

Population and Health

Лекция 4. Таблицы, совмещающие
смертность и здоровье

Lecture 4. Life tables combining health
and mortality



MAX PLANCK INSTITUTE
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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)



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)

$$\pi_y,$$

- 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 π_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 .

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

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

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

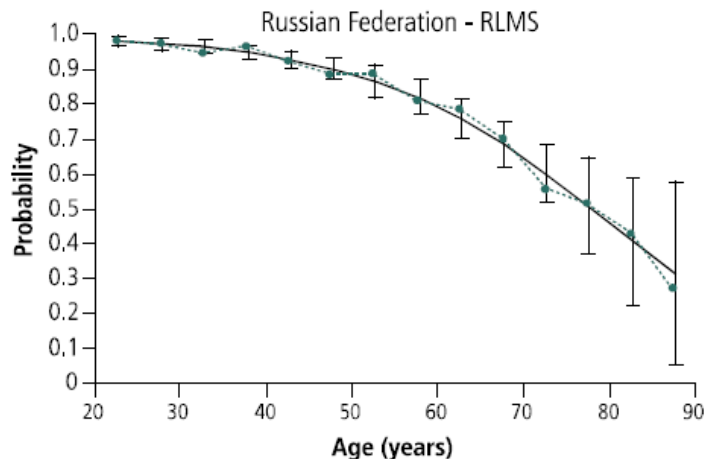
[HealthExpectancy.xls](#)



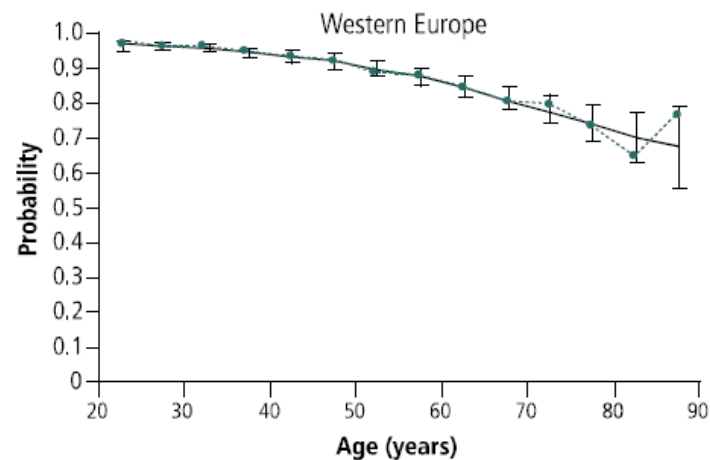
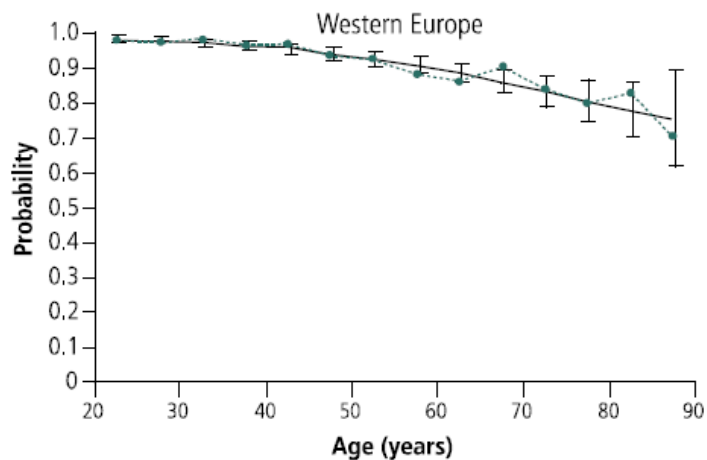
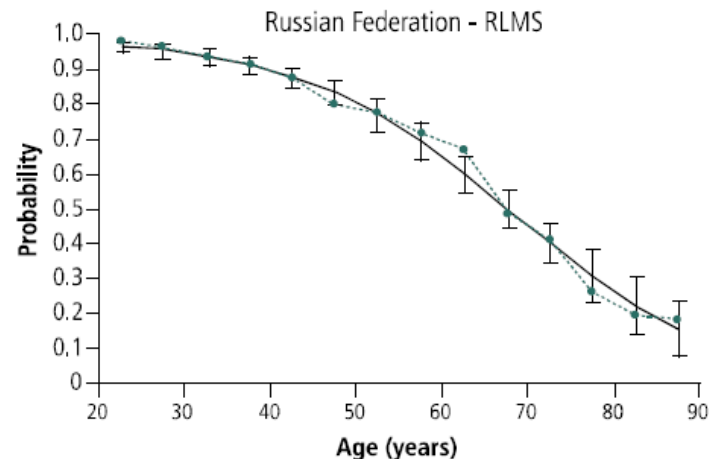
Prevalence data: Russia vs. Western Europe in the mid-1990s

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

Men



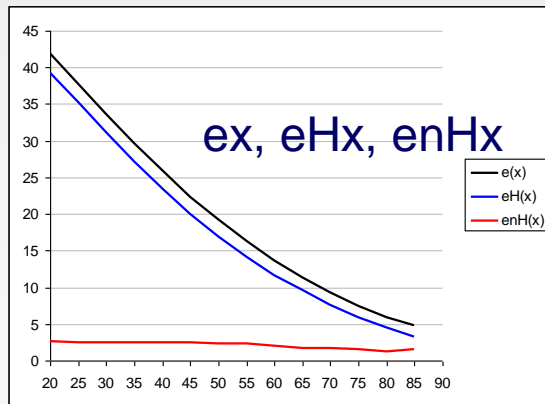
Women



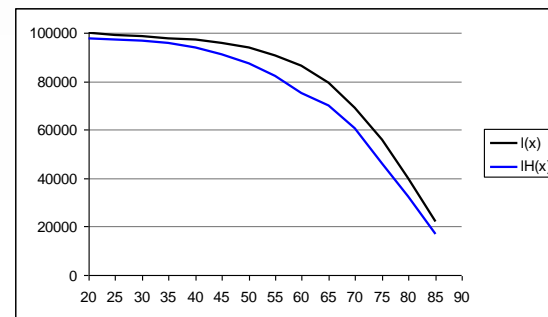
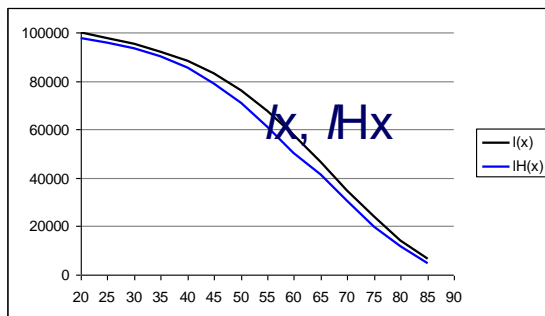
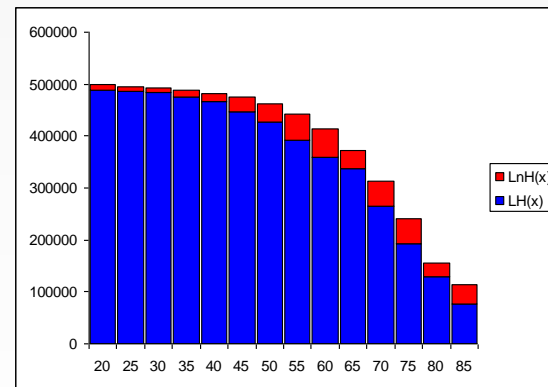
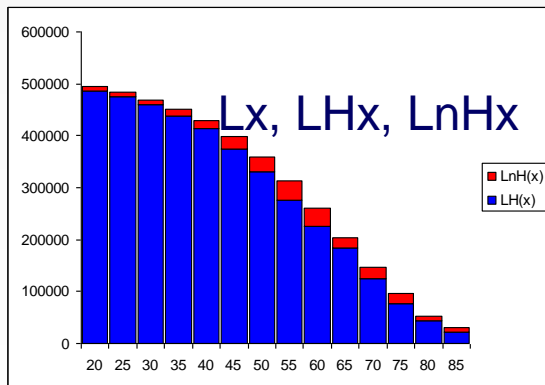
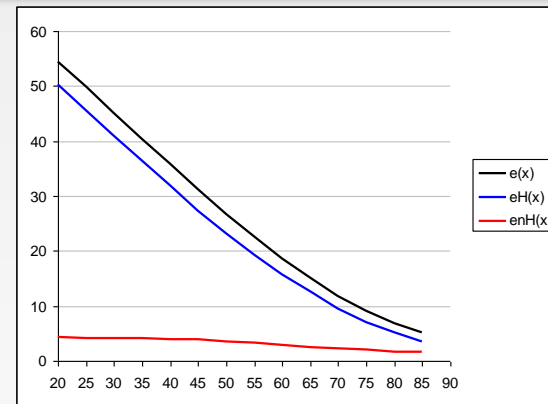


Possible outputs of healthy LE analysis: Russia vs. Western Europe in the mid-1990s

Russia, males



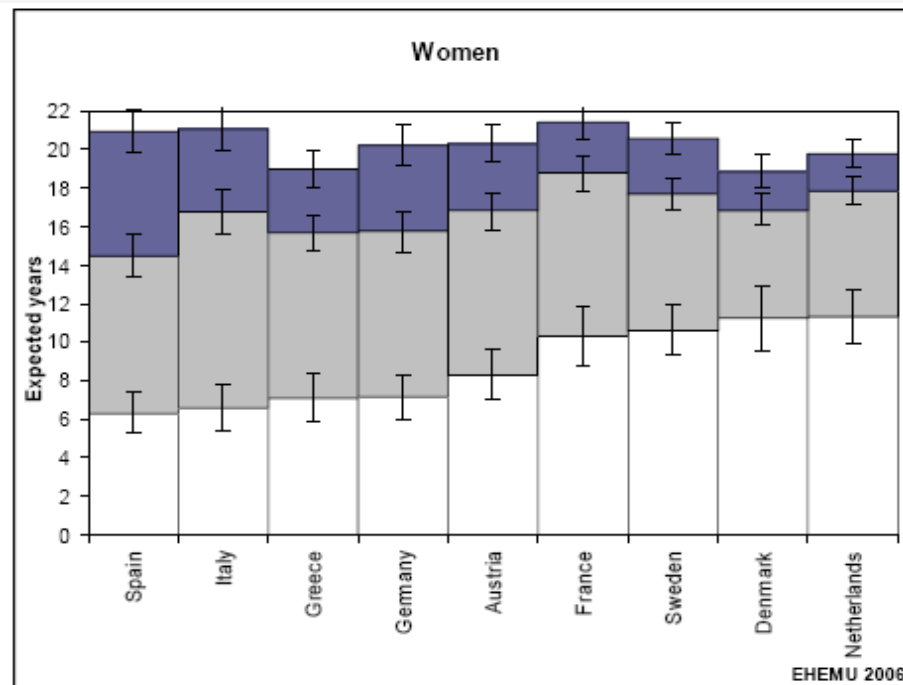
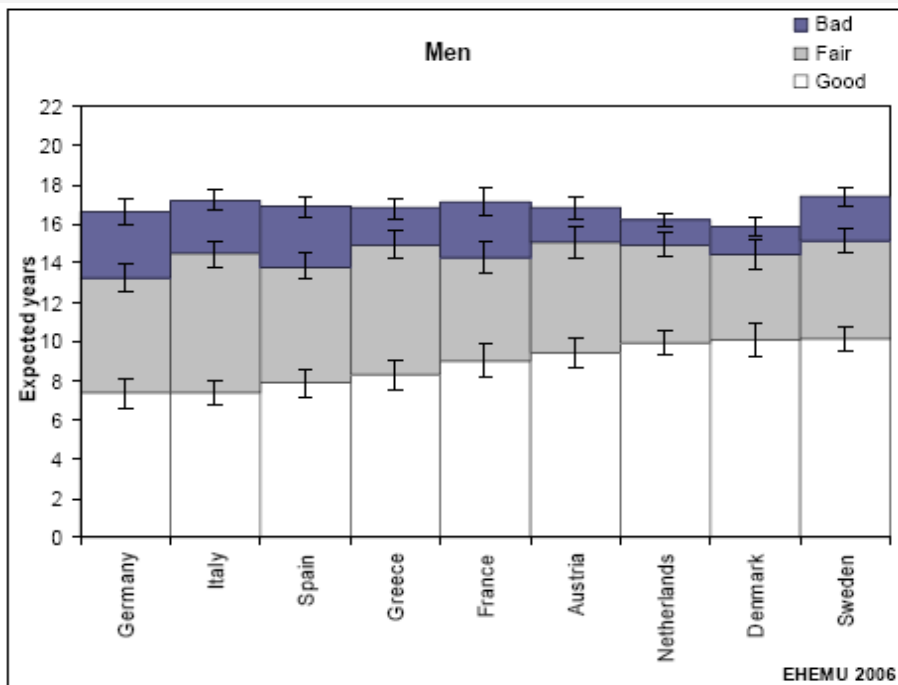
West Europe, males





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)

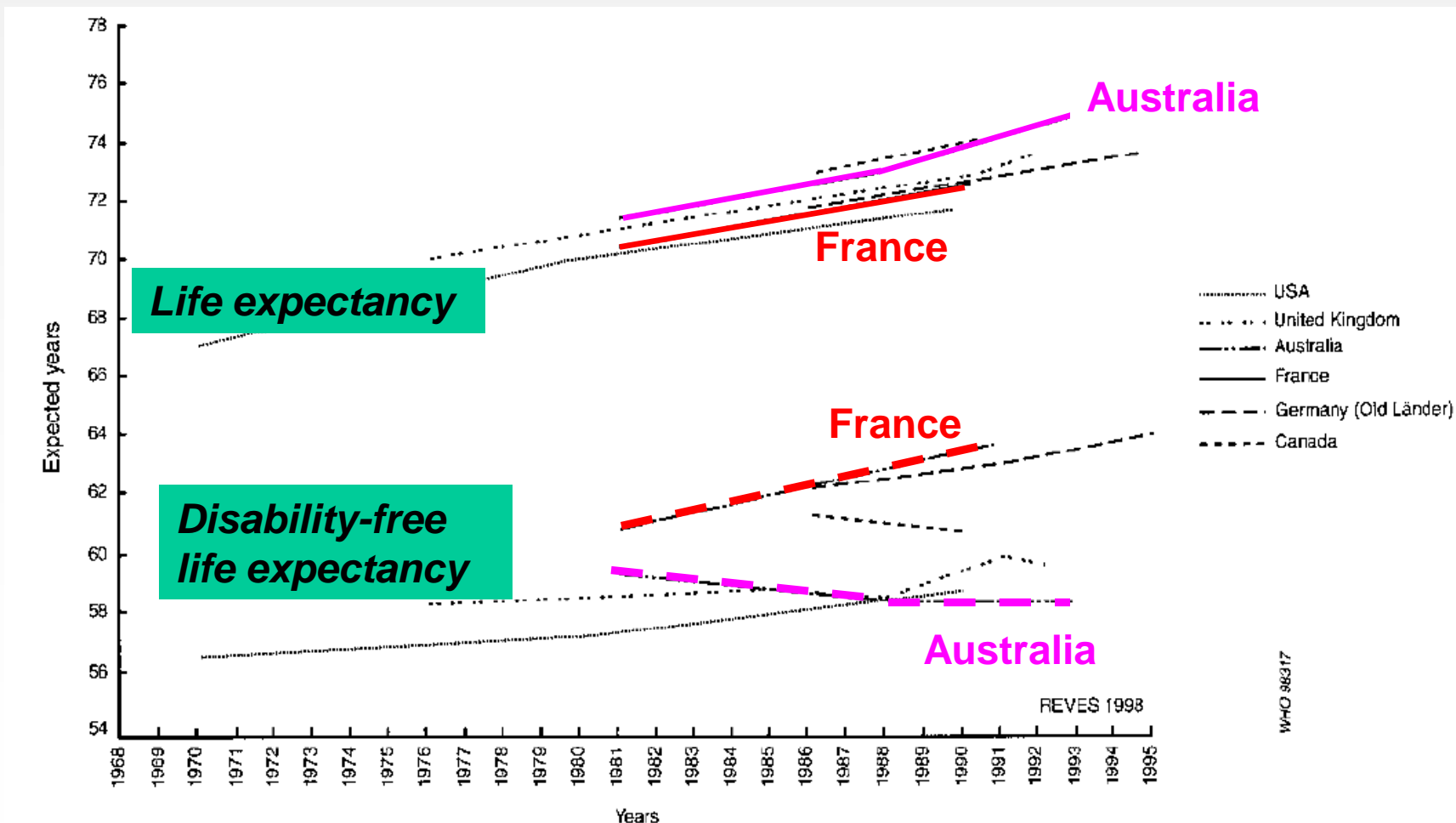


Observations: men report better health than women in spite of higher male mortality. Amounts of healthy life can considerably vary even when LE is at the same level. Inter-country comparison could be somewhat problematic due to differences in norms and cultures.



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

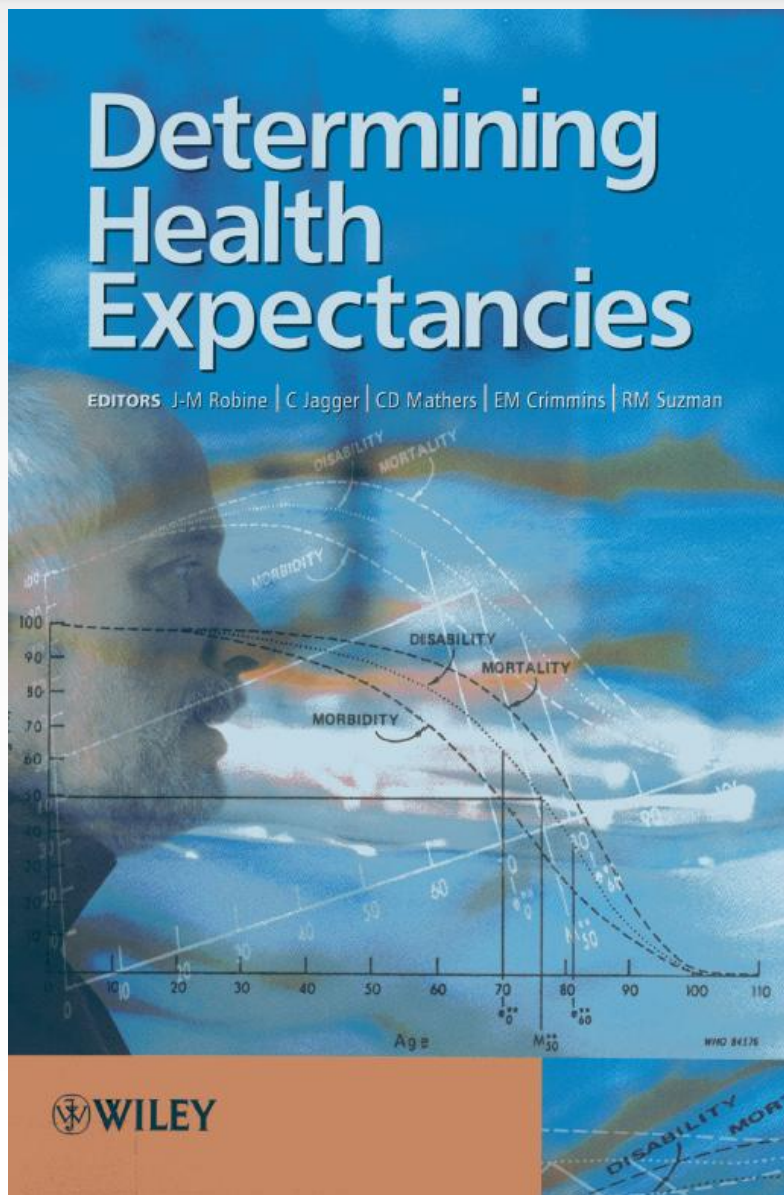


Source: Robine, Romieu, Cambois, 1999.

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).

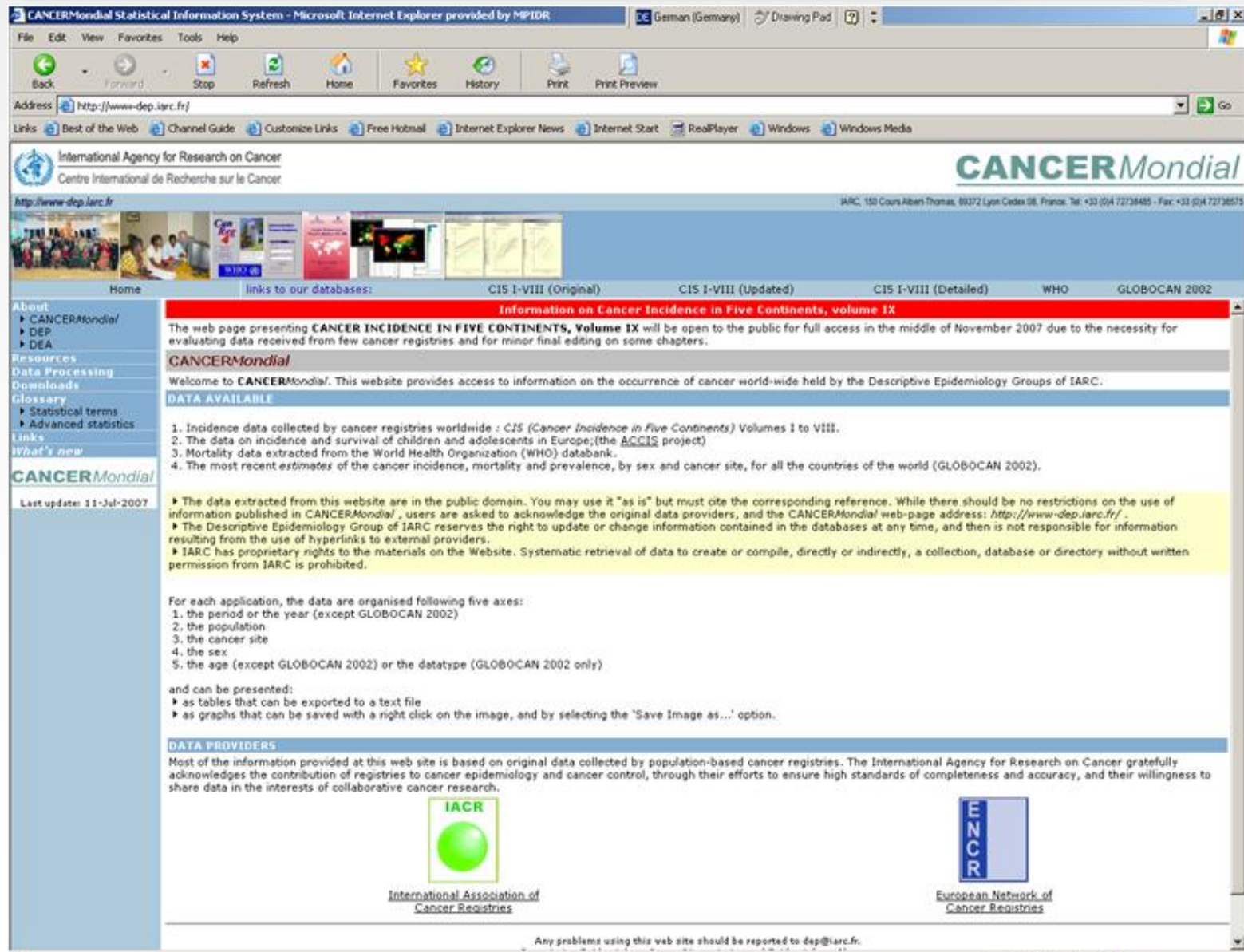
Outcome. Patient status is updated regularly to maintain accurate surveillance information. Lifetime follow-up on patients permits registries to record information about patient survival.



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/>



CANCERmondial Statistical Information System - Microsoft Internet Explorer provided by MPIDR

German (Germany) Drawing Pad

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International Agency for Research on Cancer
Centre International de Recherche sur le Cancer

CANCERmondial

<http://www-dep.iarc.fr> IARC, 150 Cours Albert Thomas, 69372 Lyon Cedex 08, France. Tel: +33 (0)4 72738485 - Fax: +33 (0)4 72738575

Home links to our databases: CIS I-VIII (Original) CIS I-VIII (Updated) CIS I-VIII (Detailed) WHO GLOBOCAN 2002

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▶ CANCERmondial/
▶ DEP
▶ DEA

Resources
Data Processing
Downloads
Glossary
▶ Statistical terms
▶ Advanced statistics

Links
What's new

CANCERmondial

Last update: 11-Jul-2007

Information on Cancer Incidence in Five Continents, volume IX

The web page presenting **CANCER INCIDENCE IN FIVE CONTINENTS, Volume IX** will be open to the public for full access in the middle of November 2007 due to the necessity for evaluating data received from few cancer registries and for minor final editing on some chapters.

CANCERmondial

Welcome to **CANCERmondial**. This website provides access to information on the occurrence of cancer world-wide held by the Descriptive Epidemiology Groups of IARC.

DATA AVAILABLE

1. Incidence data collected by cancer registries worldwide : *CIS (Cancer Incidence in Five Continents) Volumes I to VIII.*
2. The data on incidence and survival of children and adolescents in Europe;(the *ACCIS* project)
3. Mortality data extracted from the World Health Organization (WHO) databank.
4. The most recent *estimates* of the cancer incidence, mortality and prevalence, by sex and cancer site, for all the countries of the world (GLOBOCAN 2002).

▶ The data extracted from this website are in the public domain. You may use it "as is" but must cite the corresponding reference. While there should be no restrictions on the use of information published in **CANCERmondial**, users are asked to acknowledge the original data providers, and the **CANCERmondial** web-page address: <http://www-dep.iarc.fr/>.

▶ The Descriptive Epidemiology Group of IARC reserves the right to update or change information contained in the databases at any time, and then is not responsible for information resulting from the use of hyperlinks to external providers.

▶ IARC has proprietary rights to the materials on the Website. Systematic retrieval of data to create or compile, directly or indirectly, a collection, database or directory without written permission from IARC is prohibited.

For each application, the data are organised following five axes:


1. the period or the year (except GLOBOCAN 2002)
2. the population
3. the cancer site
4. the sex
5. the age (except GLOBOCAN 2002) or the datatype (GLOBOCAN 2002 only)


and can be presented:

- ▶ as tables that can be exported to a text file
- ▶ as graphs that can be saved with a right click on the image, and by selecting the "Save Image as..." option.

DATA PROVIDERS

Most of the information provided at this web site is based on original data collected by population-based cancer registries. The International Agency for Research on Cancer gratefully acknowledges the contribution of registries to cancer epidemiology and cancer control, through their efforts to ensure high standards of completeness and accuracy, and their willingness to share data in the interests of collaborative cancer research.

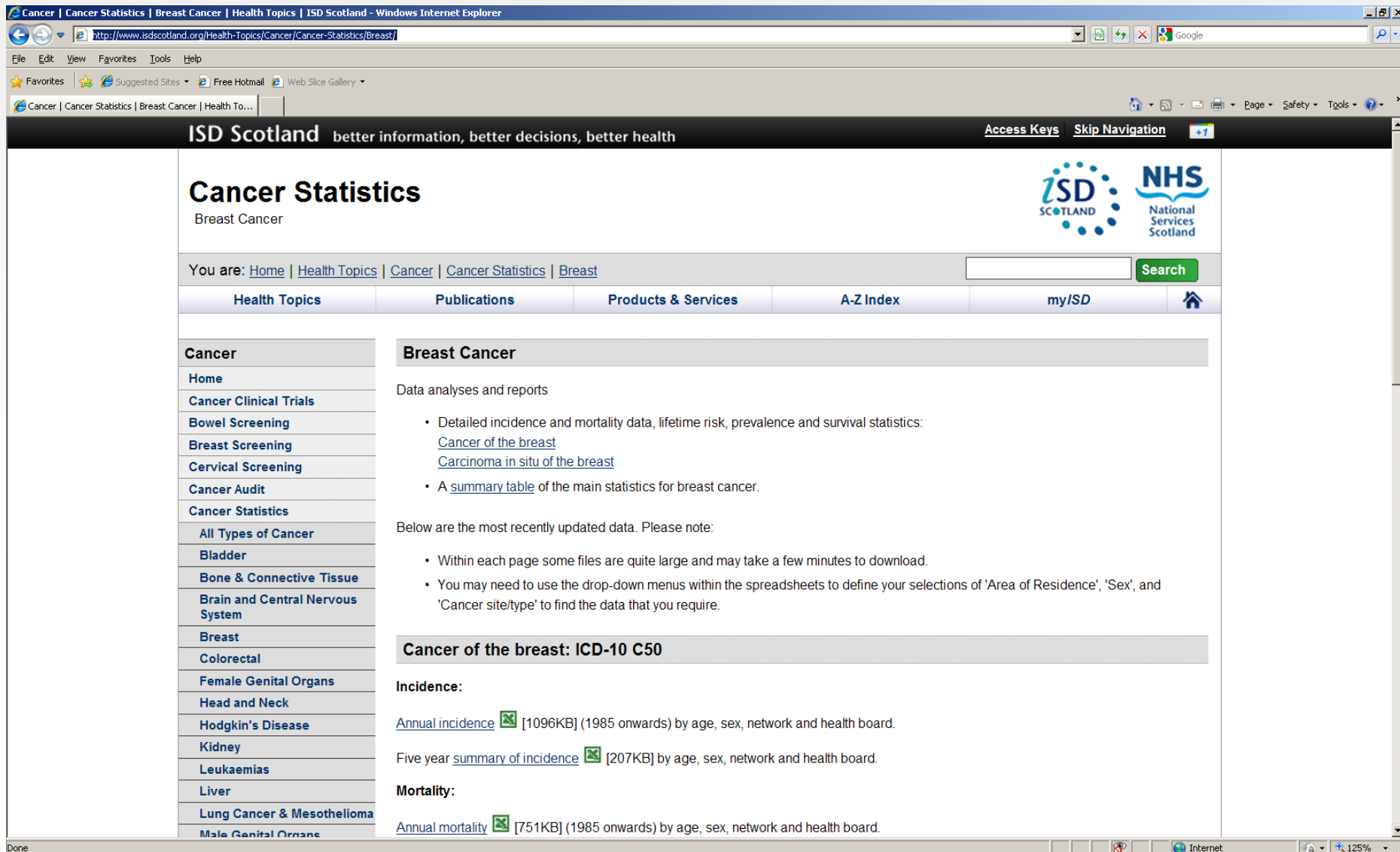

International Association of
Cancer Registries


European Network of
Cancer Registries

Any problems using this web site should be reported to dep@iarc.fr.

An example of a national Cancer Register: Scotland

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



The screenshot shows a web browser window displaying the ISD Scotland website. The browser's address bar shows the URL <http://www.isdscotland.org/Health-Topics/Cancer/Cancer-Statistics/Breast/>. The website header includes the ISD Scotland logo and the tagline "better information, better decisions, better health". The main content area is titled "Cancer Statistics" and "Breast Cancer". A navigation menu includes "Health Topics", "Publications", "Products & Services", "A-Z Index", and "my/ISD". A search bar is present. The left sidebar lists various cancer types, with "Breast" selected. The main content area provides information about breast cancer statistics, including data analyses and reports, and a list of recently updated data. The footer of the browser window shows "Done" and "Internet" icons.

ISD Scotland better information, better decisions, better health

Cancer Statistics
Breast Cancer

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Cancer

- Home
- Cancer Clinical Trials
- Bowel Screening
- Breast Screening
- Cervical Screening
- Cancer Audit
- Cancer Statistics
- All Types of Cancer
- Bladder
- Bone & Connective Tissue
- Brain and Central Nervous System
- Breast
- Colorectal
- Female Genital Organs
- Head and Neck
- Hodgkin's Disease
- Kidney
- Leukaemias
- Liver
- Lung Cancer & Mesothelioma
- Male Genital Organs

Breast Cancer

Data analyses and reports

- Detailed incidence and mortality data, lifetime risk, prevalence and survival statistics:
 - [Cancer of the breast](#)
 - [Carcinoma in situ of the breast](#)
- A [summary table](#) of the main statistics for breast cancer.

Below are the most recently updated data. Please note:

- Within each page some files are quite large and may take a few minutes to download.
- You may need to use the drop-down menus within the spreadsheets to define your selections of 'Area of Residence', 'Sex', and 'Cancer site/type' to find the data that you require.

Cancer of the breast: ICD-10 C50

Incidence:

- [Annual incidence](#) [1096KB] (1985 onwards) by age, sex, network and health board.
- Five year [summary of incidence](#) [207KB] by age, sex, network and health board.

Mortality:

- [Annual mortality](#) [751KB] (1985 onwards) by age, sex, network and health board.



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](#)



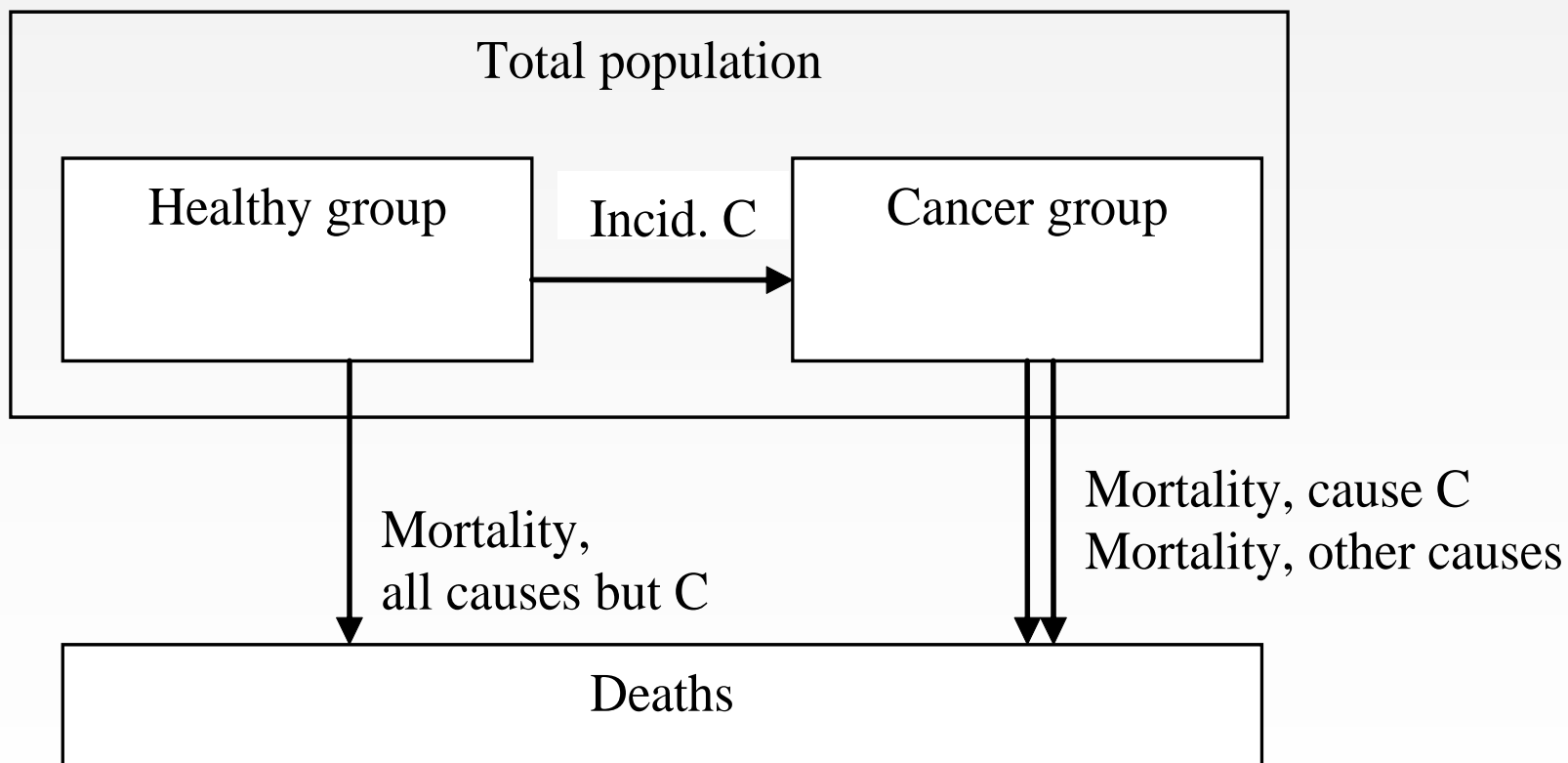
A major disadvantage of the Sullivan's model

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.

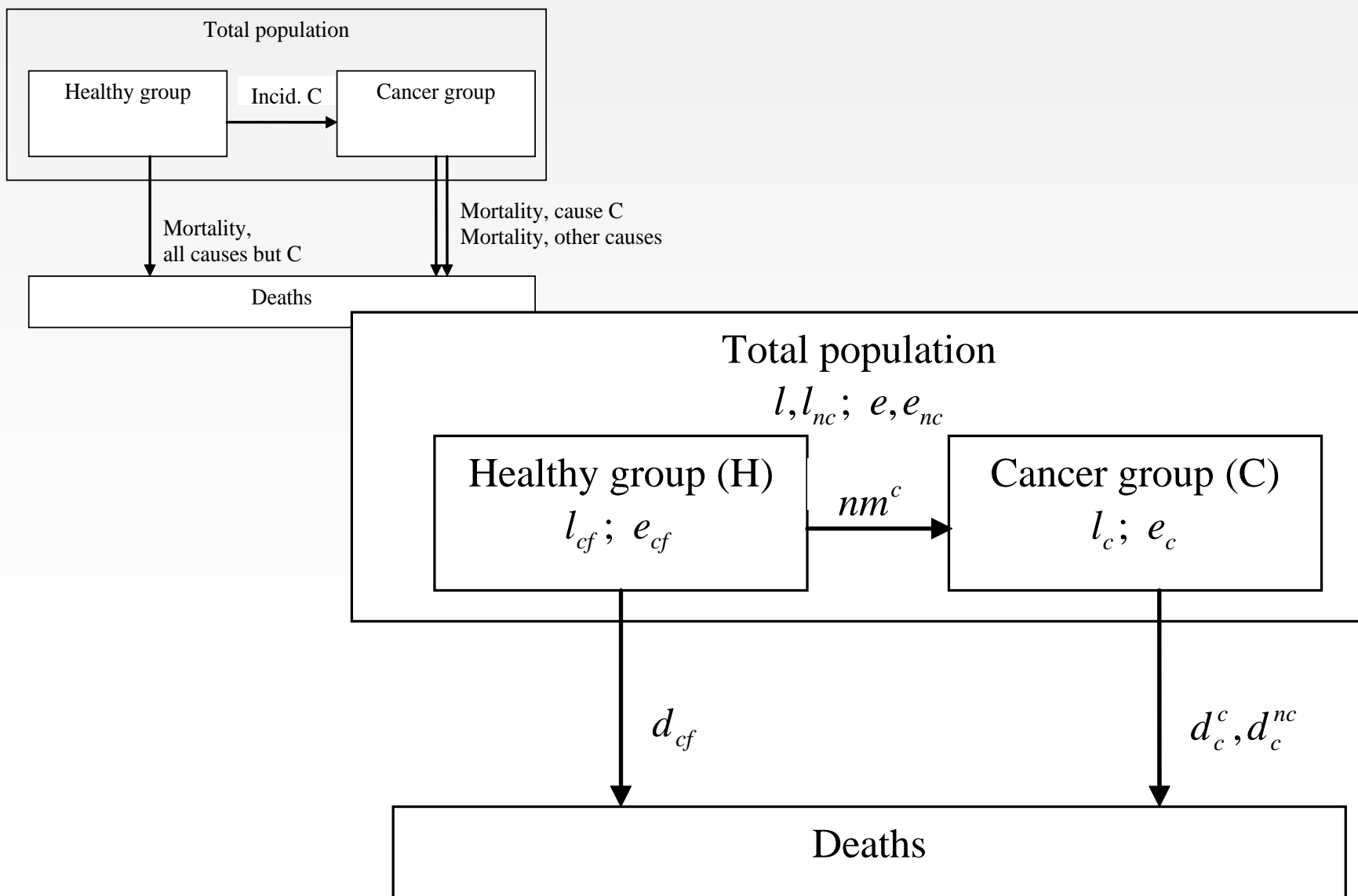
It is an oversimplification of reality!

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





Algorithm and the calculation spreadsheet

[Increment-decrement-algorithm.doc](#)

[Increment-decrement-LT-cancer.xls](#)



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.