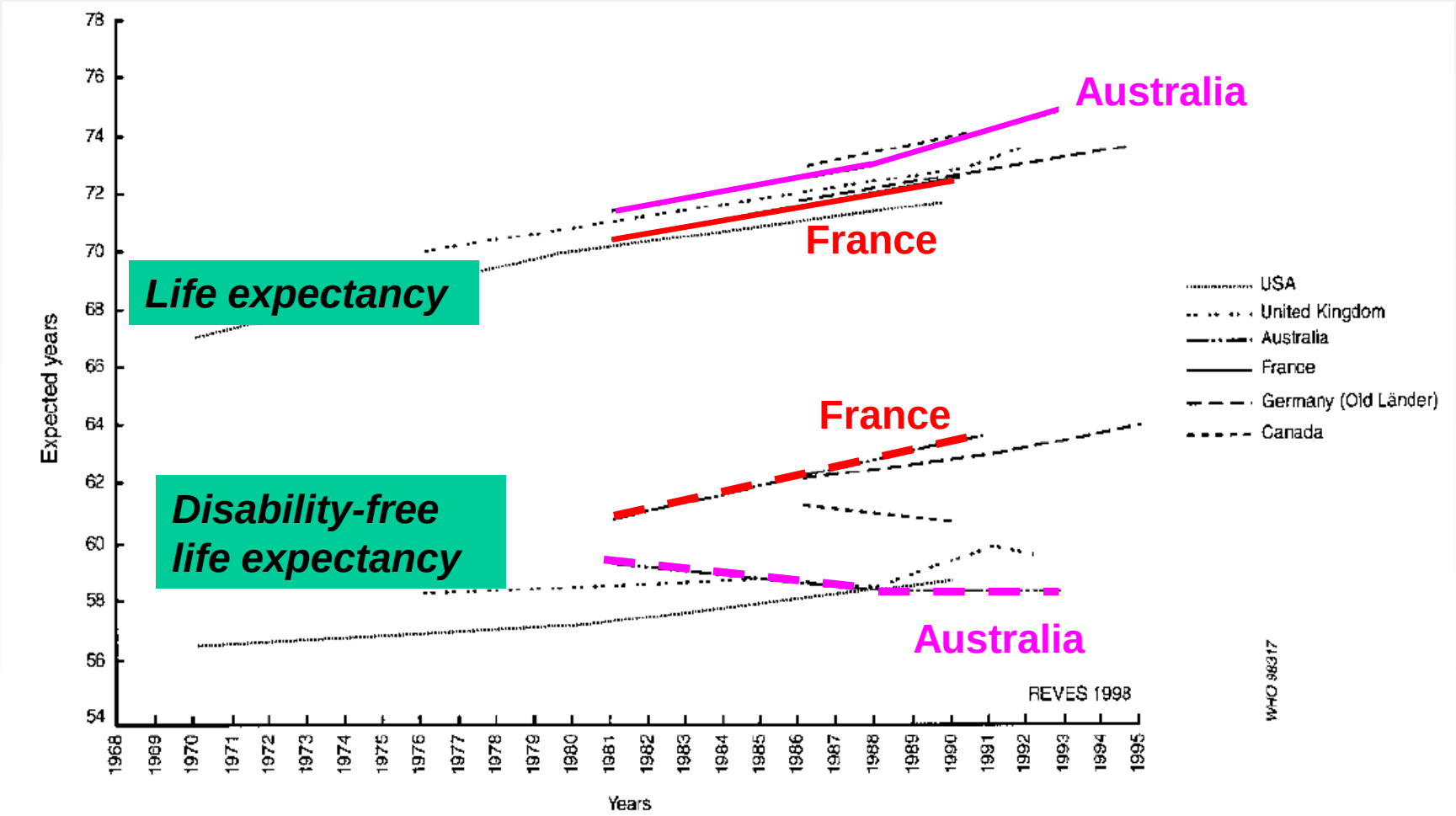




Observations: men report better health than women in spite of higher male mortality. Amounts of healthy life can considerably vary even when LE is at the same level. Inter-country comparison could be somewhat problematic due to differences in norms and cultures.

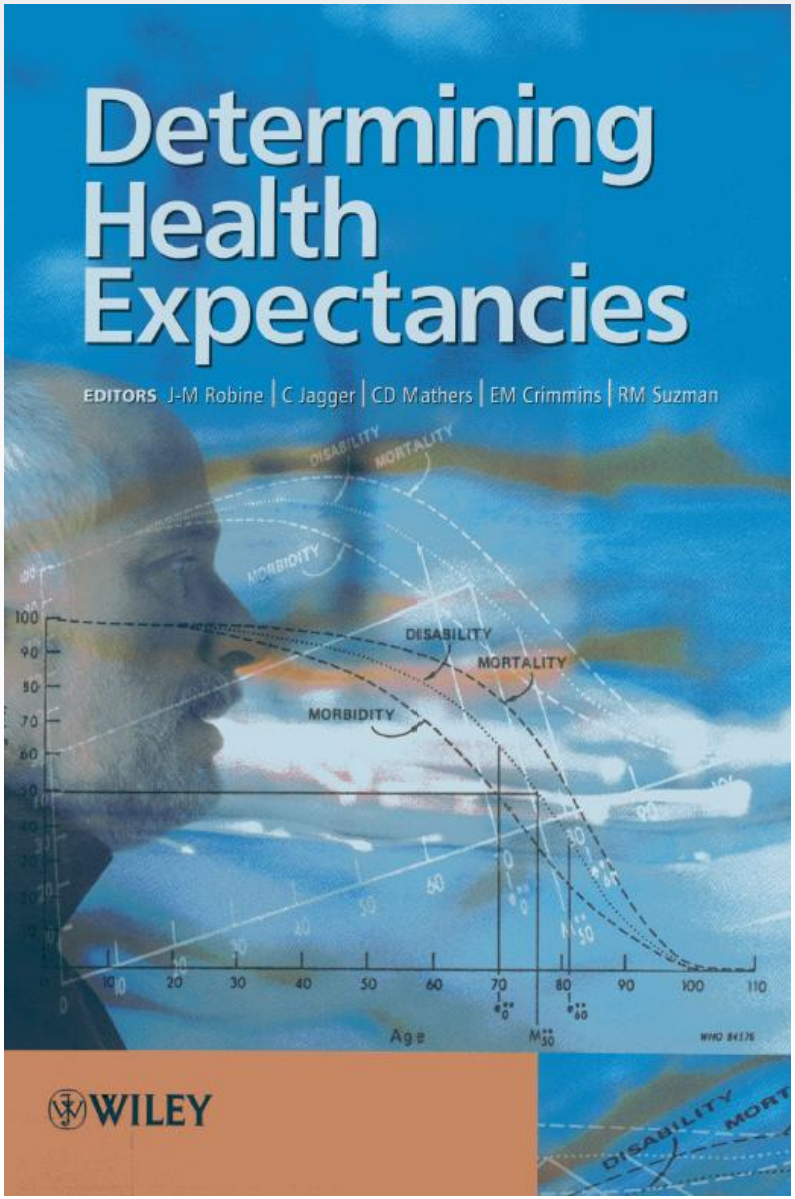
Example 2. Inter-country comparison of trends in LE and in expectation of life free of severe disability

Life expectancy and (severe) disability-free life expectancy at birth for males



Source: Robine, Romieu, Cambois, 1999.
Data are from Crimmins, Inoe et al.; Mathers, Robine &Mormiche, 1996; Wilkins, Adams, 1983.

Numerous examples can be found in this book



Cancer register data

Cancer registers are valuable source of information for oncology, epidemiology and public health. They exist in many countries and regions and are based on complete registration of incidence, disease characteristics, and survival.

The information collected by cancer registries can be placed into four categories: patient's ID and demographics, tumor (cancer) identification, treatment, and outcome.

ID and demographics. patient's name, age, sex, birthplace residence, etc. This information individually identifies the cancer patient.

Tumor identification. The primary site of the malignancy, its cell type, and the extent of disease. Dates and results of procedures used to diagnose cancer are also recorded.

Treatment. Information regarding cancer treatment (surgery, radiation therapy, chemotherapy, hormone, immunotherapy, and other).

Outcome. Patient status is updated regularly to maintain accurate surveillance information. Lifetime follow-up on patients permits registries to record information about patient survival.

Cancer register data

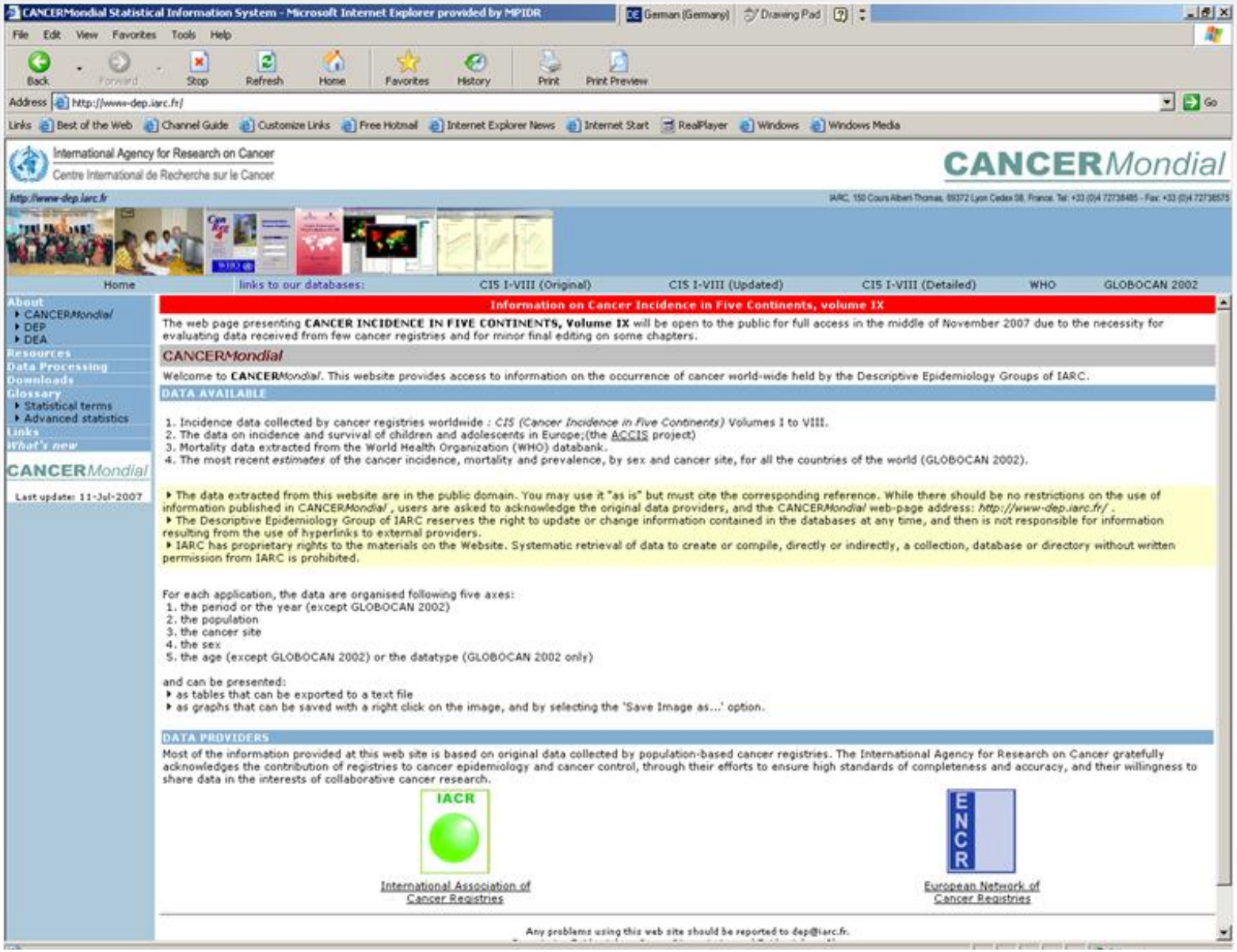
Types of data interesting for demographers:

- *Incidence of various cancers*. Dimensions: type of neoplasm, sex, age, year at diagnosis, (sometimes – stage of tumor development).

- *Survival*. Dimensions: type and site of neoplasm, sex, age group, year at diagnosis, (sometimes – stage of tumor at diagnosis), years since diagnosis (1, 3, 5, 10 years).

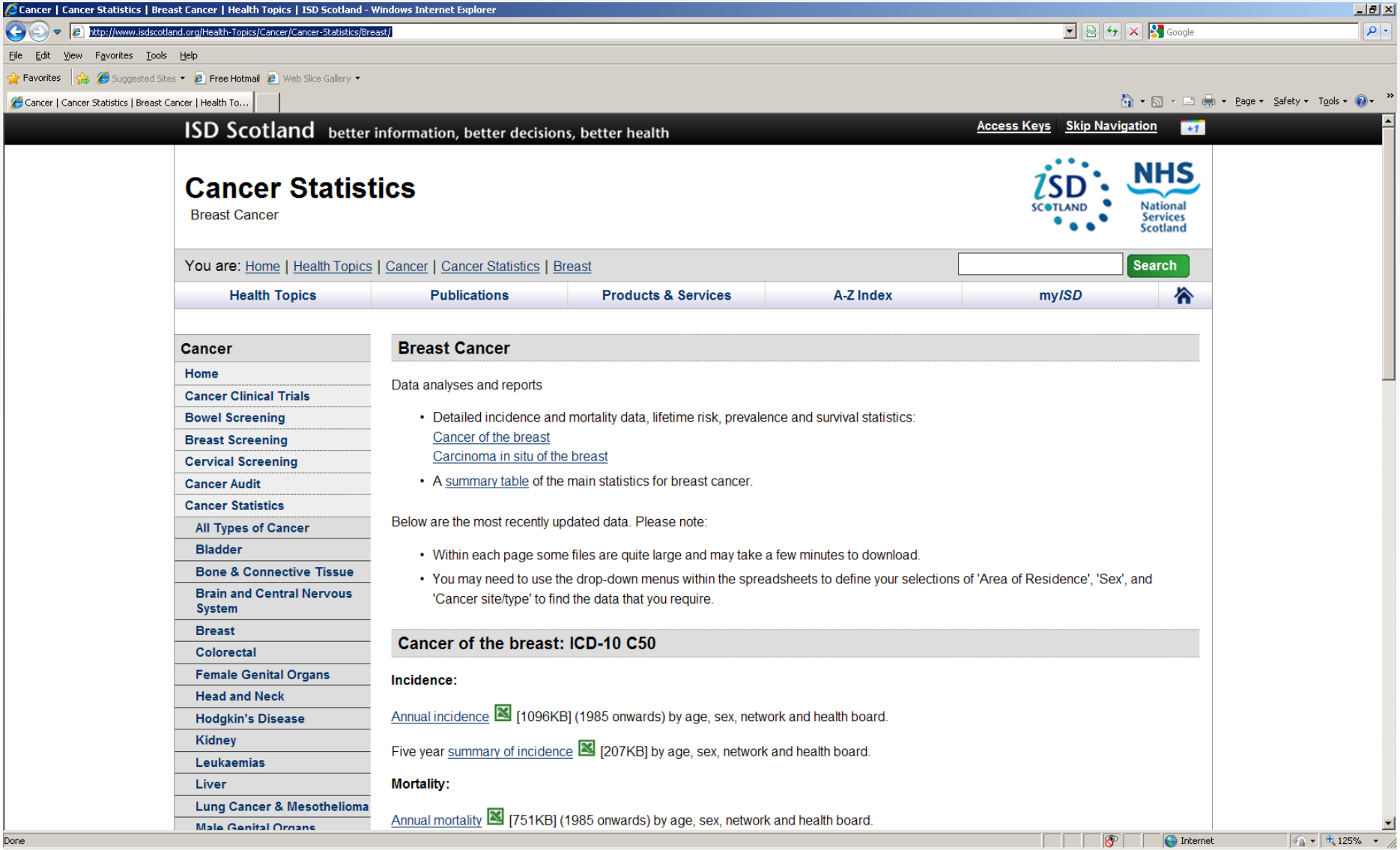
- *Prevalence*. Not always available. Dimensions: sex, age group.

IARC: International Agency for Research on Cancer (Lyon, France) http://www-dep.iarc.fr/



An example of a national Cancer Register: Scotland

http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Breast/



Data on cancer of the lung and cancer of the breast in Scotland in 1977-2001.

Let us look together at data extracted from the website.

Cancer-register-Scotland.xls

A major disadvantage of the Sullivan‘s model

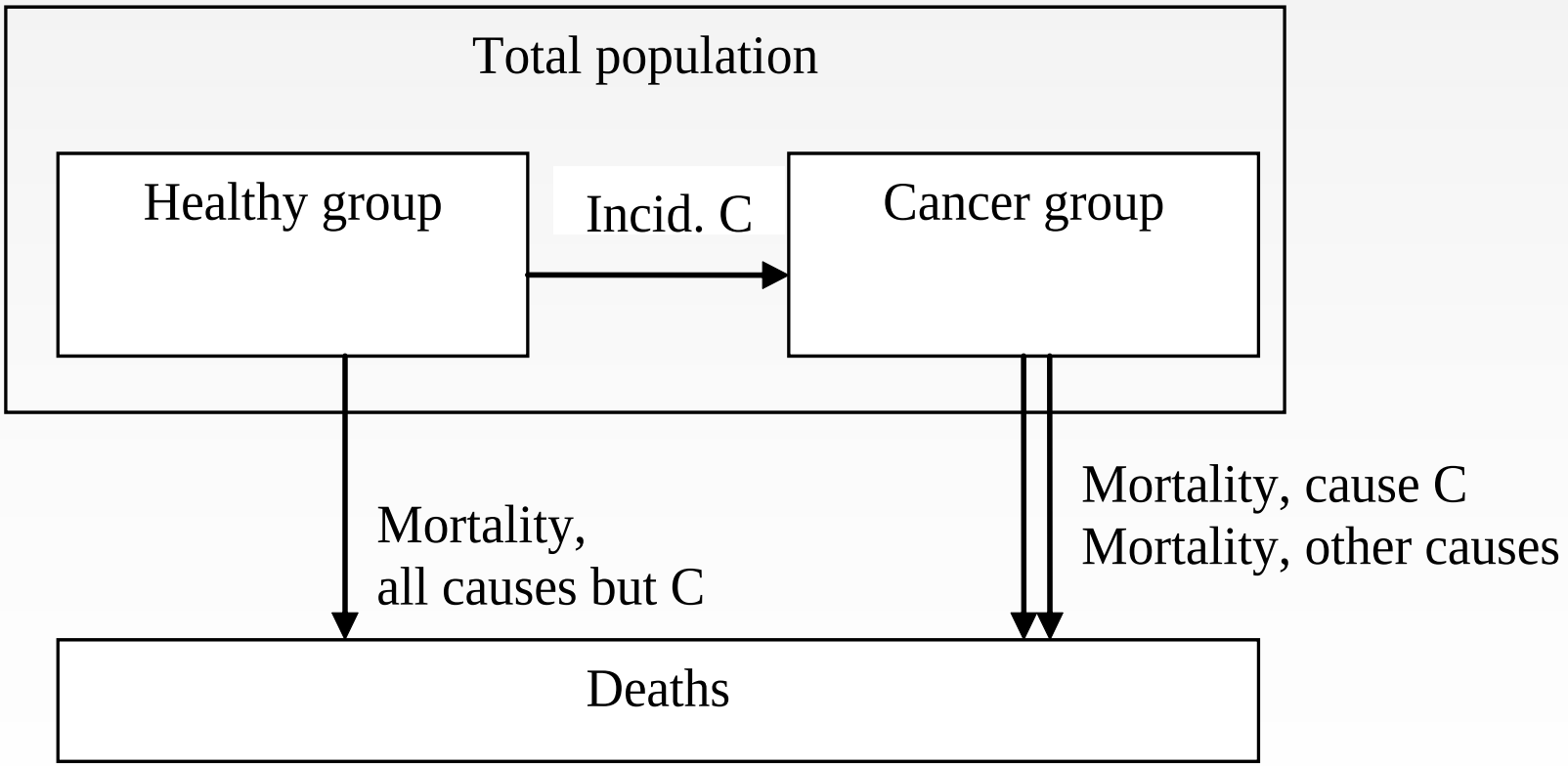
In the Sullivan‘s model healthy and unhealthy individuals are assumed to have the same mortality. Mortality and health deterioration processes are considered to be independent.

It is an oversimplification of reality!

More sophisticated increment-decrement LT and multistate LT is a way out. Unfortunately, these model require data that are rarely available. However, availability of such data is increasing.

Below we provide an example of such model. See also Duchene (2002) for more details. Note the correction in formula on p. 234.

Simple model of disease and disease-specific mortality



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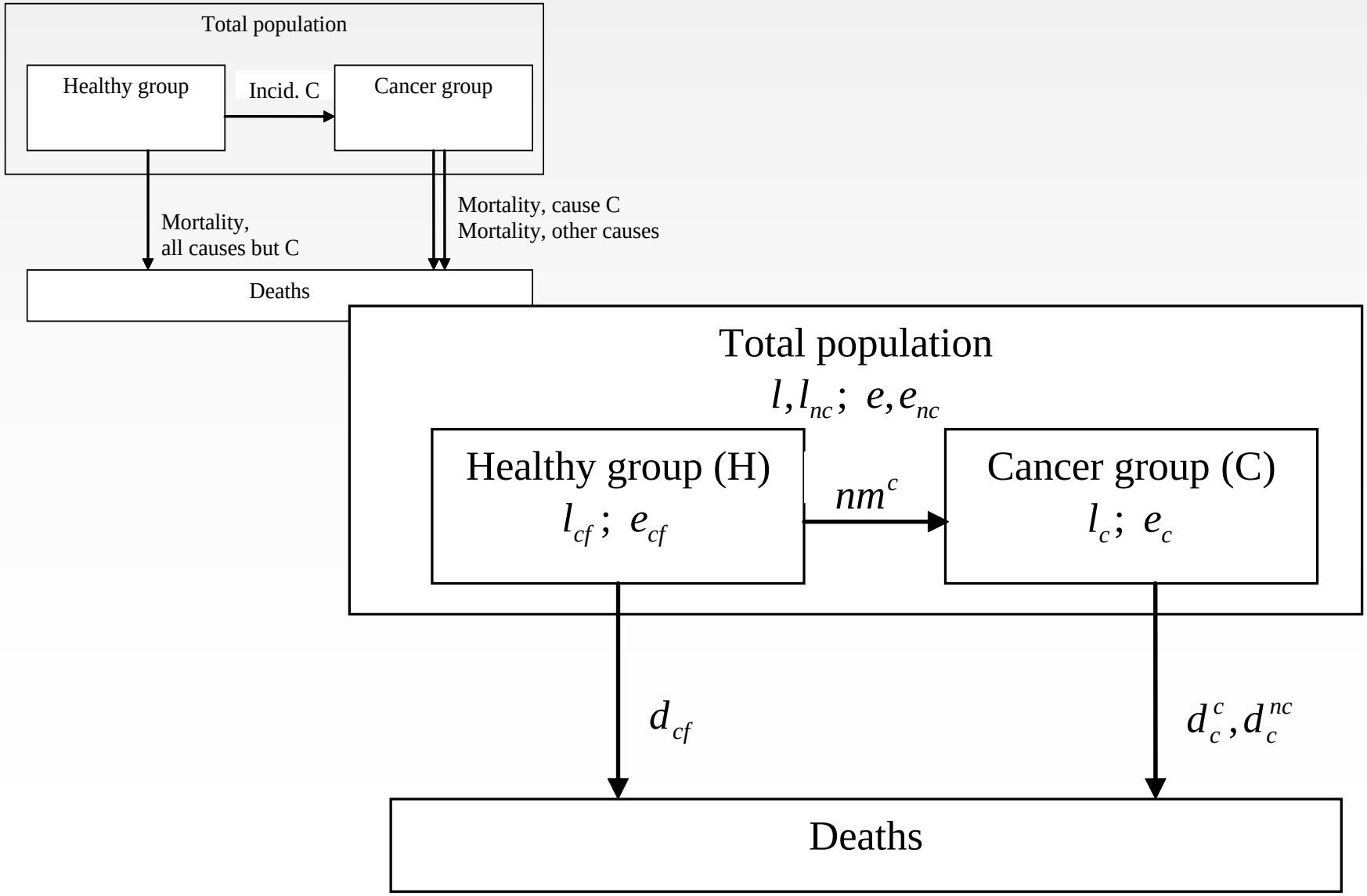

Algorithm and the calculation spreadsheet

Increment-decrement-algorithm.doc

Increment-decrement-LT-cancer.xls

Tasks

1. Рассчитайте таблицы заболеваемости мужчин раком легкого и смертности от всех причин и от рака легкого в Шотландии за 1993 и 2003 годы. Как изменилась за 10 лет продолжительность жизни в целом и при устранении рака легкого?
2. Рассчитайте возрастные коэффициенты смертности от рака легкого среди заболевших. Покажите с помощью графика как изменилась эта кривая за 10 лет.