Public health I.

- Course Requirements
- Homepage: www.nepegeszsegtan.sote.hu

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Preventive medicine and public health

The science and the art of **preventing disease**, **prolonging life**, and **promoting physical health** and efficiency through **organized community efforts** for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organization of medical and nursing service for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will **ensure to every individual in the community a standard of living** adequate for the maintenance of health.

(C-E. A. Winslow, 1920.)

A definition of public health

- *The combination of science, practical skills and values (or beliefs) directed to the maintenance and improvement of the health of all the people… a set of efforts organized by society to protect, promote and restore the people's health through collective or social action.*
- *John M. Last*
- *Public Health and Preventive Medicine*

Main functions of public health

1. **Monitoring** the health status of the population, detecting high risk communities/persons, defining **health priorities**.

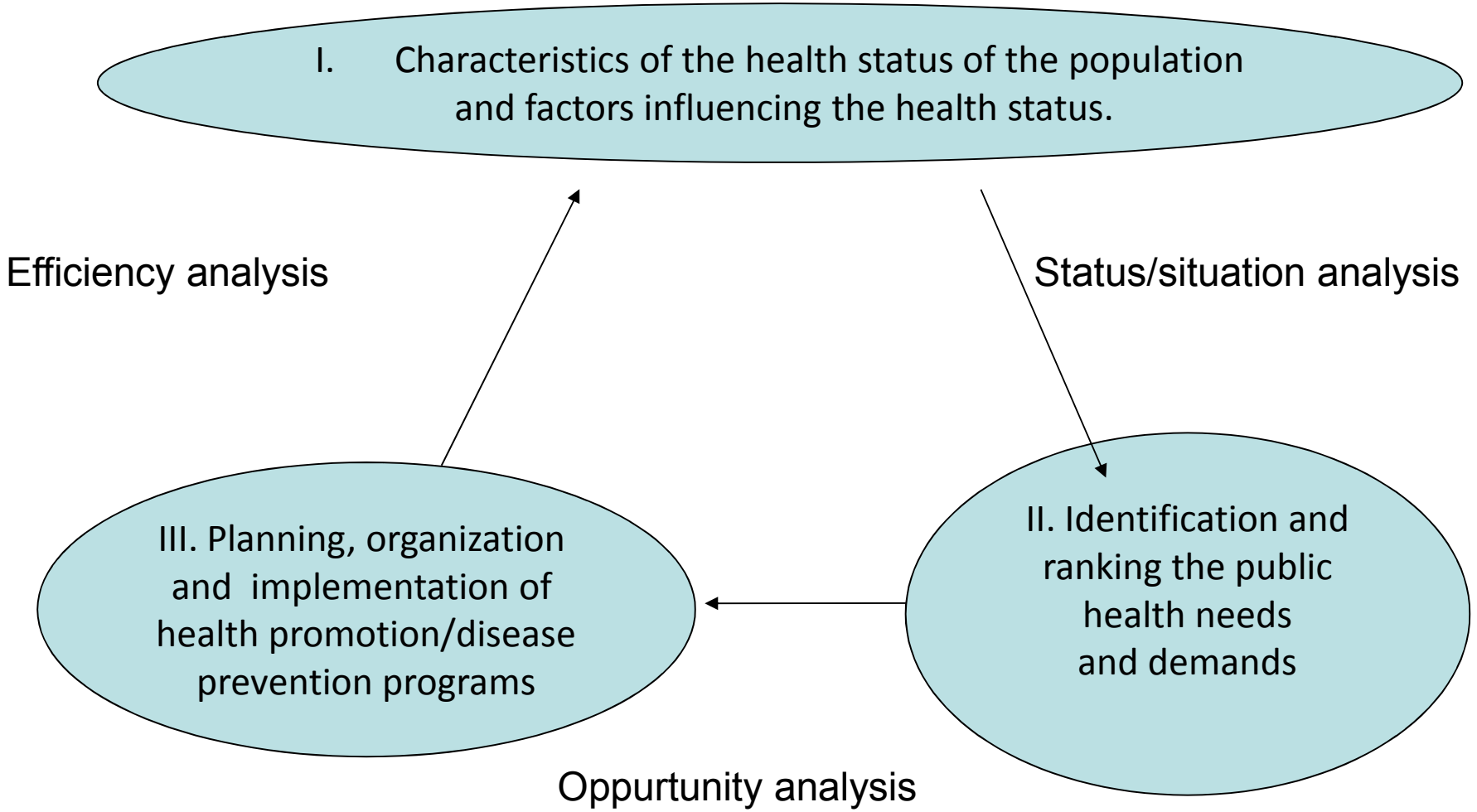
2. **Development of public health measurements** together with political and NGOs for repairing health problems.

3. **Ensure health services** (including health promotion and disease prevention) to be **appropriate, cost-effective** and **accessible** for all members of the population.

Tasks of public health

1. Continuous **monitoring** of the health status of the population, detecting health problems and health hazards.
2. Exploring the **background** of health problems.
3. **Communications** of health problems and its prevention/treatment possibilities with the population.
4. A társadalom **mozgósítása** a problémák megoldása érdekében, partnerség kialakítása az érintett kormányzati és civil szervezetek között.
5. Development of health promotion and disease prevention **programs**.
6. Support for **health-oriented decision making** and evaluation of it.
7. Support for **desining health services** and encure the general **accessibility**.
8. Graduate and postgraduate **education of human resorces** in public health.
9. Analyzing **the effectivity and accessibility** of health services.
10. Desining and implementing scientific **researches** for public health problems.

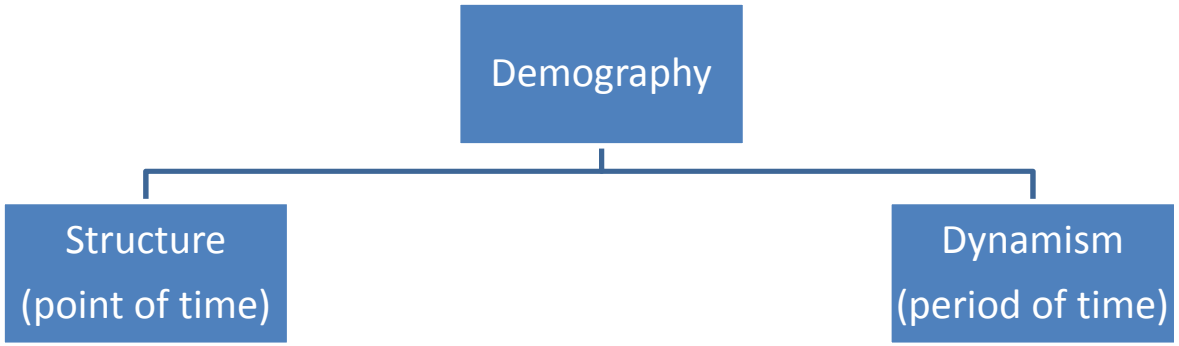
Public health cycle



Demography

Demography

The study of populations, especially with reference to size and density, fertility, mortality, growth, age distribution, migration, and vital statistics and the integration of all these with social and economic conditions. (Last)



Status of population
(number, structure)

- age
- sex
- education level
- income
- households, family
- urbanisation
- public utilities
- information on the home and it's facilities
- ethnicity

Numerical changes of population (time-frame, place)

Vital statistics

- births (natality)
- fertility
- deaths (mortality)
- reproduction
- marital status (marriage, divorce)

Migration

- Emigration
- Commuters
- Immigration

Sources of demographic data

Structure:

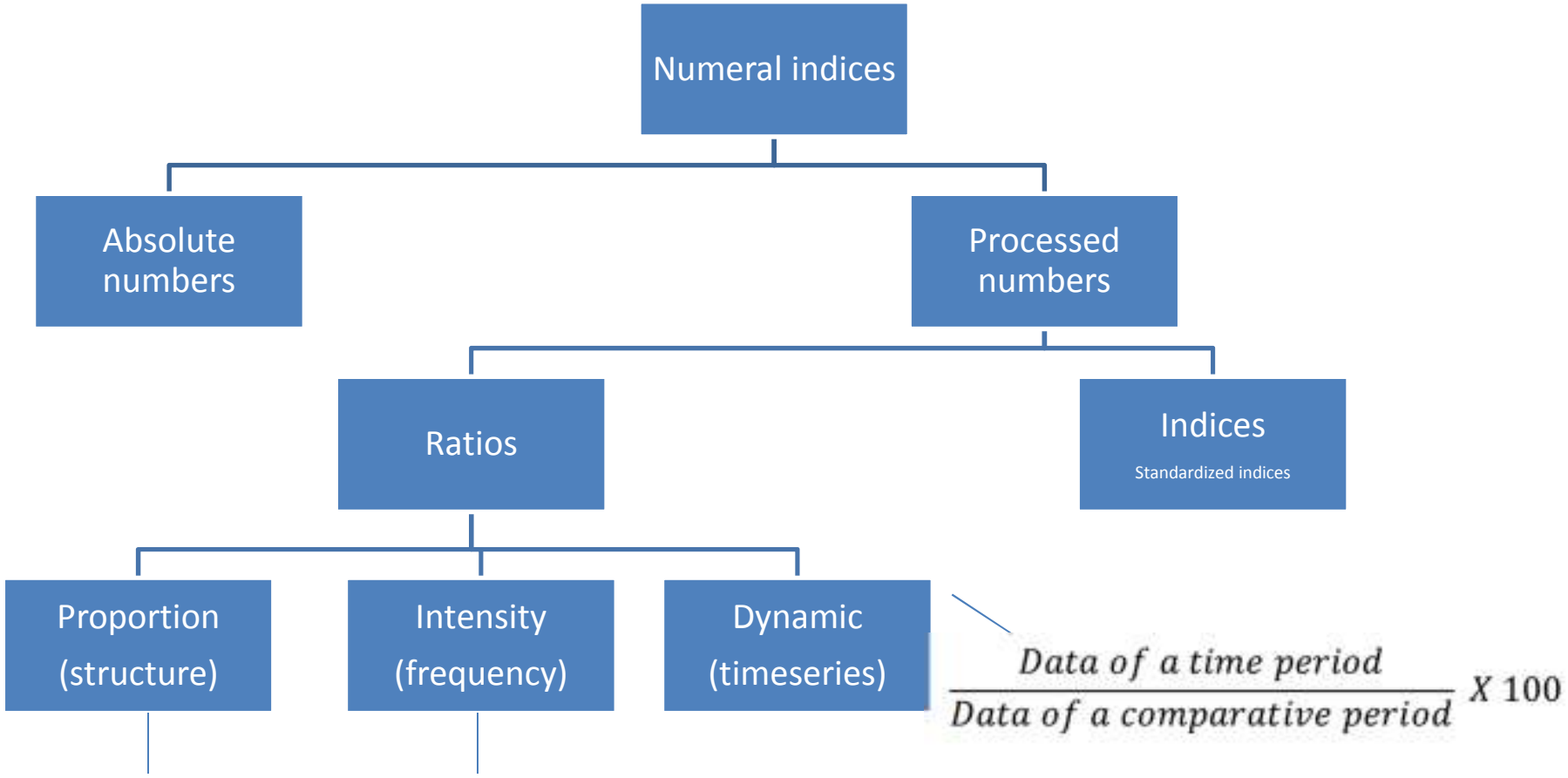
- Census
- Calculation
- Microcensus (intercensus surveys)

Population dynamic:

- Registration of births and deaths (civil registration
- Location of residence registry
- Immigration registry
- Causes of death – death certificate (ICD)

KSH = Hungarian Central Statistical Office

Types of numerical indices used in demography



Demographic structure

Presented as

- sex distribution (females and males) and sex ratio
- population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- female population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- male population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- age structure of population by life-years or five-year age-groups
- age structure of female population by life-years or five-year age-groups
- age structure of male population by life-years or five-year age-groups
- age composition, dependency ratio, ageing index
- Distribution by race, ethnicity

Tables , graphs

Year, day, month	Population number			Population distribution, %			Number of females per thousand males
	male	female	total	male	female	total	
31 December 1869	2 482 090	2 529 220	5 011 310	49,5	50,5	100,0	1 019
31 December 1880	2 618 954	2 710 237	5 329 191	49,1	50,9	100,0	1 035
31 December 1890	2 965 069	3 044 282	6 009 351	49,3	50,7	100,0	1 027
31 December 1900	3 418 016	3 436 399	6 854 415	49,9	50,1	100,0	1 005
31 December 1910	3 792 344	3 819 770	7 612 114	49,8	50,2	100,0	1 007
31 December 1920	3 874 111	4 112 764	7 986 875	48,5	51,5	100,0	1 062
31 December 1930	4 248 452	4 436 657	8 685 109	48,9	51,1	100,0	1 044
31 January 1941	4 560 875	4 755 199	9 316 074	49,0	51,0	100,0	1 043
01 January 1949	4 423 420	4 781 379	9 204 799	48,1	51,9	100,0	1 081
01 January 1960	4 804 043	5 157 001	9 961 044	48,2	51,8	100,0	1 073
01 January 1970	5 003 651	5 318 448	10 322 099	48,5	51,5	100,0	1 063
01 January 1980	5 188 709	5 520 754	10 709 463	48,4	51,6	100,0	1 064
01 January 1990	4 984 904	5 389 919	10 374 823	48,0	52,0	100,0	1 081
01 February 2001	4 851 012	5 349 286	10 200 298	47,6	52,4	100,0	1 103
01 January 2002	4 836 980	5 337 873	10 174 853	47,5	52,5	100,0	1 104
01 January 2003	4 818 456	5 323 906	10 142 362	47,5	52,5	100,0	1 105
03 January 2004	4 804 113	5 312 629	10 116 742	47,5	52,5	100,0	1 106
01 January 2005	4 793 115	5 304 434	10 097 549	47,5	52,5	100,0	1 107
01 January 2006	4 784 579	5 292 002	10 076 581	47,5	52,5	100,0	1 106
01 January 2007	4 779 078	5 287 080	10 066 158	47,5	52,5	100,0	1 106
01 January 2008	4 769 562	5 275 839	10 045 401	47,5	52,5	100,0	1 106
01 January 2009	4 763 050	5 267 925	10 030 975	47,5	52,5	100,0	1 106
01 January 2010	4 756 900	5 257 424	10 014 324	47,5	52,5	100,0	1 105
01 January 2011	4 743 901	5 241 821	9 985 722	47,5	52,5	100,0	1 105

Age-sex pyramid

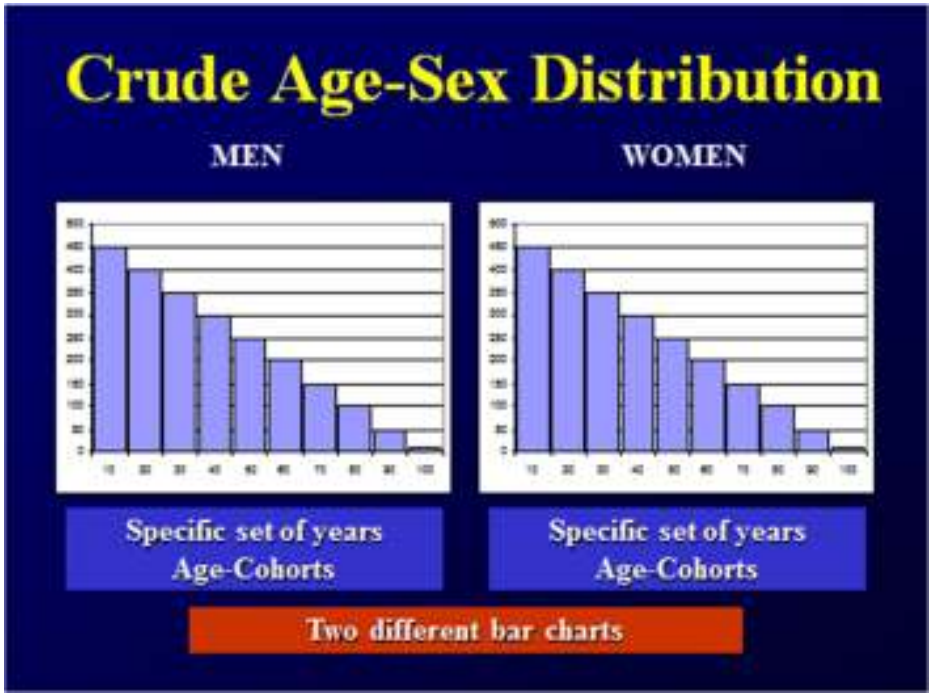
Demonstration of the demographic structure of the society.

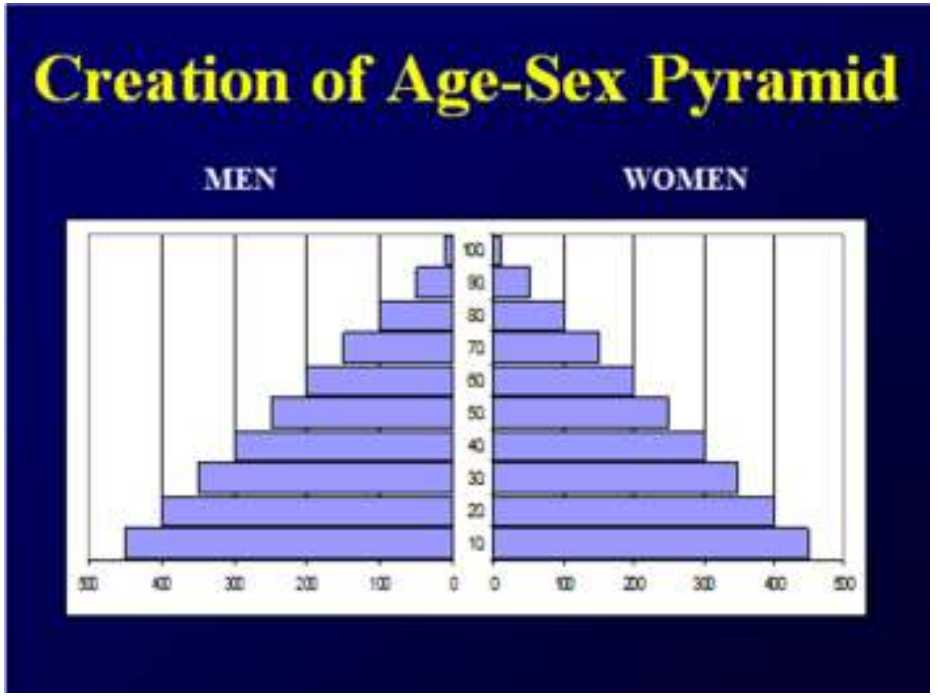
Horizontal x-axes: the life years of women and men alike. The basic unit of this category may be a single year or groups of more years.

Vertical (value) y-axes: the number of persons of each age group.

Changing the axes: the vertical one will show the age categories.

Females are traditionally on the right males on the left side.

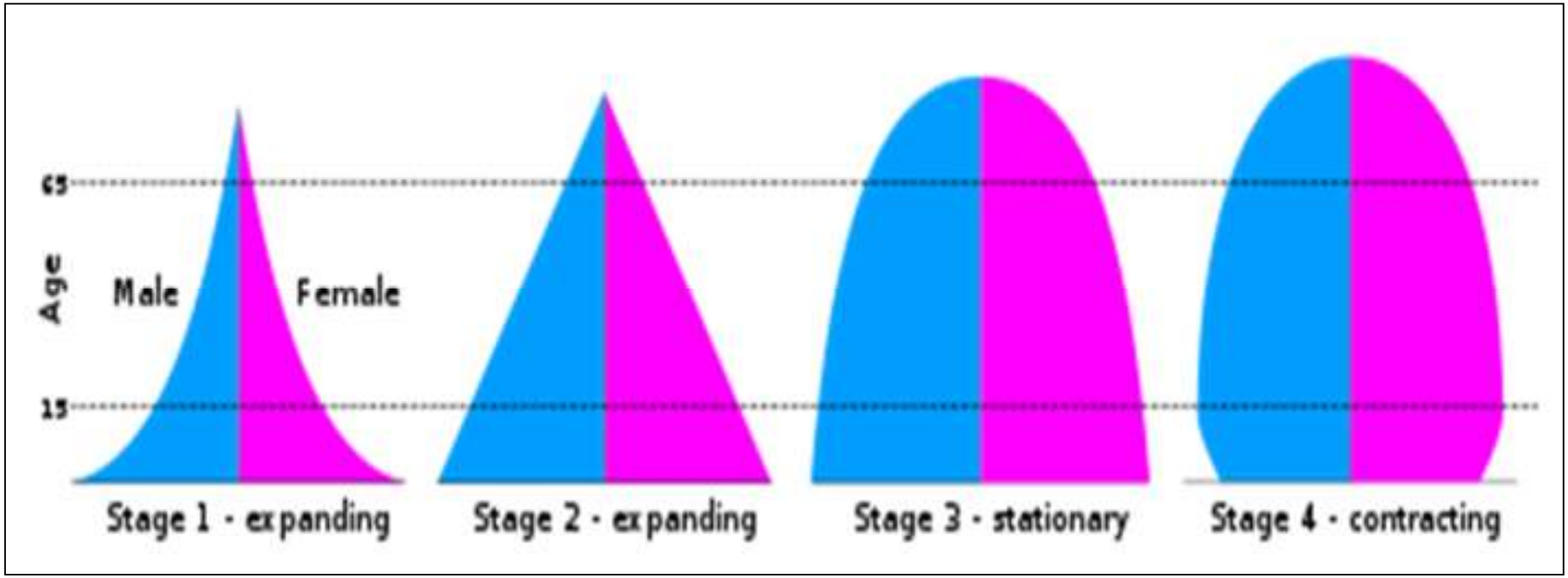




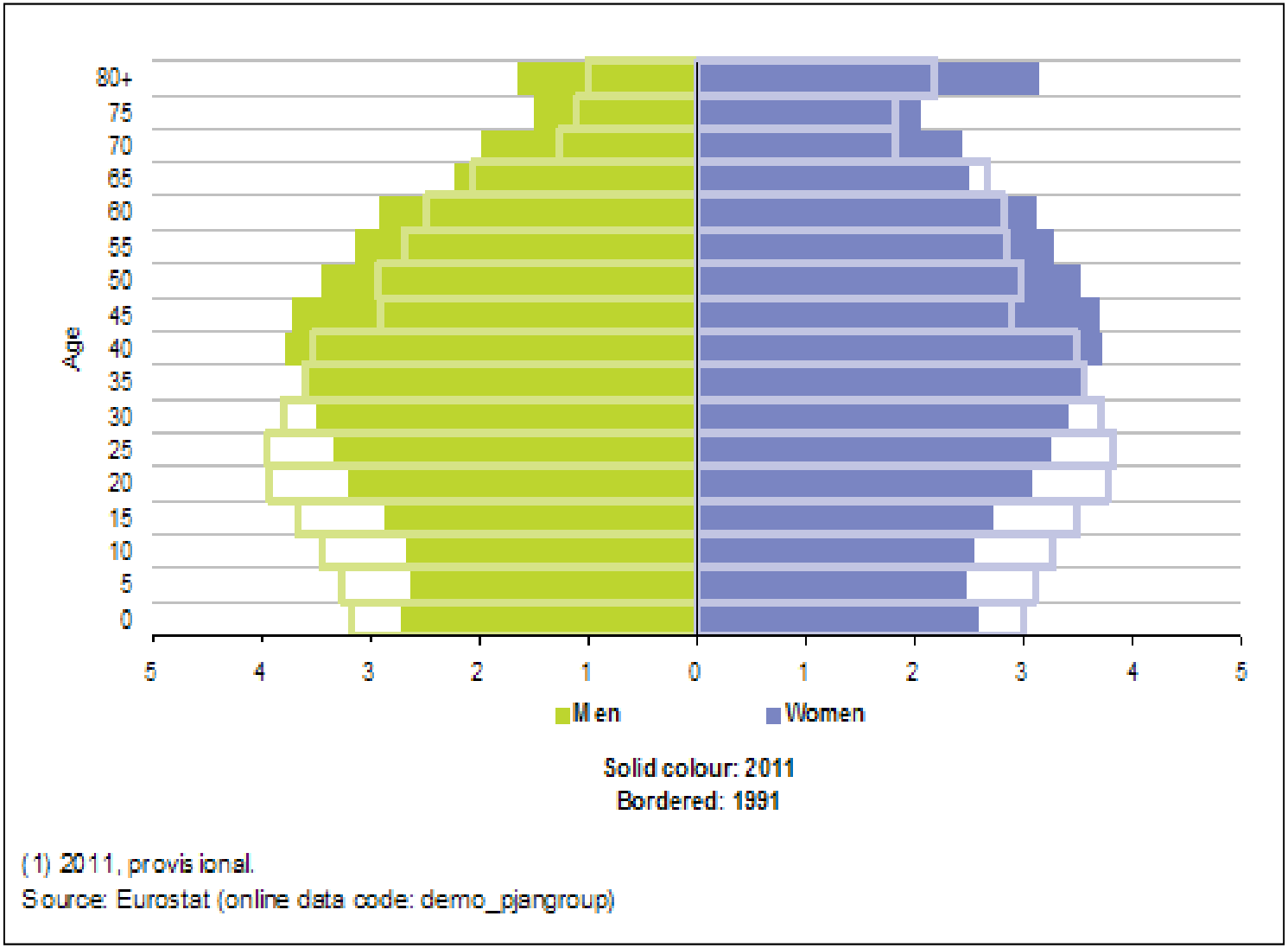
Types of age-sex pyramid

Four general types :

1. stage 1 of expanding (rapid growth)
2. stage 2 of expanding (balanced growth)
3. stage 3 stationary (growing older population)
4. stage 4 contracting (decreasing population)



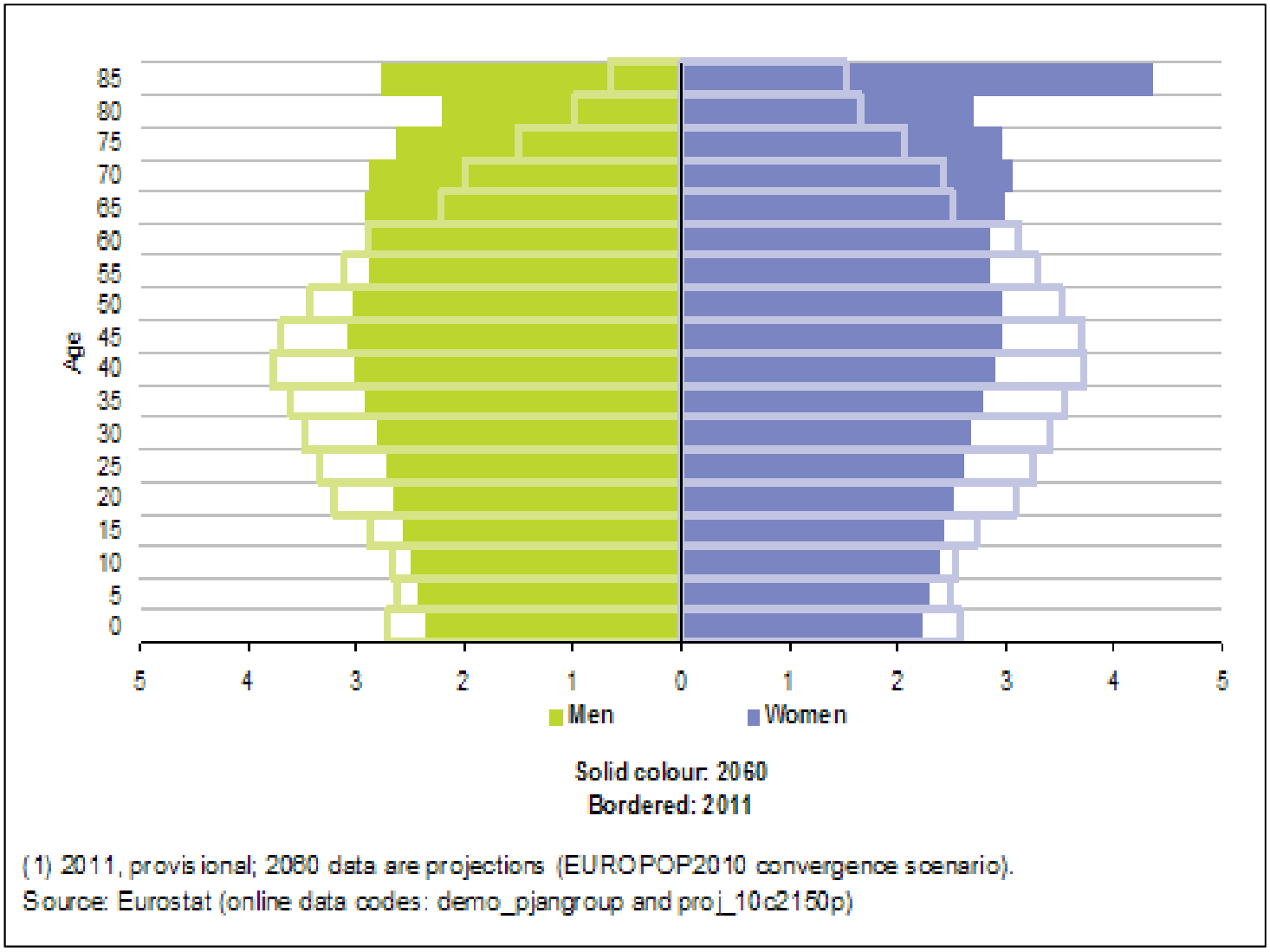
Age-sex pyramid of the EU-27 countries: changes between 1991 and 2011



(1) 2011, provisional.

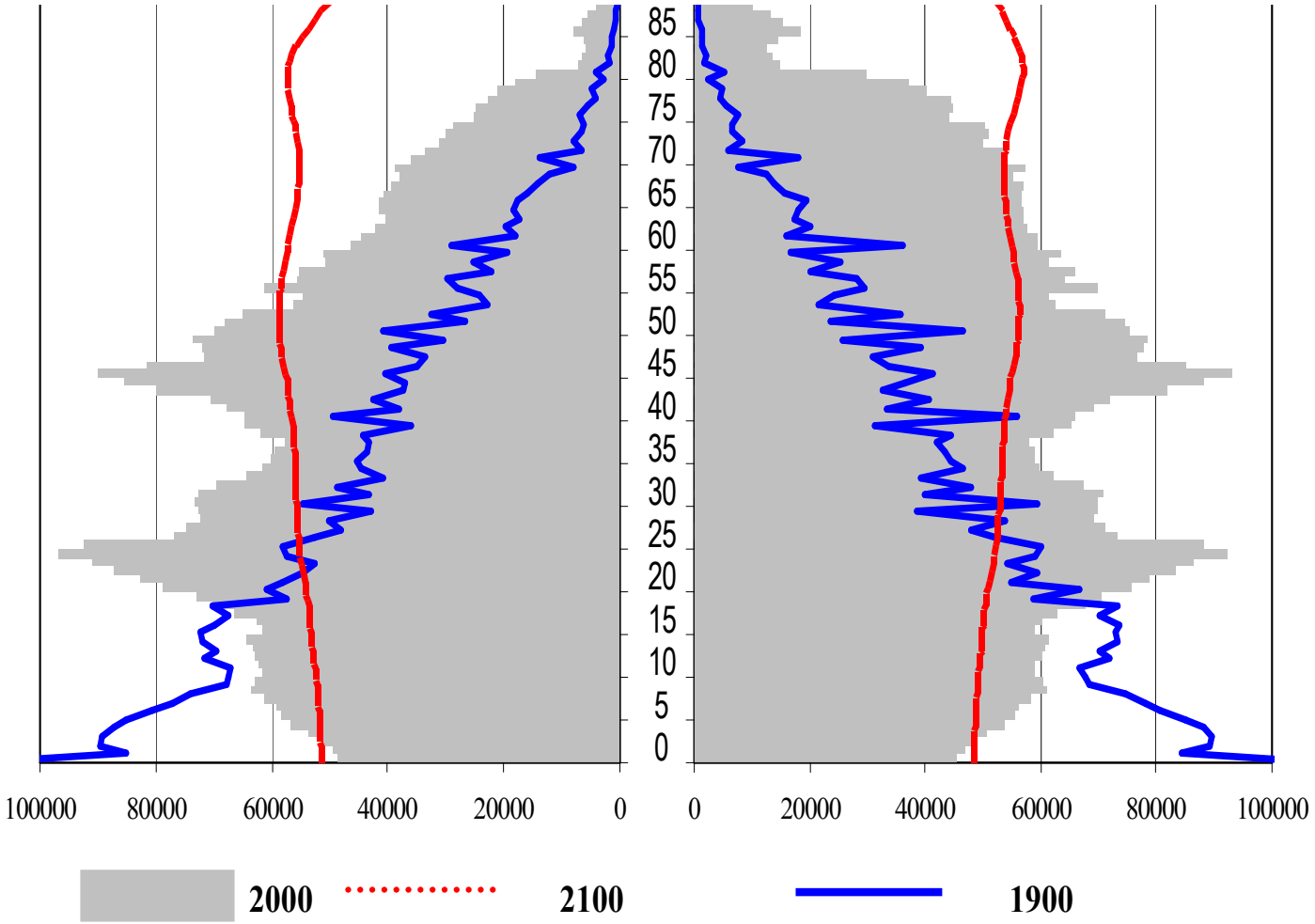
Source: Eurostat (online data code: demo_pjangroup)

Projected changes 2011-2060 of the EU-27 countries

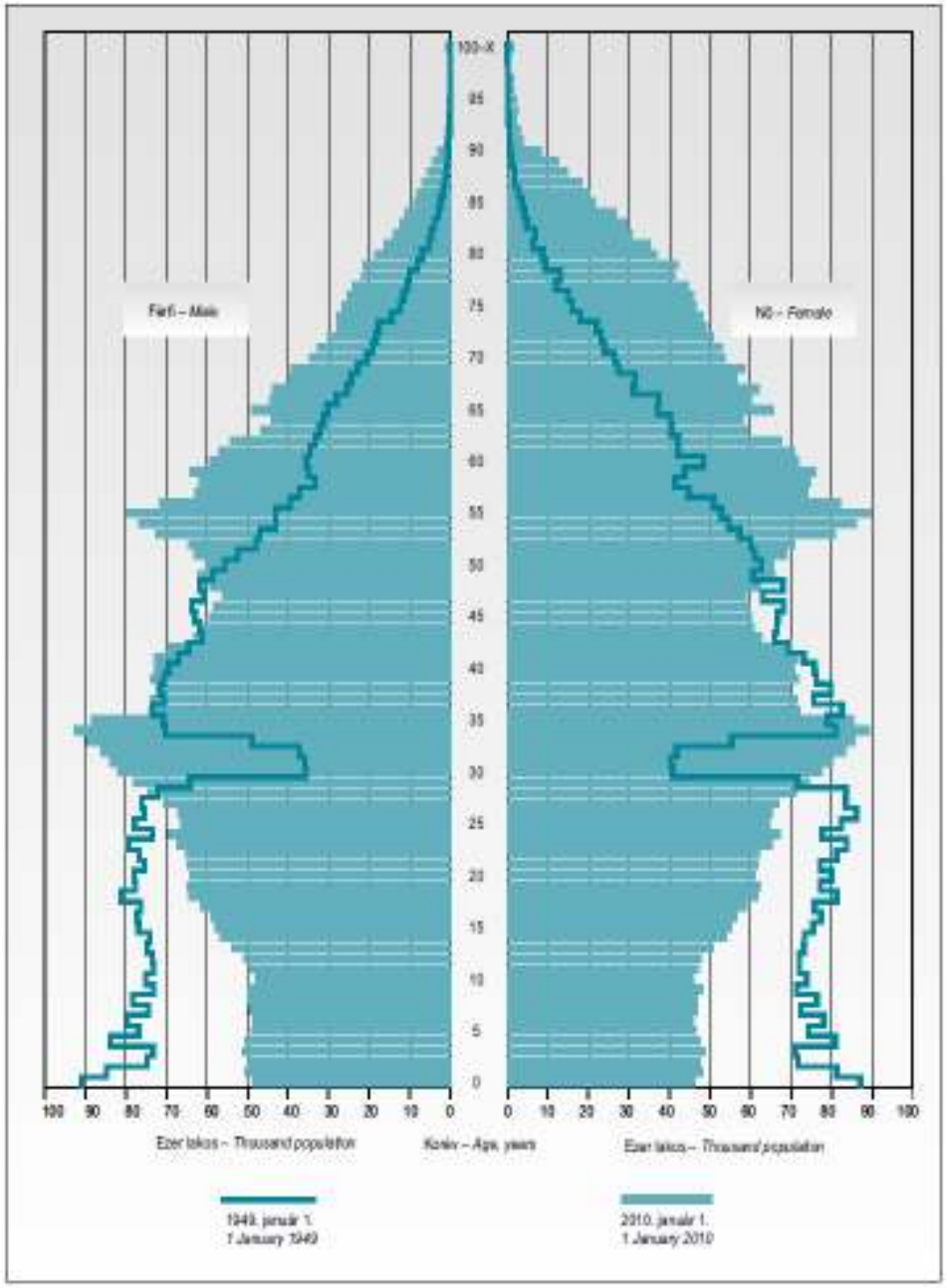


(1) 2011, provisional; 2060 data are projections (EUROPOP2010 convergence scenario).
Source: Eurostat (online data codes: demo_pjangroup and proj_10c2150p)

Population pyramid

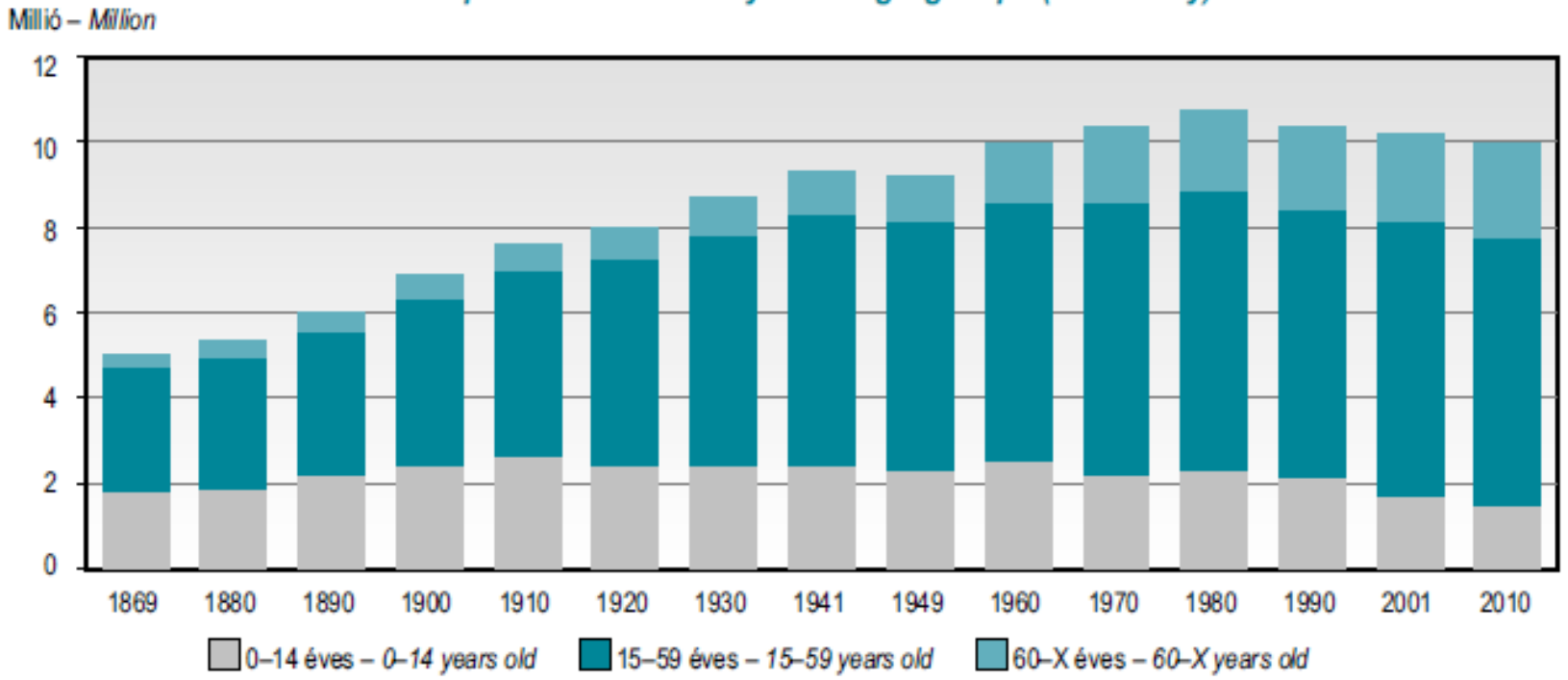


G.1. A népesség száma nem és életkor szerint
Population number by sex and age



G.3. A népesség száma főbb korcsoportok szerint (január 1.)*

*Population number by main age-groups (1 January) **



Aging of population

- Shift toward older ages in the age distribution of the developed countries.
- Ageing is one of the global demographic trends in the 21th century as a result of the decreasing number of younger age cohorts and the prolonged life of older cohorts in the population.
- It has numerous
  - socio-economic (aging of labor force, social security systems under pressure) and
  - health consequences (global increasing of disease burden).

$$Ageing\ index = \frac{\text{N of persons } \geq 60 \text{ years}}{\text{N of persons } \leq 14 \text{ years}} \times 100$$

How much percentage represent the persons ≥ 60 life years if the persons ≤ 14 life years are considered as 100 percent in a given population.

Combining the ageing index with socio-economic considerations: cutoff value of 65 life years. (old age retirement)

$$Ageing\ index = \frac{\text{N of persons } \geq 65 \text{ years}}{\text{N of persons } \leq 14 \text{ years}} \times 100$$

Hungary’s population by age groups on January 1, 2012

0 ≤ 14 years	1,441,842
15-64 years	6,835,357
65 + years	1,680,532
Total	9,957,731

$$Ageing\ index = \frac{1{,}680{,}532}{1{,}441{,}842} \times 100 = 116.6\%$$

Aging of population

Dependency ratio

- combined demographic index showing the relationship of socio-economically dependent and independent population.
- Total dependency ratio
- Youth dependency ratio
- Old age dependency ratio

Total dependency ratio = the number of persons ≤ 14 years plus ≥ 65 years divided by the number of persons 15 to 64 years

$$Total\ dependency\ ratio = \frac{\text{N of persons } \leq 14 + \geq 65 \text{ years}}{\text{N of persons 15 to 64}} \times 100$$

$$Total\ dependency\ ratio = \frac{1{,}441{,}842 + 1{,}680{,}532}{6{,}835{,}357} \times 100 = 45.7\%$$

Aging of population

Youth dependency ratio = the number of persons 0-14 years divided by persons 15- 64 years

$$Youth\ dependency\ ratio = \frac{\text{N of persons } \leq 14 \text{ years}}{\text{N of persons 15 to 64 years}} \times 100$$

$$Youth\ dependency\ ratio = \frac{1{,}441{,}842}{6{,}835{,}357} \times 100 = 21.1\%$$

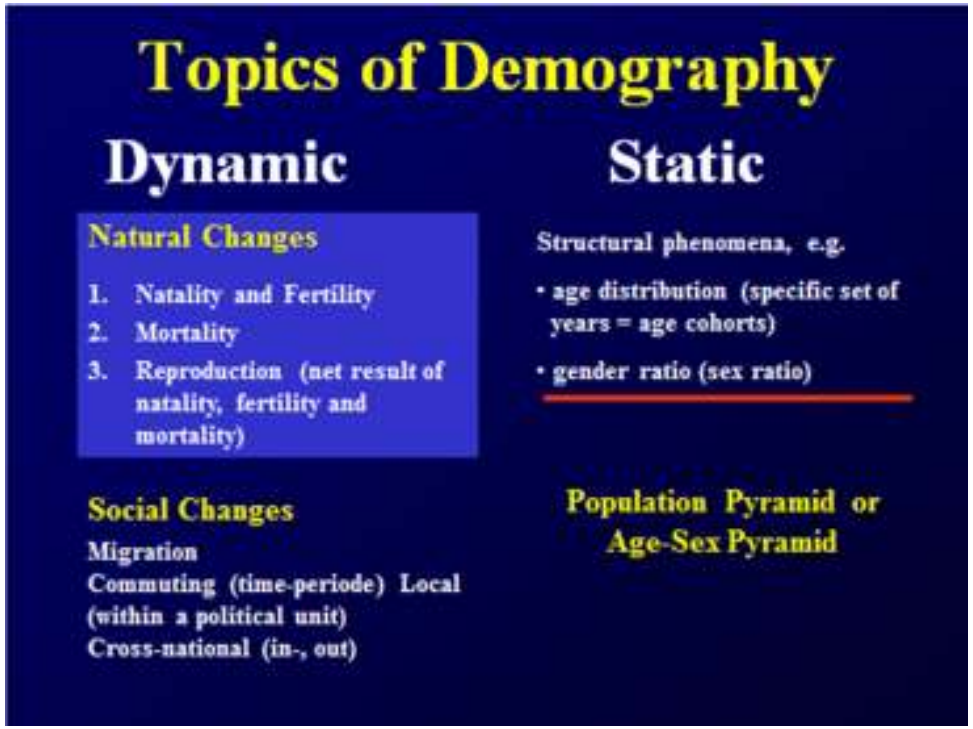
Old age dependency ratio = the number of persons ≥ 65 years divided by persons 15 to 64 years

$$Old\ age\ dependency\ ratio = \frac{\text{N of persons } \geq 65 \text{ years}}{\text{N of persons 15 to 64 years}} \times 100$$

$$Old\ age\ dependency\ ratio = \frac{1{,}680{,}532}{6{,}835{,}357} \times 100 = 24.6\%$$

Population dynamics

- Diversities in demographic situations across countries and regions, as well as within countries.
- There are two driving forces behind these evolving demographic changes
- bio-social phenomena
  - birth = natality if related to neonates, fertility if related to mothers
  - death = mortality (in scientific terms)
- social phenomena (internal and international migration)



Natality

***Birth** (by WHO definition 1950) **as a natality event** means live birth (contrasted to the stillbirth) that occurs when a foetus exits the maternal body and subsequently shows any signs of life as*

- heartbeat,
- pulsation of the umbilical cord,
- any voluntary movement

Complete birth is the infant's entire separation from the maternal body (by cutting of the umbilical cord) after 42 completed weeks (294 days) of gestation.

Birth in demographic terms may be

- *Singleton:* one offspring produced in the same gestation period
- *Multiple*: two or more offspring produced in the same gestation period
- *Preterm (PTB):* birth of an infant before 37 completed weeks (259 days) of gestation
- *Low weight (LBW)*: the infant's weight is <2500 gram

Natality

Crude birth rate is the number of live births in a year per 1000 of the population. First the total number of live birth is divided by the mid-year population of the referred territorial unit (e.g. Hungary) and the outcome has to be multiplied by 1000.

$$Birth\,rate = \frac{\text{N of live births}}{\text{Mid} - \text{year population}} \times 1000$$

Calculation of Example-country's birth rate:
number of live birth = 85,000 and the mid-year population = 10,000,000.

$$Birth\,rate = \frac{85{,}000}{10{,}000{,}000} = 0.0085 \times 1000 = 8.5$$

Basic rule in demography: rates are related at least to one whole person. Thus the outcome has to be multiplied by 1000 to get 8.5. In other words, 1000 persons are producing 8.5 live-born babies in Hungary in a year.

Natality

Preterm birth (PTB) rate is the number of preterm born infants per 100 live births in a year.

$$PTB\ rate = \frac{\text{N of preterm births}}{\text{N of all live births}} \times 100$$

Calculation of Example-country's PTB-rate

$$PTB\ rate = \frac{7{,}225}{85{,}000} = 0{,}085 \times 100 = 8.5\%$$

Low birth weight (LBW) rate is the number of substandard (<2500 gram) weight infants per 100 live births in a year.

$$LBW\ rate = \frac{\text{N of substandard weight infants}}{\text{N of all live births}} \times 100$$

Calculation of Example-country's LBW rate:

$$LBW\ rate = \frac{7{,}140}{85{,}000} = 0.084 \times 100 = 8.4\%$$

Fertility

Fertility is a child bearing capacity of the population represented by women between the ages of 15 and 49 years.
Fertility rate is a number of births per 1000 women of specific compositions.

1. General fertility rate,
2. Age-specific fertility rate
3. Total fertility rate

General fertility rate (GFR): number of live births per 1000 women between the ages of 15 and 49 years.

$$GFR = \frac{\text{N of live births}}{\text{Mid} - \text{year female population aged } 15 - 49} \times 1000$$

Example-country's GFR:

$$GFR = \frac{90{,}254}{2{,}374{,}912} \times 1000 = 38.0$$

Fertility

Age-specific fertility rate: number of births to women of a particular age (a year or age group). E.g. females in the age group 20-24 years.

$$Age-specific\ FR = \frac{\text{N of live births of mothers aged } 20-24 \text{ years}}{\text{Mid}-\text{year female population aged } 20-24 \text{ years}} \times 1000$$

Example-country's fertility rate

$$Age-specific\ FR = \frac{12{,}668}{314{,}375} \times 1000 = 40.3$$

Fertility

Total fertility rate (TFR): average number of children a woman would bear during her reproductive lifetime (15-49 years), assuming her childbearing conforms to her age-specific fertility rate every year of her childbearing years.

Computation of total fertility rate, based on Hungary's 2010 data:

	Life year categories						
	15-19	20-24	25-29	30-34	35-39	40-44	45-49
N. of children	5 220	12 668	25 090	31 489	13 438	2 271	78
N. of women	287 568	314 375	335 856	401 619	388 074	346 058	301 362
Fertility rate	0,02	0,04	0,07	0,08	0,03	0,01	0,00
N. of children/women in five years	0,10	0,20	0,35	0,40	0,15	0,05	0,00

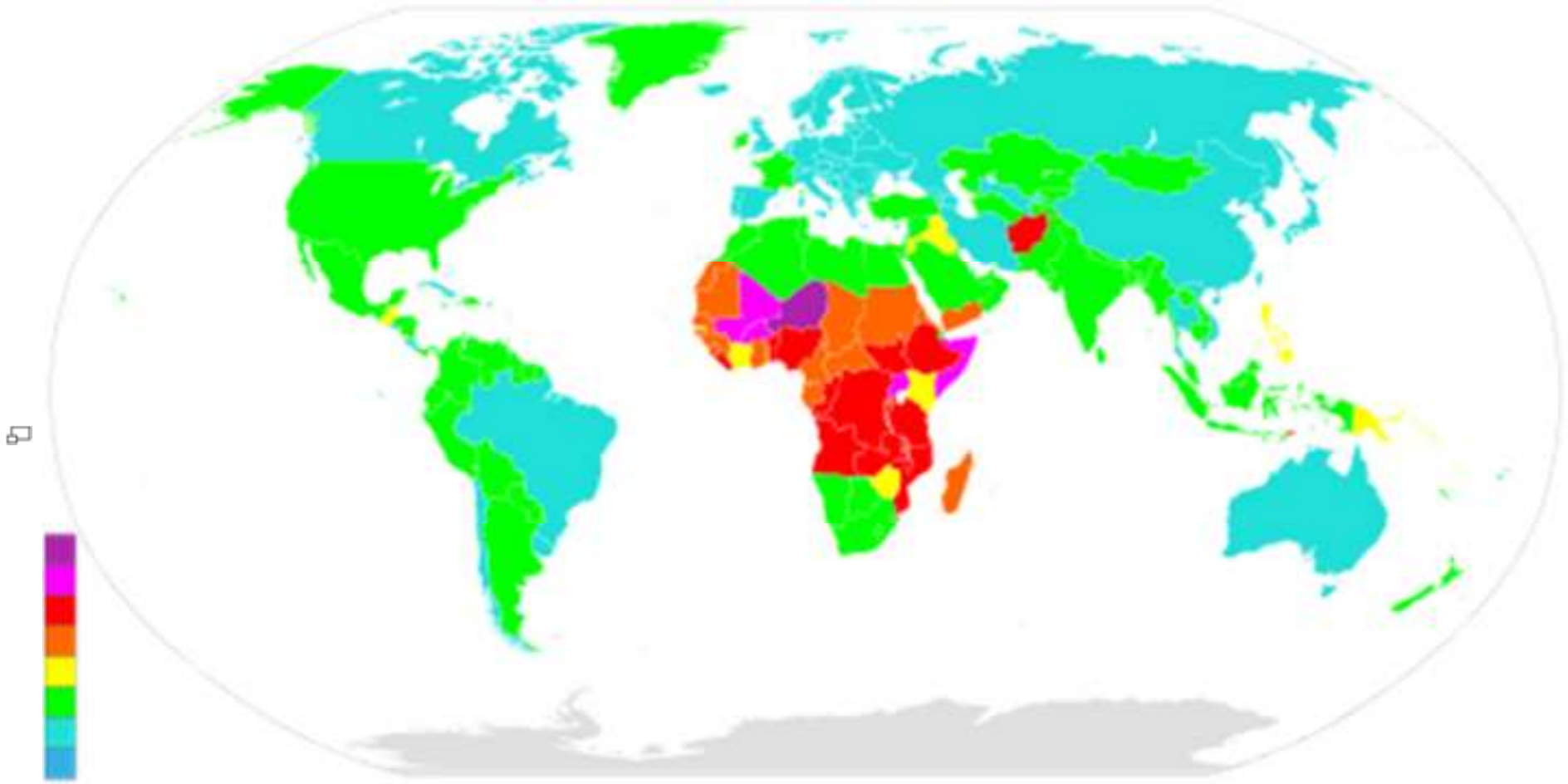
$$TFR = 0{,}10 + 0{,}20 + 0{,}350 + 0{,}40 + 0{,}15 + 0{,}05 + 0{,}00 = 1{,}25$$

From biological point of view (without concerning migration and at a stable level of mortality) TFR indicates clearly the trend of the human reproduction. The cut value is TRF=2, which means that mother and father in the family will be replaced by 2 children.

TFR greater than 2 means growing population

TFR less than 2 means decreasing number of the population

A world map showing countries by TFR, from 7-8 children to 0-1 children



The colour bar indicates TFR 7-8 at the top and TFR 0-1 at the bottom.

Calculation of total fertility rate (TFR)
For 1000 women from age 15 through age 45 years

Age	Births	
15	110	
16	110	
17	110	(average annual fertility
18	110	from ages 15-19 = 110/1000)
19	110	
20	180	
21	180	
22	180	(average annual fertility
. . .		from ages 20-29 = 180/1000)
29	180	
30	80	
31	80	(average annual fertility
. . .		from ages 30-45 = 80/1000)
44	80	
45	80	
	3,630	

or about 3.6 children born to each woman.

(This TFR could also be calculated more compactly as
110 x 5 + 180 x 10 + 80 x 16 = 3,630)

Note that the TFR is a hypothetical measure based on the assumption that the age-specific fertility rates do not change until the cohort has aged beyond them. The TFR is a projection, not a prediction—essentially, a technique for summarizing a set of age-specific rates into an intuitively meaningful number.

Reproduction ratios

Gross reproduction rate (GRR): The sum of the age-specific female fertility rates (births of daughters), for all reproductive age groups for a particular period (usually a year) conventionally expressed per woman. The GRR indicates **how many daughters a woman would have if, throughout her reproductive life, she had children at the age-specific rates prevalent in the specified year of period**. The GRR can be calculated either by summing female age specific fertility rates, (relating to births of daughters rather than all births) or using the formula

GRR = TFR × Proportion of female births

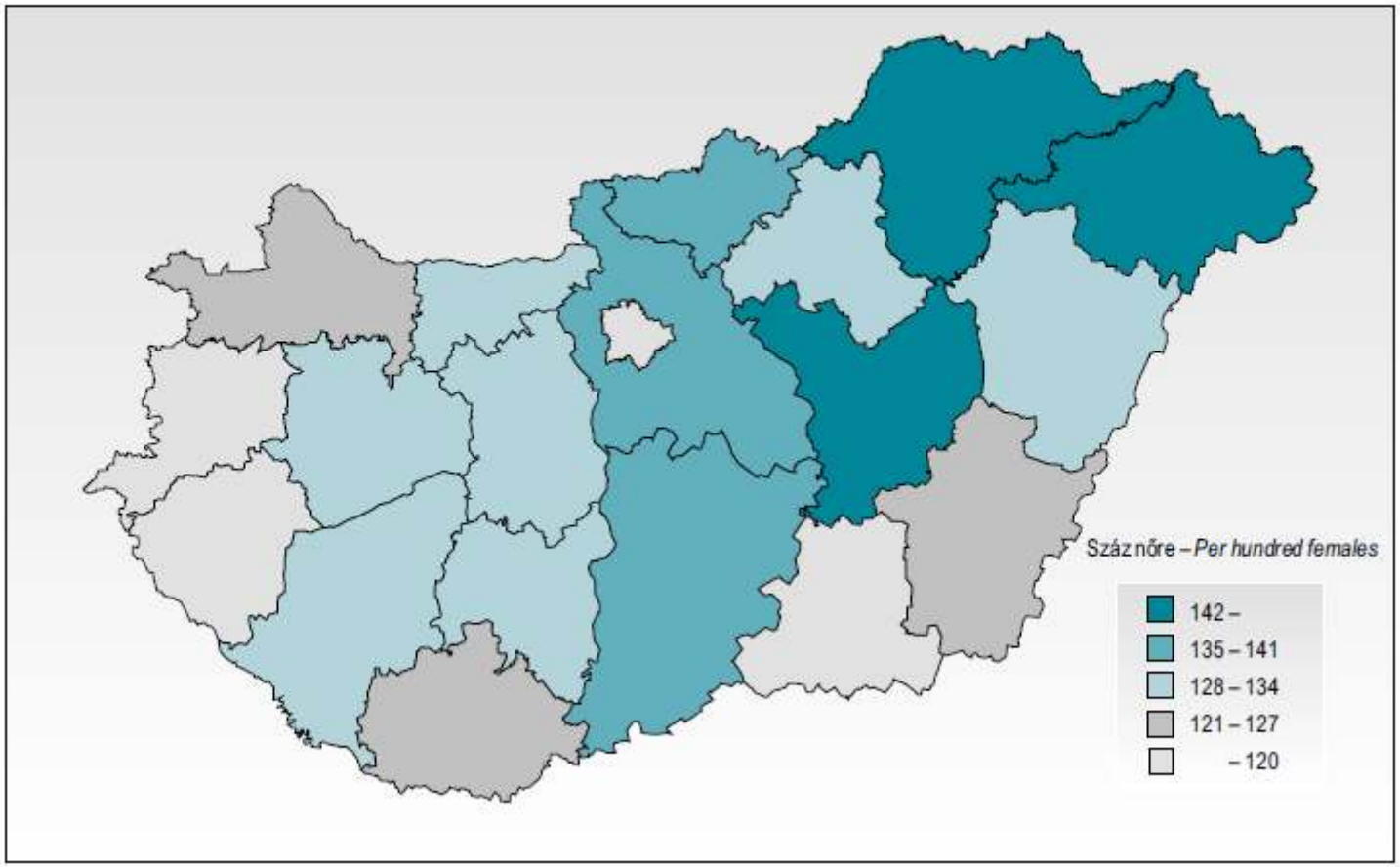
The proportion of female births can be taken as 0.488 (100/205) in the absence of more detailed information.

Net reproduction rate (NRR): The average number of daughters that would be borne, according to specified rates of mortality and of bearing daughters, by a woman subject through life to these rates. The NRR employs the same fertility data as the GRR, but also takes into account the effects of mortality. An NRR of 1 indicates that a population's fertility and mortality levels would result in exact replacement of mothers by daughters.

1.4.1. Élveszületési és termékenységi mutatók
Indicators of live birth and fertility

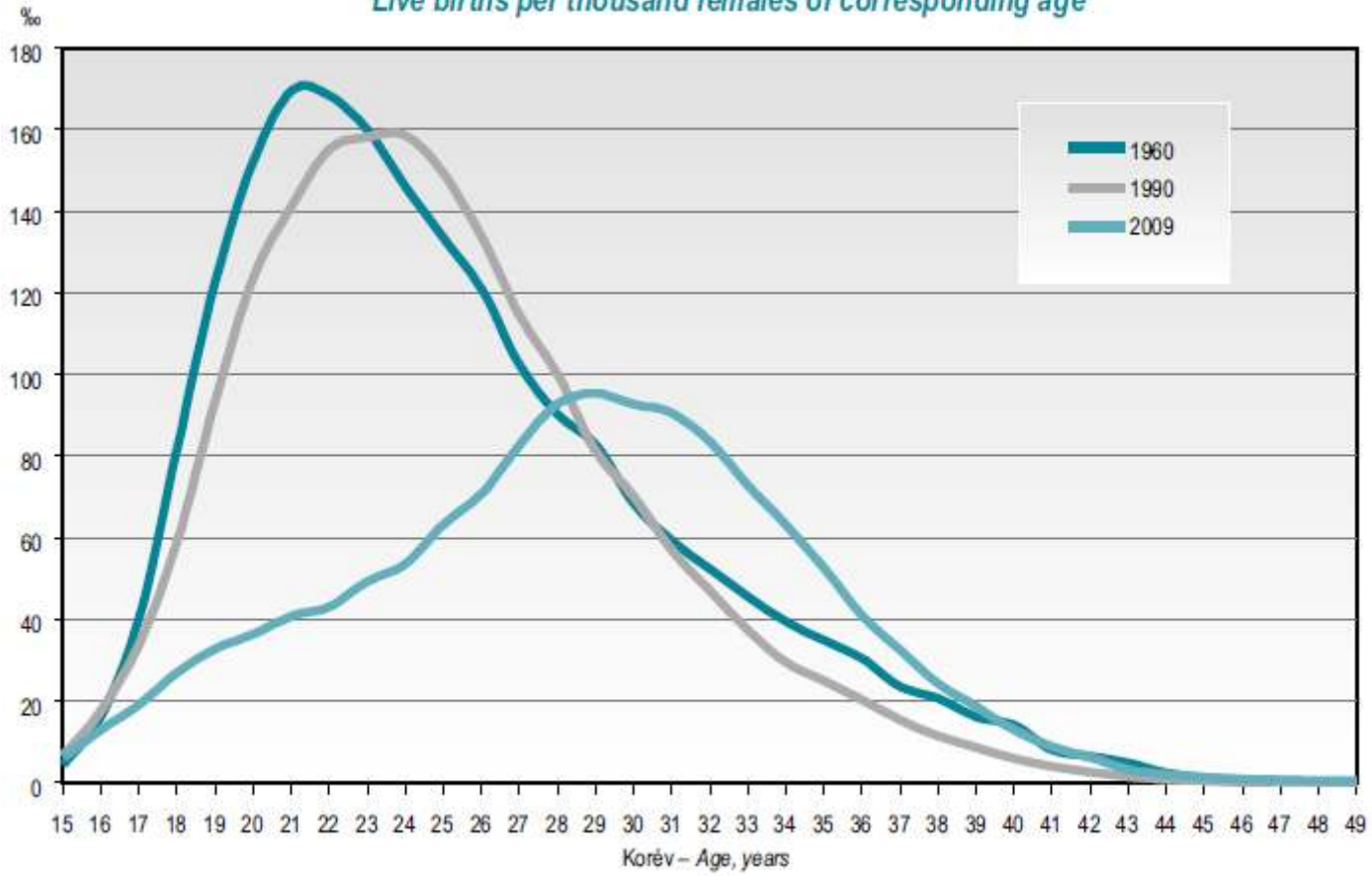
Év *Year*	Élveszületések száma *Number of live births*	Teljes termékenységi arányszám *Total fertility rate*	Reprodukciós együttható *Reproduction rates*		Ezer – *Live births*			
			nyers *crude*	tisztított *net*	15–49 éves nőre jutó élveszületés *per thousand females aged 15–49*	15–49 éves házas nőre házasságból jutó éléveszületés *in wedlock per thousand married females aged 15–49*	15–49 éves nem házas nőre jutó házasságon kívüli élveszületés *out of wedlock per thousand non-married females aged 15–49*	15–59 éves házas férfira házasságból jutó élveszületés *in wedlock per thousand married males aged 15–59*
1949	190 398	2,54	1,223	1,060	75,4	111,3	16,5	98,9
1960	146 461	2,02	0,975	0,917	58,9	78,4	11,0	67,4
1970	151 819	1,97	0,953	0,912	56,6	76,1	10,2	68,1
1980	148 673	1,92	0,937	0,909	57,6	73,7	14,8	62,3
1990	125 679	1,84	0,900	0,889	49,4	67,4	17,7	57,5
2000	97 597	1,33	0,643	0,635	38,1	52,1	23,0	42,6
2001	97 047	1,31	0,636	0,627	38,1	52,1	23,6	42,3
2002	96 804	1,31	0,635	0,626	38,3	52,8	23,9	42,5
2003	94 647	1,28	0,617	0,609	37,8	52,5	23,7	41,9
2004	95 137	1,28	0,626	0,618	38,4	53,4	24,8	42,0
2005	97 496	1,32	0,637	0,630	39,8	56,1	25,8	43,4
2006	99 871	1,35	0,659	0,651	41,1	59,0	26,5	44,9
2007	97 613	1,32	0,645	0,637	40,5	57,9	26,9	43,5
2008	99 149	1,35	0,659	0,652	41,3	58,8	28,3	43,9
2009	96 442	1,33	0,645	0,638	40,3	57,7	28,0	43,0

G.16. Teljes termékenységi arányszám megyénként, 2009
Total fertility rate by counties, 2009

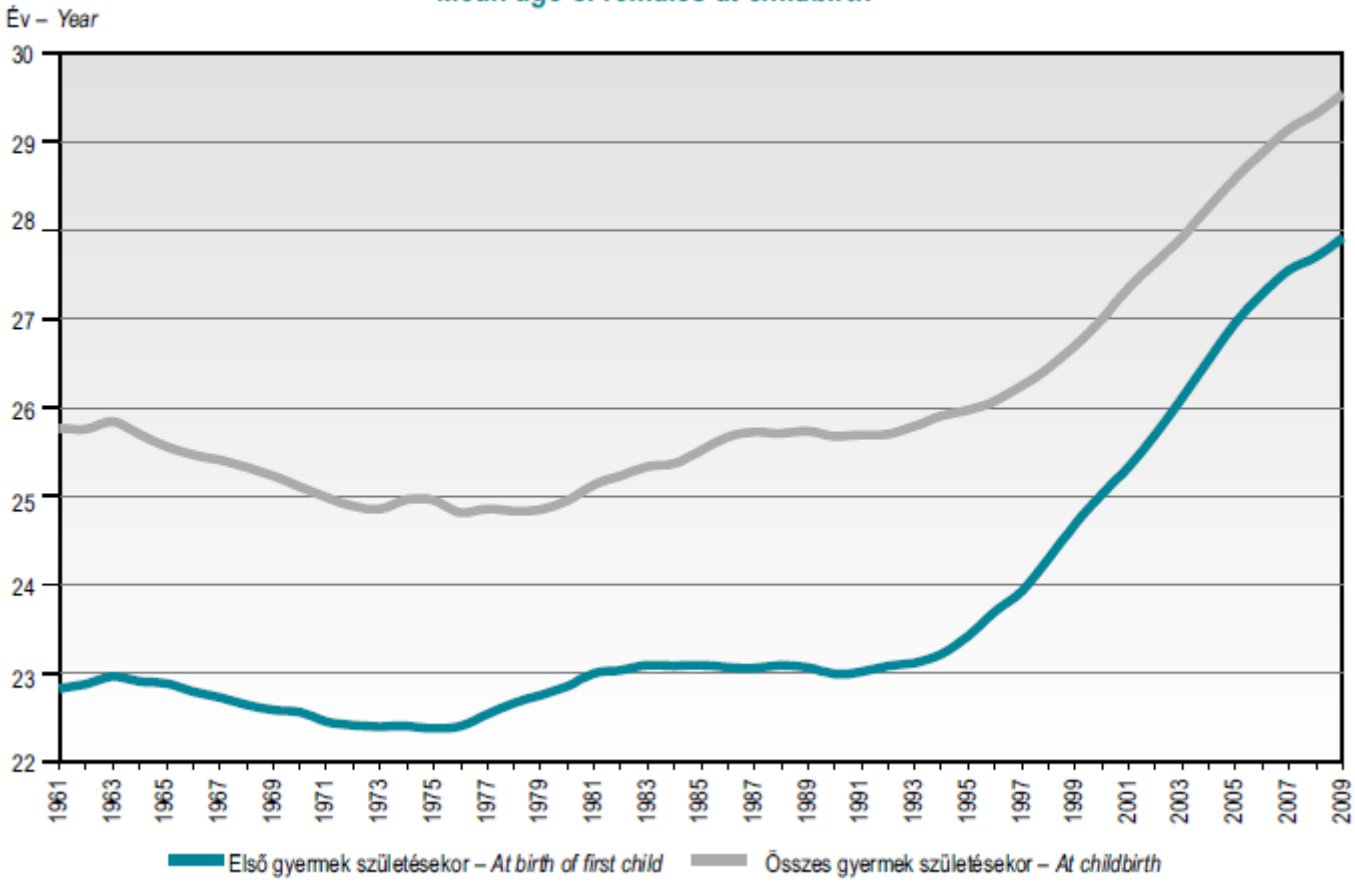


G.13. Ezer megfelelõ korú nõre jutó élveszületés

Live births per thousand females of corresponding age



G.14. A nők átlagos kora gyermekük születésekor
Mean age of females at childbirth



Mortality

Mortality is a relationship of death cases to the whole population.
Two basic types of mortality:

1. General (crude) mortality rate or death rate
2. Specific mortality rates
   - Age and sex related (special rates: infant mortality and foetal losses)
   - Cause related (diseases, injuries, suicide, homicide)
   - Life expectancy (sex and age related)

Crude death rate (or mortality rate) is the number of death cases in a year per 1000 of the population.

$$Crude\ Mortality\ Rate\ (CMR) = \frac{\text{N of death cases}}{\text{Mid} - \text{year population}} \times 1000$$

Calculation of Example-country's CMR: number of death cases = 135,000 and the mid-year population = 10,000,000.

$$CMR = \frac{135{,}000}{10{,}000{,}000} = 0.0135 \times 1000 = 13.5$$

Mortality

Age and sex related mortality rate: CMRs can be computed for both genders and age groups. The age group under 1 year is separately treated (the infant mortality).

General population between 40-49 years:

$$CMR_{40-49\ years} = \frac{\text{N of death cases of the cohort}}{\text{Midyear population of the cohort}} \times 1000$$

The real number for Hungary of the same cohort was 3.6 in 2011, which means that in every thousand persons aged 40-49 years died more than 3 in this year.

$$CMR_{40-49\ years} = \frac{4677}{1{,}308{,}882} = 0.0036 \times 1000 = 3.6$$

Mortality

Female population between 40-49 years:

$$CMR_{Females\ 40-49\ years} = \frac{\text{N of death cases of the cohort}}{\text{Midyear population of the cohort}} \times 1000$$

The real number for Hungary of the same cohort was 2.32 in 2011, which means that in every thousand women aged 40-49 years died more than 2 persons in this year.

$$CMR_{Females\ 40-49\ years} = \frac{1{,}508}{564{,}107} = 0.0023 \times 1000 = 2.32$$

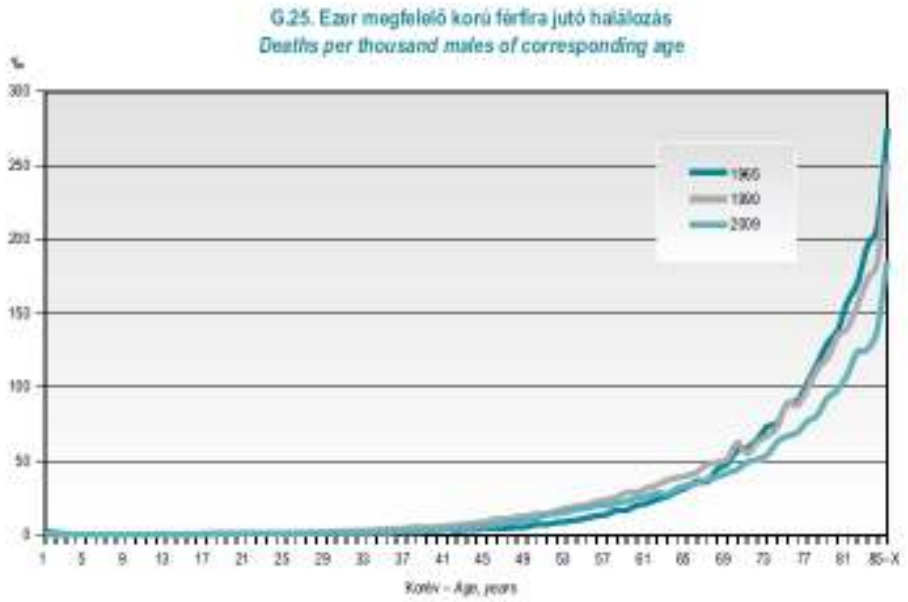
Male population between 40-49 years:

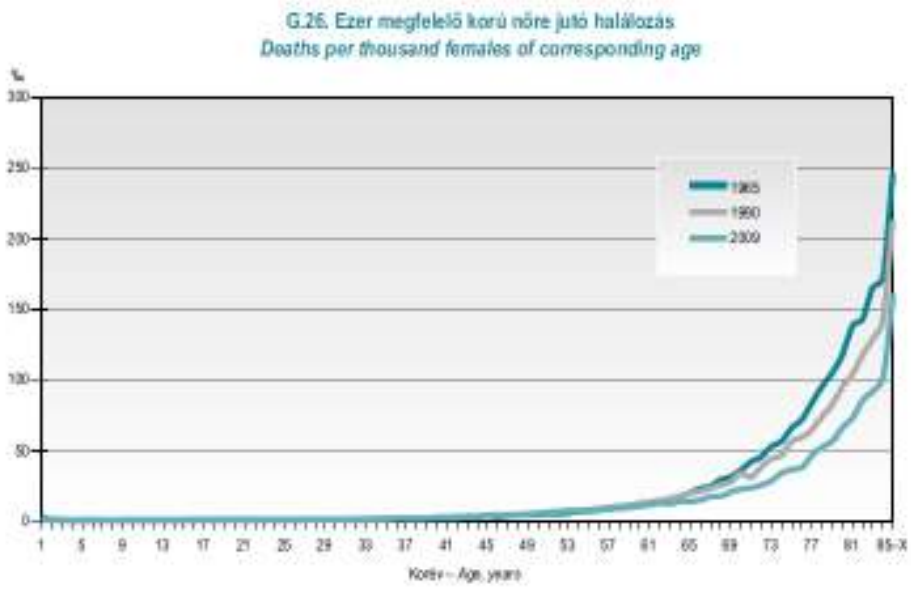
$$CMR_{Males\ 40-49\ years} = \frac{\text{N of death cases of the cohort}}{\text{Midyear population of the cohort}} \times 1000$$

The real number for Hungary of the same cohort was 4.88 in 2011, which means that in every thousand women aged 40-49 years died nearly 5 persons in this year.

$$CMR_{Males\ 40-49\ years} = \frac{3{,}169}{654{,}715} = 0.0048 \times 1000 = 4.8$$

Frequency of deaths by age





Mortality

Infant mortality rate: is the number of deaths of infants under one year (365 days) old in a given year per 1,000 live births occurred in the same year. This rate is divided up for 4 subgroups and often used as an indicator of the level of health in a country.

Indicators of the level of health in a country

Mortality

General infant mortality rate

$$Infant\ Mortality\ Rate = \frac{\text{N of infants died in the first 365 days}}{\text{N of infants born in a given year}} \times 1000$$

Hungary's infant mortality rate was 4.9 in 2011, which means that 5 infants died out of 1,000 prior their first birthday:

$$Infant\ Mortality\ Rate = \frac{433}{88{,}049} = 0.0049 \times 1000 = 4.9$$

Perinatal mortality rate: Separated perinatal mortality (first 24 hours) does not include stillbirths:

$$Perinatal\ Mortality\ Rate = \frac{\text{N of infants died in the first 24 hours}}{\text{N of infants born in a given year}} \times 1000$$

Hungary's perinatal mortality rate was 1.0 in 2011, which means that 1 infant died out of 1,000 in the first 24 hours:

$$Perinatal\ Mortality\ Rate = \frac{92}{88{,}049} = 0.001 \times 1000 = 1.0$$

Mortality

Postnatal mortality rate:

$$Postnatal\ Mortality\ Rate = \frac{\text{N of infants died in the first } 0-6 \text{ days}}{\text{N of infants born in a given year}} \times 1000$$

Hungary's postnatal mortality rate was 2.2 in 2011, which means that more than 2 infants died out of 1,000 within the first week of their life:

$$Postnatal\ Mortality\ Rate = \frac{190}{88{,}049} = 0.0022 \times 1000 = 2.2$$

Neonatal mortality rate:

$$Neonatal\ Mortality\ Rate = \frac{\text{N of infants died between the days } 7-27}{\text{N of infants born in a given year}} \times 1000$$

Hungary's neonatal mortality rate was 0.9 in 2011, which means that nearly 1 neonate died out of 1,000 between the days 7-27 of his/her life:

$$Neonatal\ Mortality\ Rate = \frac{83}{88{,}049} = 0.0022 \times 1000 = 2.2$$

Postneonatal mortality rate:

$$Postneonatal\ Mortality\ Rate = \frac{\text{N of infants died in the days } 28-365}{\text{N of infants born in a given year}} \times 1000$$

Hungary's postnatal mortality rate was 1.6 in 2011, which means that more than 1 infant died out of 1,000 within the days 7-365 of his/her life:

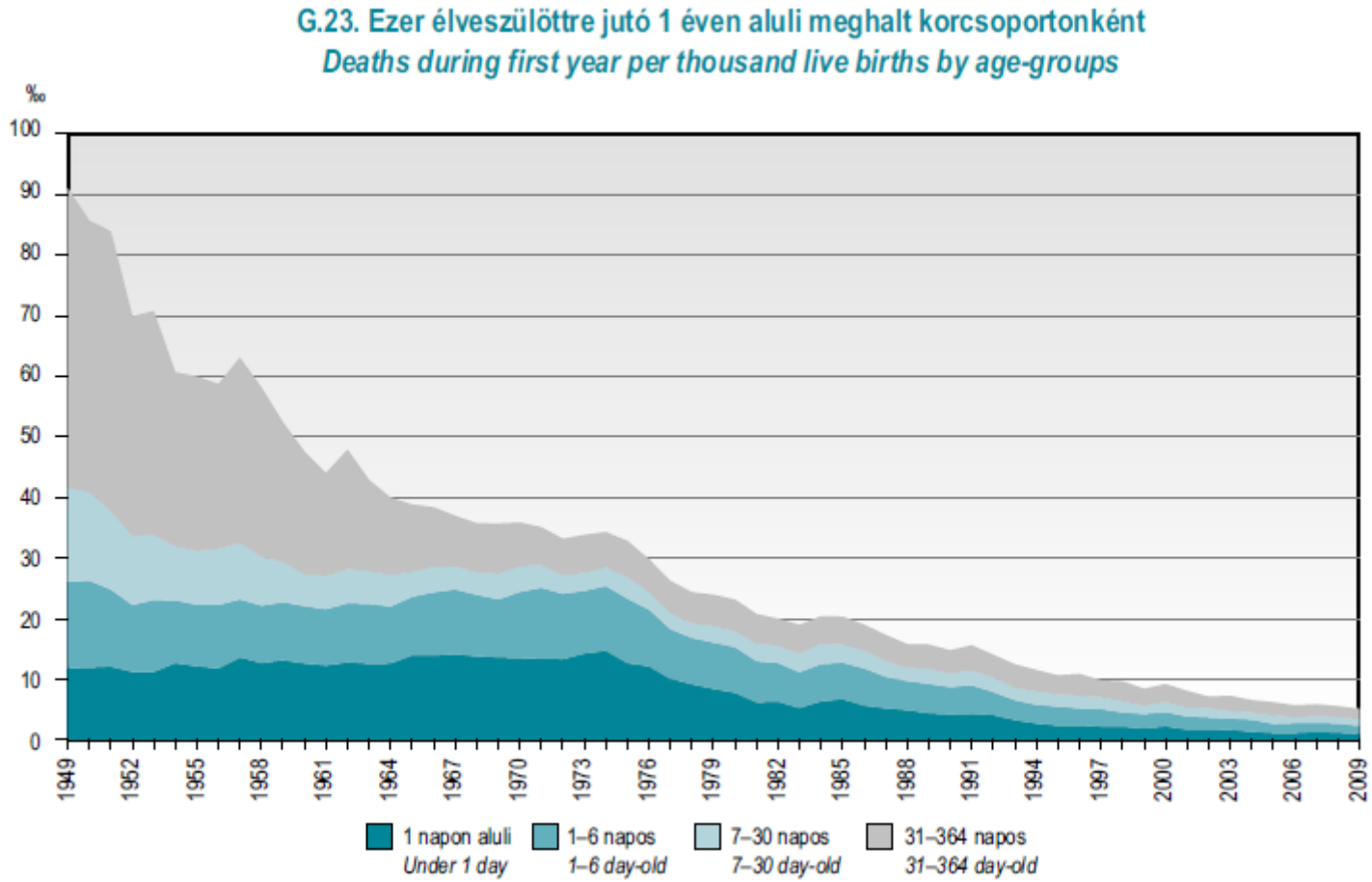
$$Postneonatal\ Mortality\ Rate = \frac{160}{88{,}049} = 0.0018 \times 1000 = 1.8$$

Infant mortality rate

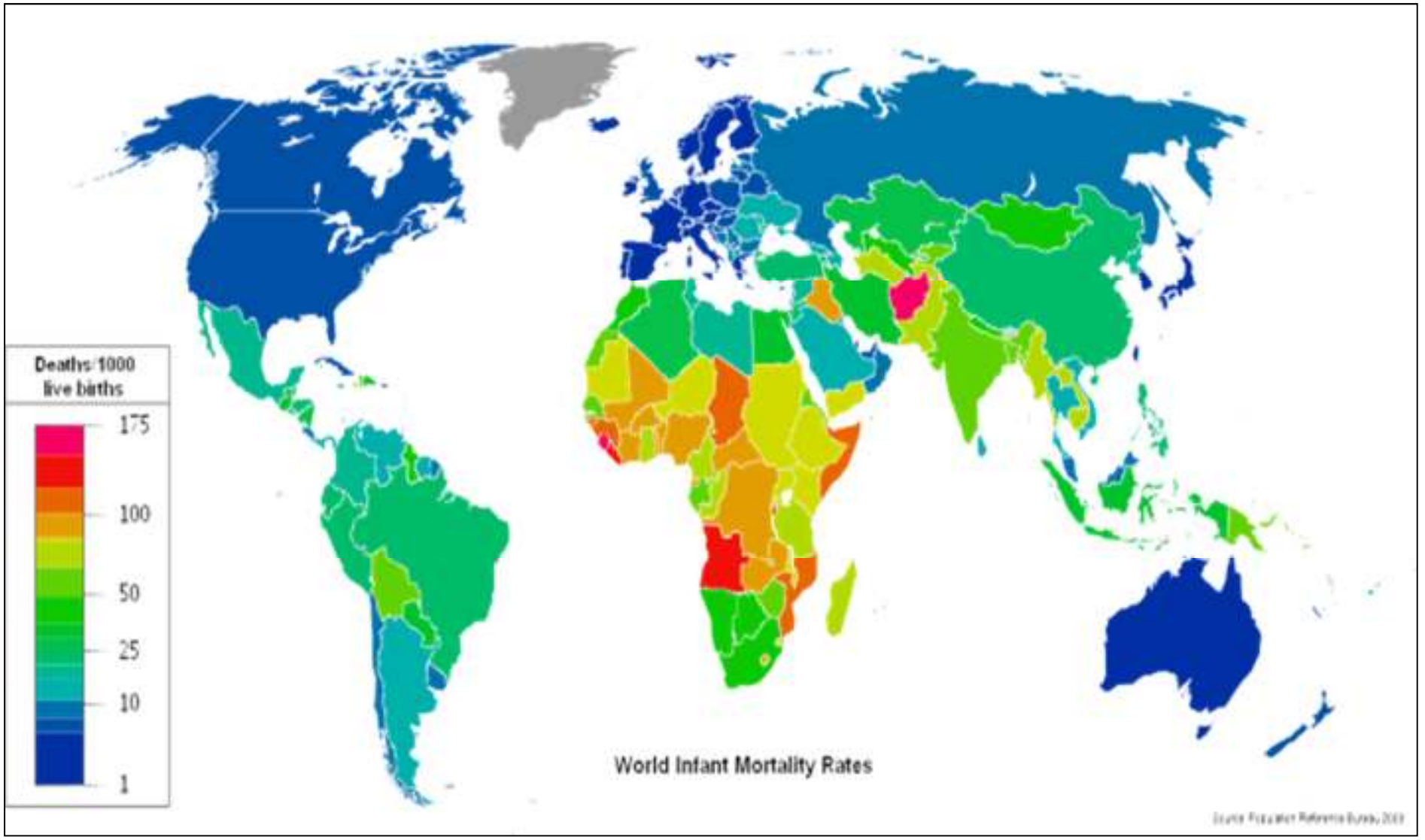
- *neonatal (0-27 days)*
  - *early (0-6 days)*
  - *late (7-27 days)*

- *Post-neonatal (from day 28 – to 1 year)*

Infant mortality rate

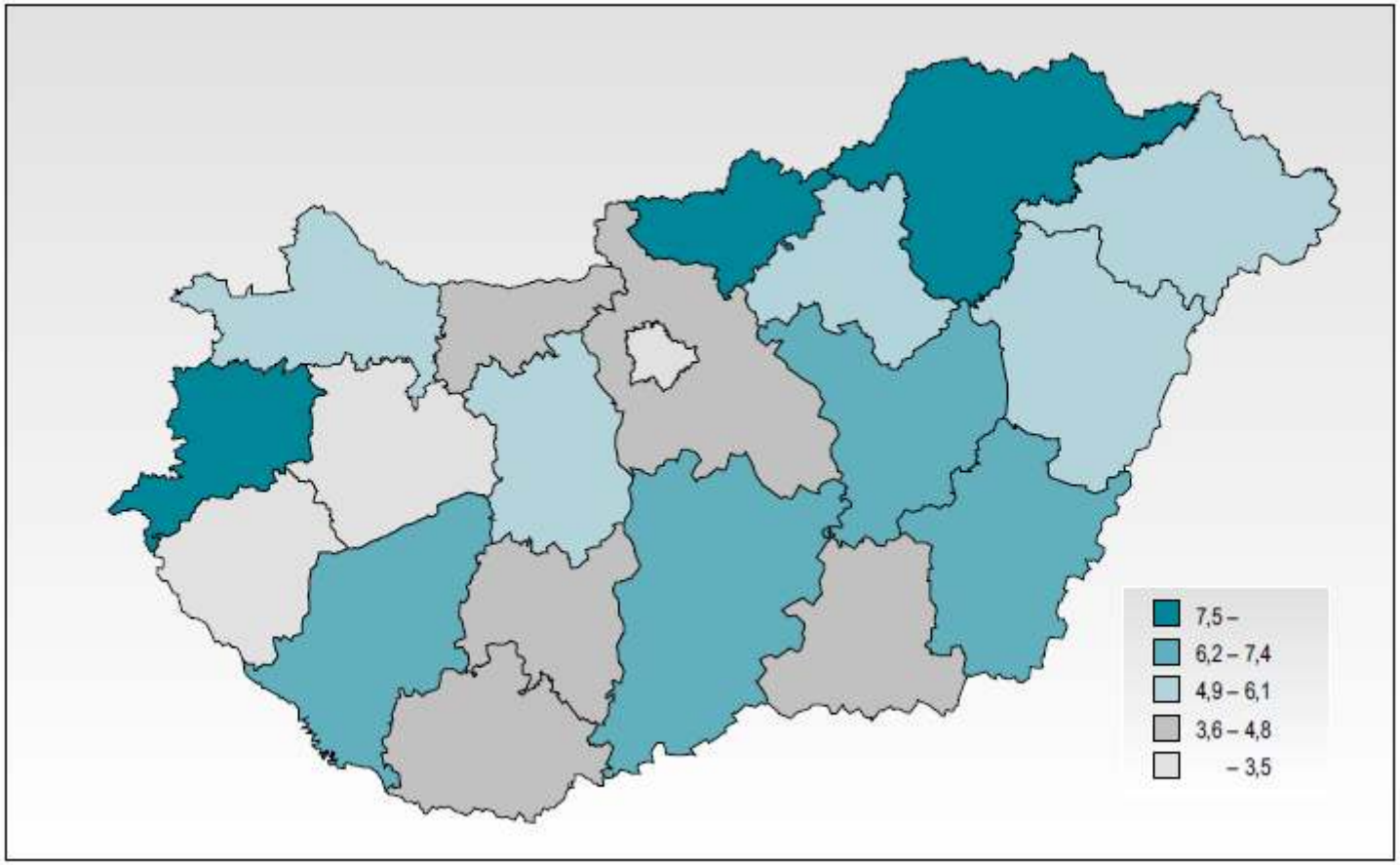


World map of infant mortality rates in 2008

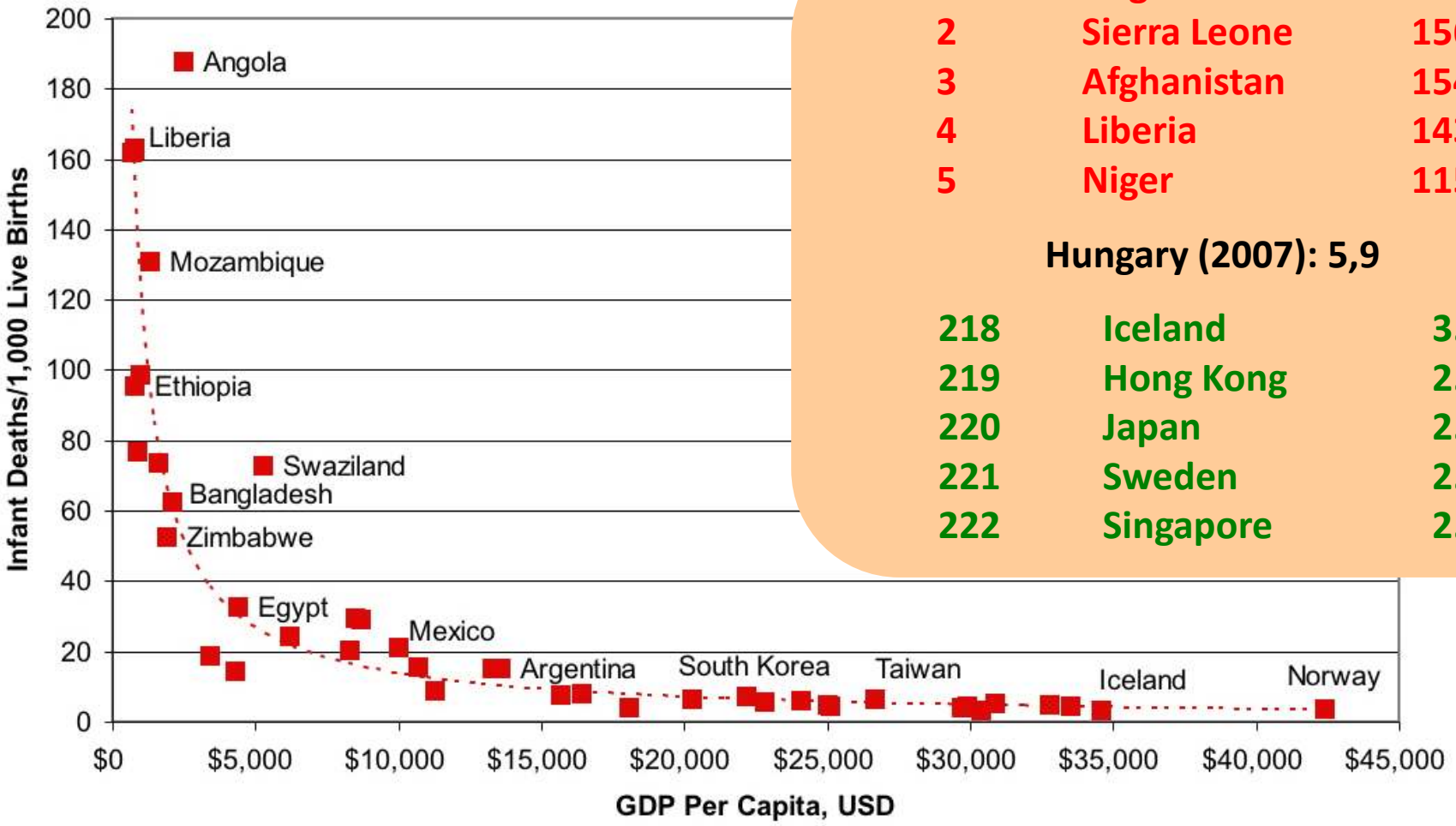


Infant mortality rate

G.24. Ezer élveszülöttre jutó 1 éven aluli meghalt megyénként, 2009
Deaths during first year per thousand live births by counties, 2009



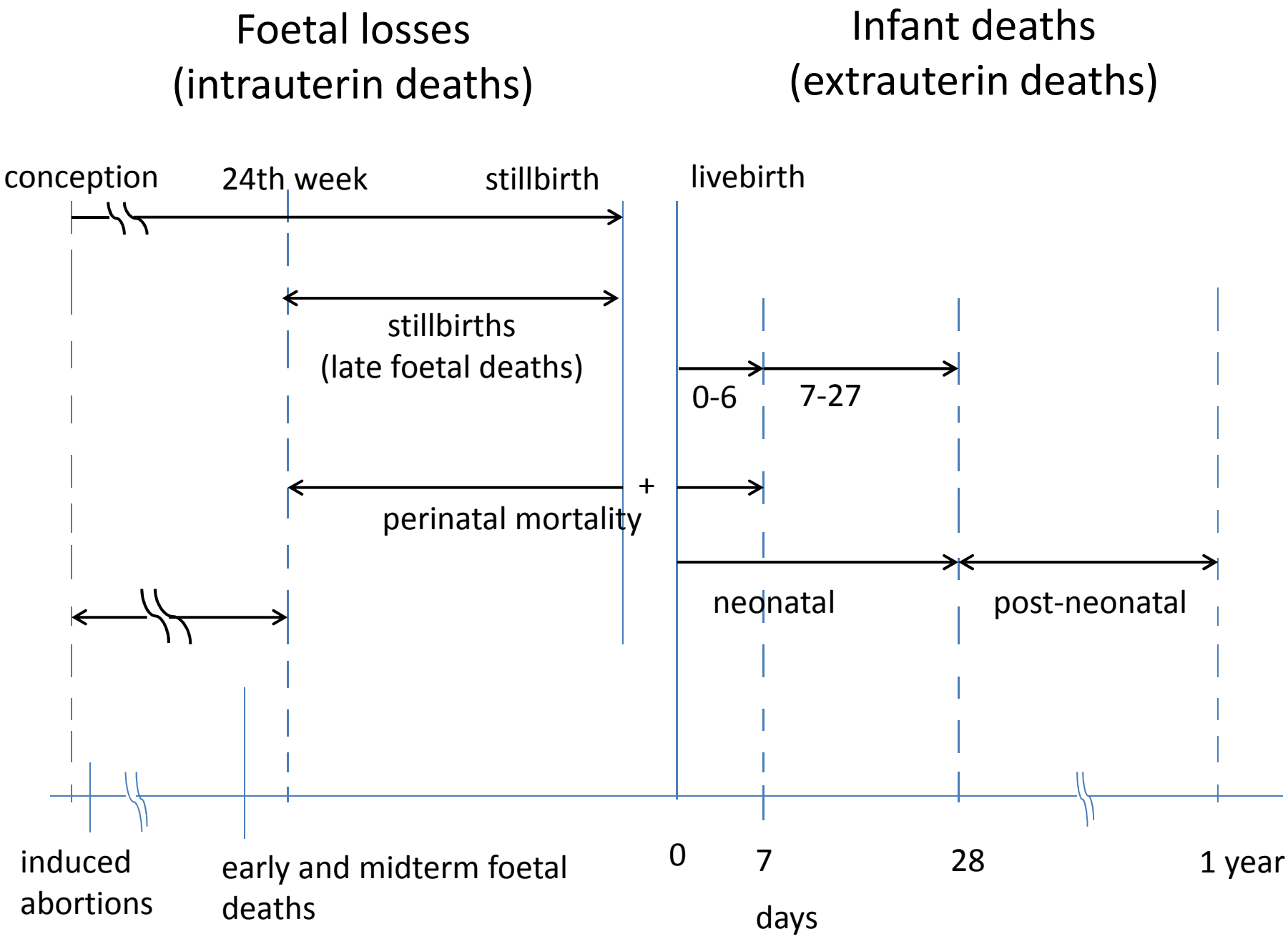
Infant mortality rate by GDR per capita



1	Angola	182.31
2	Sierra Leone	156.48
3	Afghanistan	154.67
4	Liberia	143.89
5	Niger	115.42

Hungary (2007): 5,9

218	Iceland	3.25
219	Hong Kong	2.93
220	Japan	2.80
221	Sweden	2.75
222	Singapore	2.30


Foetal losses
(intrauterin deaths)
Infant deaths
(extrauterin deaths)
conception
24th week
stillbirth
livebirth
stillbirths
(late foetal deaths)
0-6
7-27
+
perinatal mortality
neonatal
post-neonatal
induced
abortions
early and midterm foetal
deaths
0
7
28
1 year
days

Mortality

Foetal loss is defined as a total sum of foetal death cases and induced abortions.

Foetal death cases may be related to the number of live birth or the number of fertile female population.

$$Foetal\ death\ rate = \frac{\text{N of foetal death cases}}{\text{N of infants born in a given year}} \times 100$$

Hungary's relevant rate in 2011:

$$Foetal\ death\ rate = \frac{17{,}220}{88{,}049} \times 100 = 19.6\ \%$$

Abortion is the termination of pregnancy either spontaneous or induced.
In demography abortion means *induced and legally regulated procedure* for termination of pregnancy irrespective of medical or other legal reasons.

Numbers and Rates: Global and regional estimates of induced abortion, 1995, 2003 and 2008

Region	No. of abortions (millions)			Abortion rate*		
	1995	2003	2008	1995	2003	2008
World	45.6	41.6	43.8	35	29	28
Developed countries	10.0	6.6	6.0	39	25	24
Excluding Eastern Europe	3.8	3.5	3.2	20	19	17
Developing countries	35.5	35.0	37.8	34	29	29
Excluding China	24.9	26.4	28.6	33	30	29
Africa	5.0	5.6	6.4	33	29	29
Asia	26.8	25.9	27.3	33	29	28
Europe	7.7	4.3	4.2	48	28	27
Latin America	4.2	4.1	4.4	37	31	32
North America	1.5	1.5	1.4	22	21	19
Oceania	0.1	0.1	0.1	21	18	17

*Abortions per 1,000 women aged 15–44.

Source: Sedgh G et al., Induced abortion: incidence and trends worldwide from 1995 to 2008, *Lancet*, 2012 (forthcoming).

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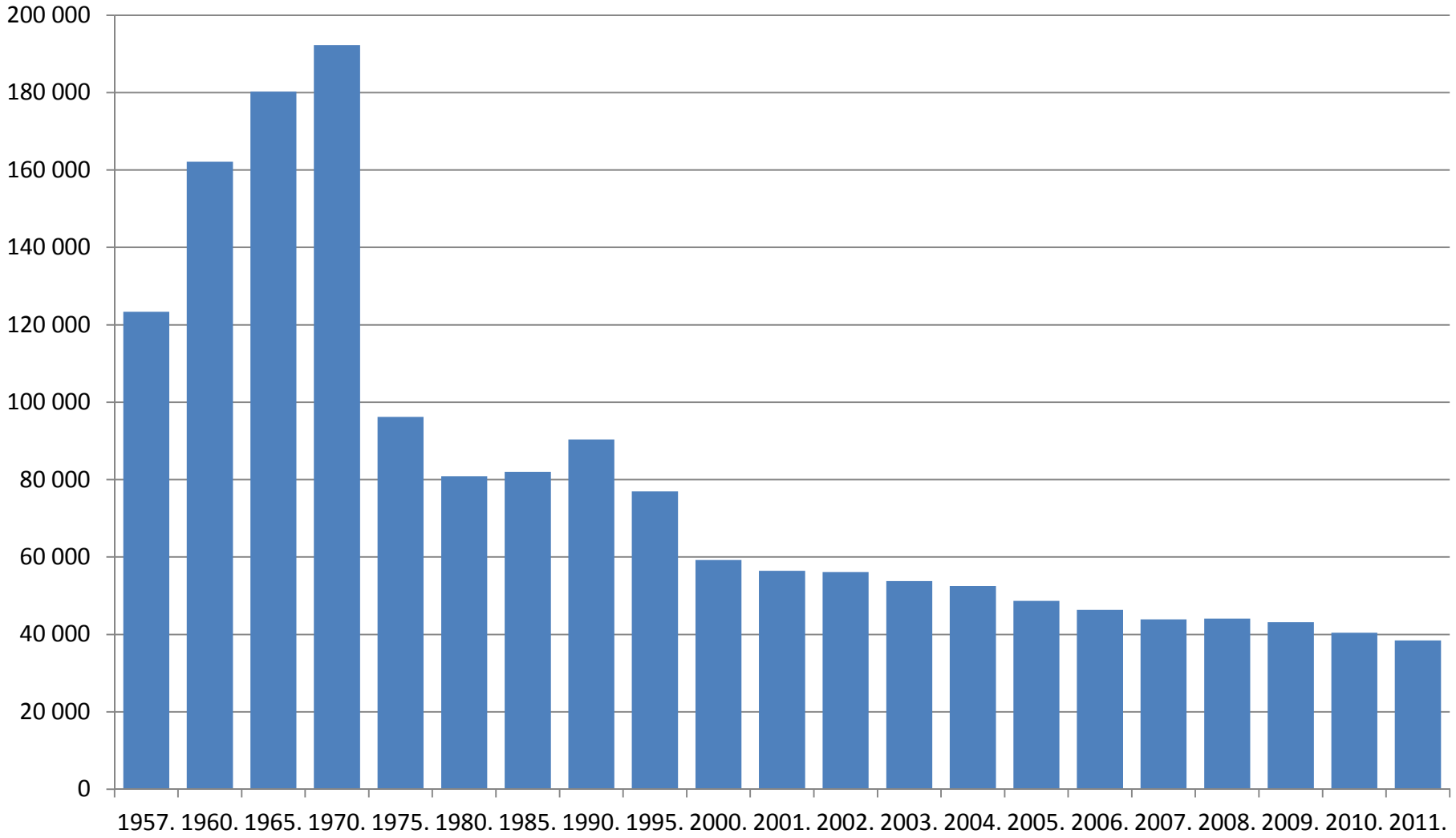
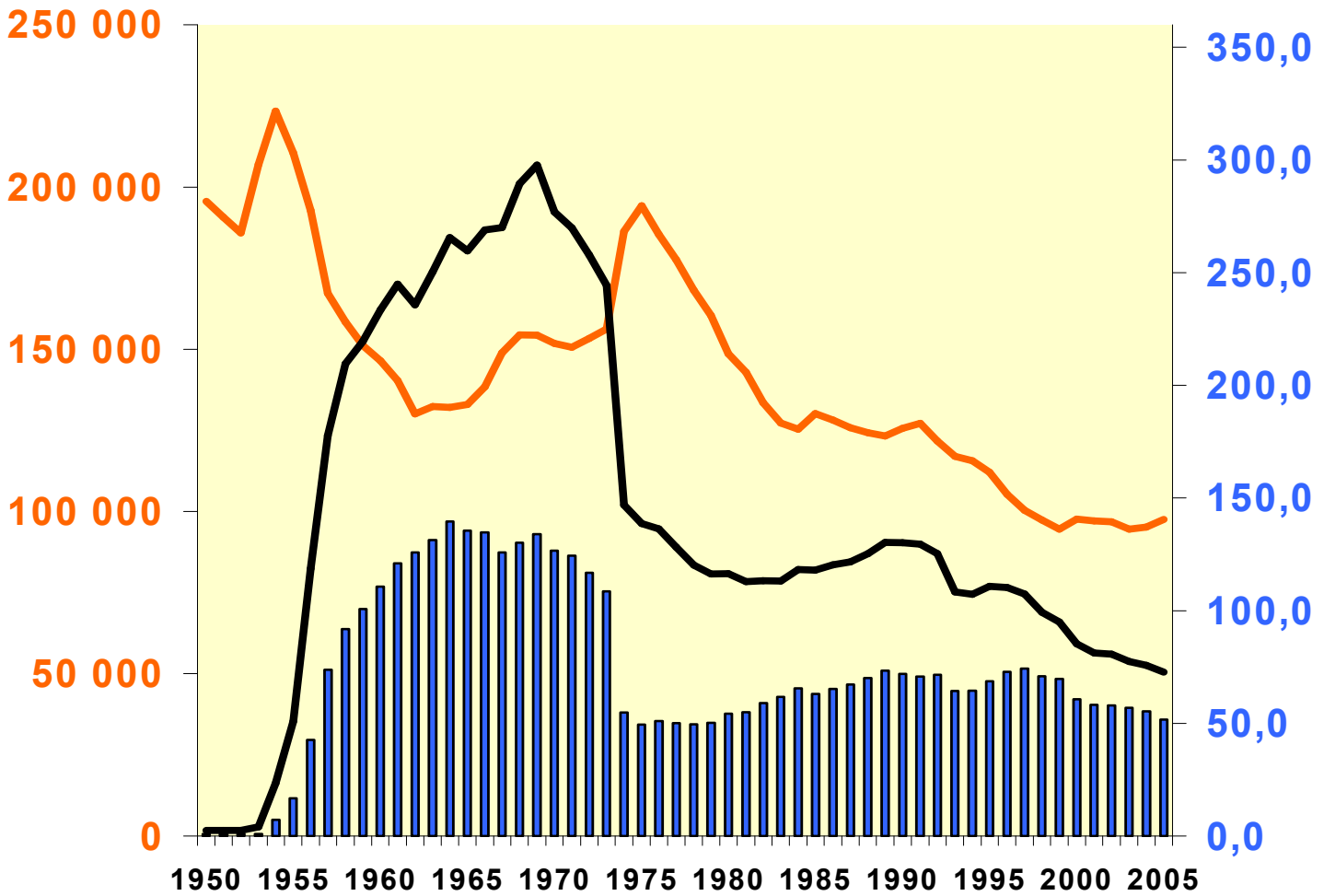
Induced abortion in Hungary, 1957-2011



1.6. Magzati veszteségek
Foetal losses

Megnevezés *Denomination*	1970	1980	1990	2000	2008	2009
Korai és középidős magzati halálozások száma *Number of early and midterm foetal deaths*	29 837	19 972	17 596	14 923	17 283	17 366
Késői magzati halálozások száma *Number of late foetal deaths*	1 520	1 156	699	538	431	519
Összes magzati halálozások száma *Total number of foetal deaths*	31 357	21 128	18 295	15 461	17 714	17 885
Terhességmegszakítások száma *Number of induced abortions*	192 283	80 882	90 394	59 249	44 089	43 181
Ezer 15–49 éves nőre jutó magzati veszteség *Foetal losses per thousand women aged 15–49 years old*	83,4	39,6	42,8	29,2	25,8	25,6
Száz élveszületésre jutó magzati veszteség *Foetal losses per hundred live births*	147,3	68,6	86,5	76,6	62,3	63,3
Ezer 15–49 éves nőre jutó terhességmegszakítás *Induced abortions per thousand women aged 15–49 years old*	71,5	31,4	35,6	23,2	18,4	18,1
Száz élveszületésre jutó terhességmegszakítás *Induced abortions per hundred live births*	126,7	54,4	71,9	60,7	44,5	44,8


250 000
200 000
150 000
100 000
50 000
0
350,0
300,0
250,0
200,0
150,0
100,0
50,0
0,0
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005
Terhesség-megszakítások száma 100 élveszületésre
Élveszületések száma
Terhességmegszakítások száma
Number of induced abortions per hundred live births
Number of live births
Number of induced abortions

Foetal losses, 2009.

Number of early and midterm foetal deaths: 17366

Number of late foetal deaths: 519

Number of foetal deaths per hundred live births: 18,5

Number of induced abortions: 43181

Number of induced abortions per hundred live births: 44,7

Total number of foetal losses: 61066

Number of foetal losses per hundred live births: 63,3

Number of conceptions: number of live births(96442)+
number of foetal losses(61066) = 157508

61,2 %

Number of deaths: 130414

Mortality

Maternal mortality

- special case of sex-related mortality.
- Represents death cases of women who die during pregnancy and childbirth inclusive the first 42 days after the delivery (WHO definition).
- The number per year is relatively small (developed countries), thus maternal mortality rate is computed per 100,000 live births.
- ~ 11/100,000 in the developed countries.

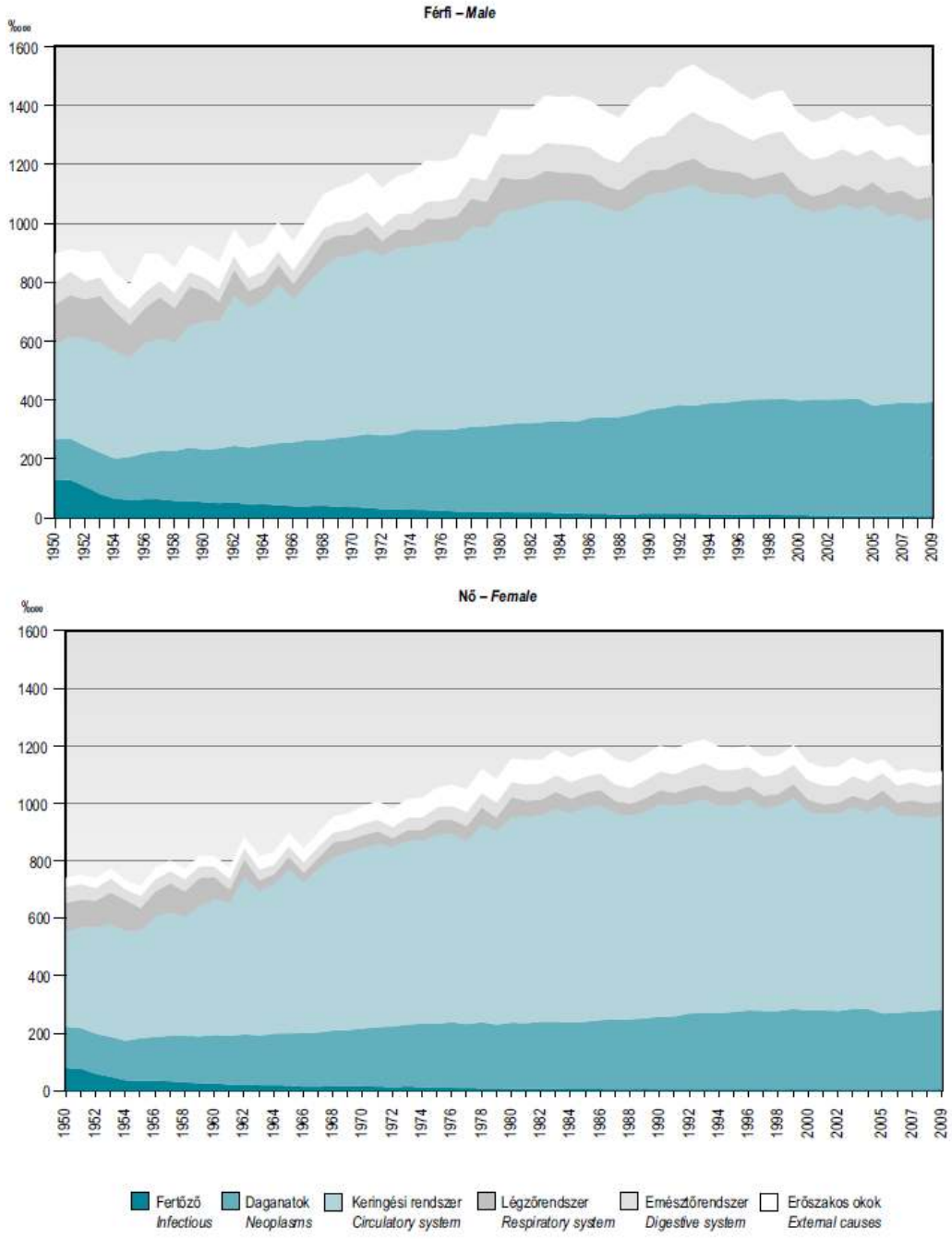
$$Maternal\ mortality\ rate = \frac{\text{N of maternal deaths}}{\text{N of infants born in a given year}} \times 100{,}000$$

Mortality

Cause related mortality

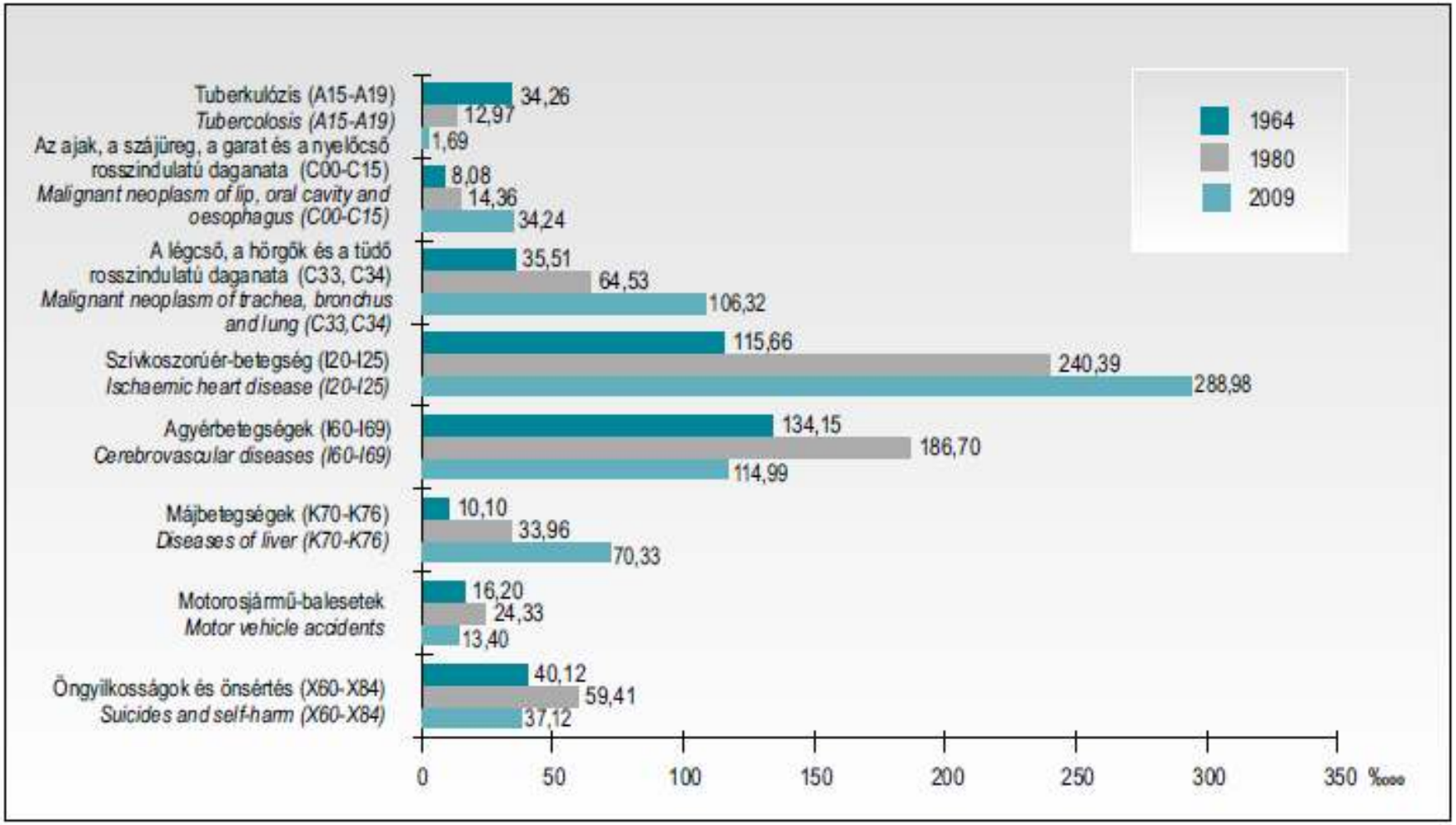
Demography is concerning only the main types of diseases, motor vehicle accidents and suicide (homicide).

G.33. Százezer lakosra jutó halálozás betegségfőcsoportok szerint
Deaths per hundred thousand population by main groups of diseases



Causes of death

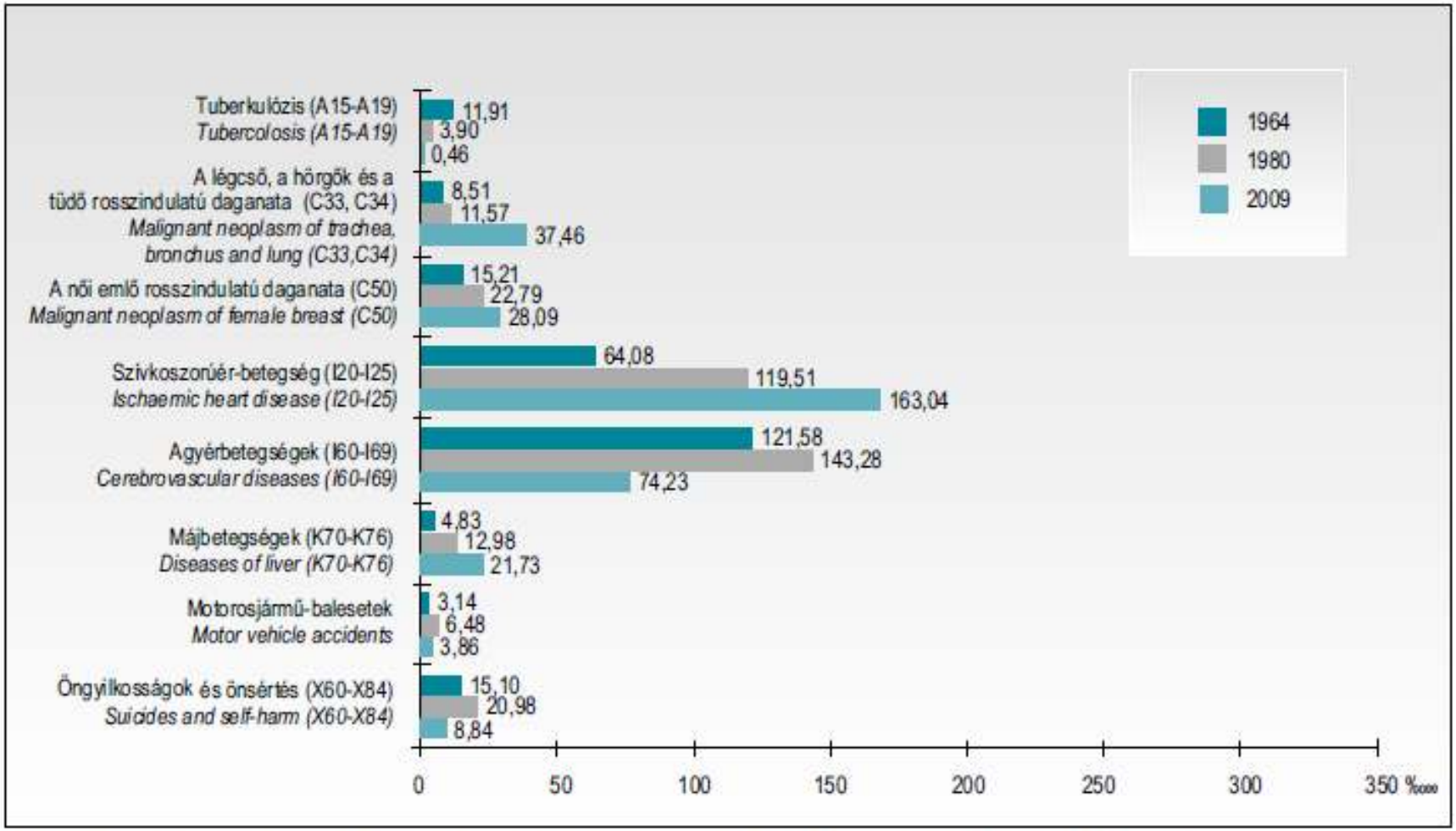
G.34. Százezer férfira jutó halálozás kiemelt halálokok szerint
Deaths per hundred thousand males by selected causes of death



Megjegyzés: A Betegségek Nemzetközi Osztályozása X. Revíziója szerint. 1964-ben a májbetegségek csak a májzsugorodás adatait tartalmazzák.
Az európai népesség kormegoszlására standardizált arányszámok.

Causes of death

G.35. Százezer nőre jutó halálozás kiemelt halálokok szerint
Deaths per hundred thousand females by selected causes of death



Megjegyzés: A Betegségek Nemzetközi Osztályozása X. Revíziója szerint. 1964-ben a májbetegségek csak a májzsugorodás adatait tartalmazzák.
Az európai népesség kormegoszlására standardizált arányszámok.

Life expectancy

Life expectancy:
the average number of years an individual of a given age is expected to live if current age-specific mortality rates continue to apply. Every cohort had different experiences in its earlier life that might have influenced its mortality rate in a given year.

Life expectancy at birth:
Average number of years a newborn is expected to live if current mortality structure persists throughout its life.

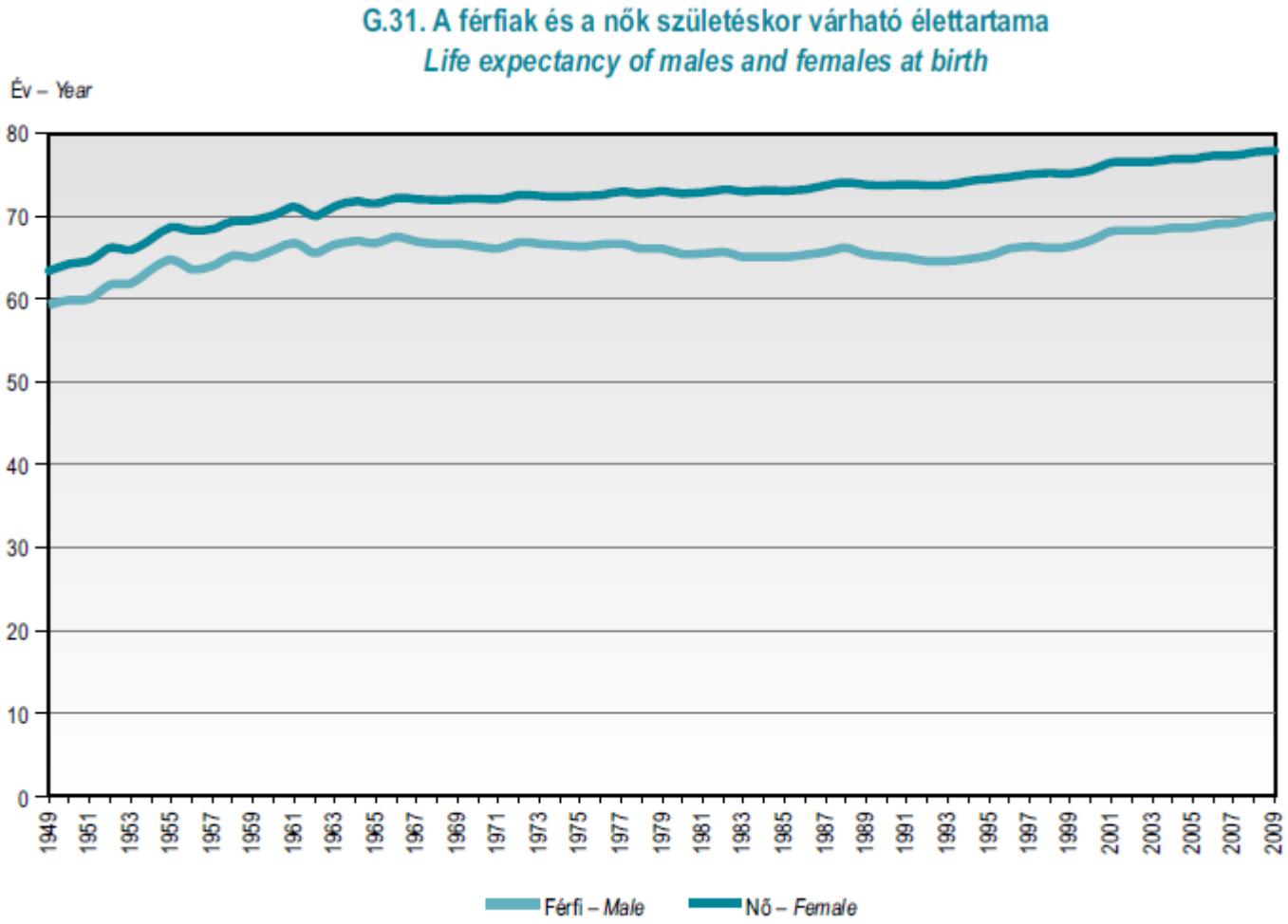
Because of the gender difference, life expectancy is calculated also separately for men and women.
Life expectancy is a hypothetical measure and indicator of current health and mortality conditions.

Life expectancy data at birth in the 27 EU member countries and non-member countries from 1980 to 2011

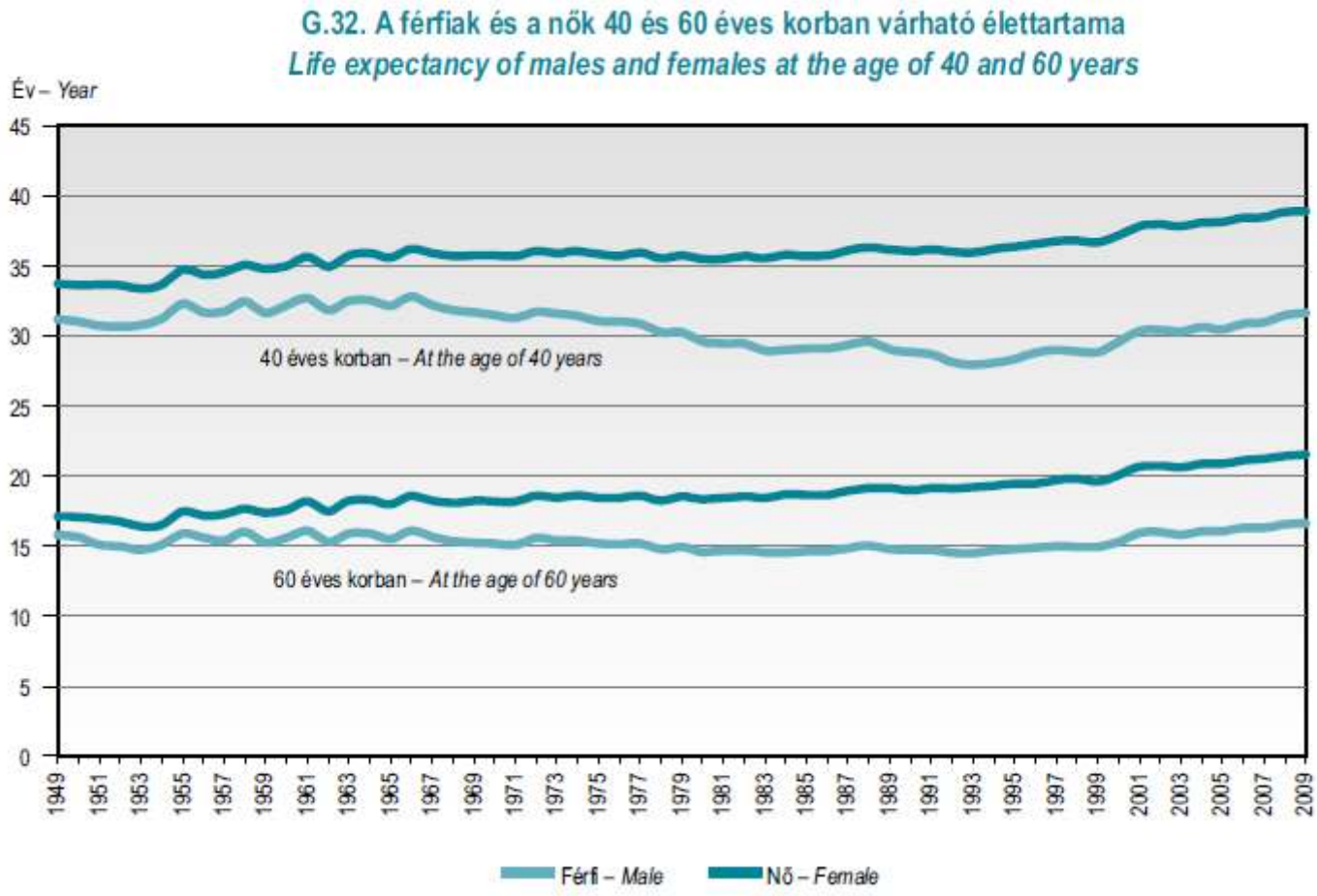
	Total						Men						Women					
	1980	1990	2000	2009	2010	2011	1980	1990	2000	2009	2010	2011	1980	1990	2000	2009	2010	2011
EU-27	:	:	:	79.7	:	:	:	:	:	76.7	:	:	:	:	:	82.6	:	:
Belgium	73.3	76.2	77.9	80.1	80.3	:	69.9	72.7	74.6	77.3	77.6	:	76.7	79.5	81.0	82.8	83.0	:
Bulgaria	71.1	71.2	71.6	73.7	73.8	74.2	68.4	68.0	68.4	70.1	70.3	70.7	73.9	74.7	75.0	77.4	77.4	77.8
Czech Republic	70.4	71.5	75.1	77.4	77.7	78.0	66.9	67.6	71.7	74.2	74.5	74.8	74.0	75.5	78.5	80.5	80.9	81.1
Denmark	74.2	74.9	76.9	79.0	79.3	79.9	71.2	72.0	74.5	76.9	77.2	77.8	77.3	77.8	79.2	81.1	81.4	81.9
Germany	73.1	75.4	78.3	80.3	80.5	80.8	69.6	72.0	75.1	77.8	78.0	78.4	76.2	78.5	81.2	82.8	83.0	83.2
Estonia	:	69.9	70.8	75.2	76.0	76.5	:	64.7	65.2	69.8	70.6	71.2	:	74.9	76.2	80.2	80.8	81.3
Ireland	:	74.8	76.6	79.9	81.0	80.6	:	72.1	74.0	77.4	78.7	78.3	:	77.7	79.2	82.5	83.2	82.8
Greece	75.3	77.1	78.0	80.2	80.6	80.8	73.0	74.7	75.5	77.8	78.4	78.5	77.5	79.5	80.6	82.7	82.8	83.1
Spain	75.4	77.0	79.3	81.9	82.3	82.5	72.3	73.4	75.8	78.7	79.1	79.4	78.4	80.6	82.9	84.9	85.3	85.4
France (1)	:	77.0	79.2	81.6	81.9	:	72.8	75.4	75.3	78.0	78.3	:	:	81.2	83.0	85.0	85.3	:
Italy	:	77.1	79.9	82.1	:	:	:	73.8	76.9	79.4	:	:	:	80.3	82.8	84.6	:	:
Cyprus	:	:	77.7	81.1	81.5	81.2	:	:	75.4	78.6	79.2	79.3	:	:	80.1	83.6	83.9	83.1
Latvia	:	:	:	73.3	73.7	73.9	:	:	:	68.1	68.6	68.6	:	:	:	78.0	78.4	78.8
Lithuania	70.5	71.5	72.2	73.2	73.5	73.8	65.4	66.4	66.8	67.5	68.0	68.1	75.4	76.3	77.5	78.7	78.9	79.3
Luxembourg	72.8	75.7	78.0	80.8	80.8	81.1	70.0	72.4	74.6	78.1	77.9	78.5	75.6	78.7	81.3	83.3	83.5	83.6
Hungary	69.1	69.4	71.9	74.4	74.7	75.1	65.5	65.2	67.5	70.3	70.7	71.2	72.8	73.8	76.2	78.4	78.6	78.7
Malta	70.4	:	78.4	80.3	81.4	:	68.0	:	76.2	77.9	79.2	:	72.8	:	80.3	82.7	83.6	:
Netherlands	:	77.1	78.2	80.9	81.0	81.3	:	73.8	75.6	78.7	78.9	79.4	:	80.2	80.7	82.9	83.0	83.1
Austria	72.7	75.8	78.3	80.5	80.8	81.2	69.0	72.3	75.2	77.6	77.9	78.3	76.1	79.0	81.2	83.2	83.5	83.9
Poland	:	70.7	73.8	75.9	76.4	76.9	:	66.3	69.6	71.5	72.1	72.6	:	75.3	78.0	80.1	80.7	81.1
Portugal	71.5	74.1	76.7	79.6	79.8	80.9	67.9	70.6	73.2	76.5	76.7	77.6	74.9	77.5	80.2	82.6	82.8	84.0
Romania	69.2	69.9	71.2	73.5	73.8	74.6	66.6	66.7	67.7	69.8	70.1	71.0	71.9	73.1	74.8	77.4	77.6	78.2
Slovenia	:	73.9	76.2	79.4	79.8	80.1	:	69.8	72.2	75.9	76.4	76.8	:	77.8	79.9	82.7	83.1	83.3
Slovakia	70.4	71.1	73.3	75.3	75.6	76.1	66.7	66.7	69.2	71.4	71.7	72.3	74.4	75.7	77.5	79.1	79.3	79.8
Finland	73.7	75.1	77.8	80.1	80.2	80.6	69.2	71.0	74.2	76.6	76.9	77.3	78.0	79.0	81.2	83.5	83.5	83.8
Sweden	75.8	77.7	79.6	81.5	81.6	81.9	72.8	74.8	77.4	79.4	79.6	79.9	79.0	80.5	82.0	83.5	83.6	83.8
United Kingdom	:	:	78.0	80.5	80.7	:	:	:	75.5	78.3	78.7	:	:	:	80.3	82.5	82.6	:
Iceland	76.8	78.1	79.7	81.8	81.9	82.4	73.5	75.5	77.8	79.8	79.8	80.7	80.4	80.7	81.6	83.8	84.1	84.1
Liechtenstein	:	:	77.0	81.7	81.8	81.9	:	:	73.9	79.5	79.5	79.5	:	:	79.9	83.6	84.3	84.2
Norway	75.8	76.6	78.8	81.0	81.2	81.4	72.4	73.4	76.0	78.7	79.0	79.1	79.3	79.9	81.5	83.2	83.3	83.6
Switzerland	75.7	77.5	80.0	82.3	82.6	82.8	72.3	74.0	77.0	79.9	80.2	80.5	79.0	80.9	82.8	84.6	84.8	85.0
Montenegro	:	:	:	75.3	75.9	:	:	:	:	72.9	73.5	:	:	:	:	77.6	78.4	:
Croatia	:	:	:	76.4	76.8	:	:	:	:	73.0	73.5	:	:	:	:	79.7	79.9	:
FYR of Macedonia	:	:	73.0	74.4	75.0	75.1	:	:	70.8	72.3	72.9	73.1	:	:	75.2	76.7	77.2	77.2
Turkey	:	:	:	76.0	:	:	:	:	:	73.3	:	:	:	:	:	78.8	:	:

(1) Excluding French overseas departments before 1991.
Source: Eurostat (online data code: demo_mlexpec)

Life expectancy



Life expectancy



Population growth

Crude birth rate (CBR): The ratio of births in a year (other specified period) to the average population in the same year/period (mid-year population), expressed per 1000

$$\text{CBR} = \frac{number\ of\ births}{mid\text{-}year\ population} \times 1000$$

Crude death rate: The ratio of deaths in a year (other specified period) to average population in the same year/period (mid-year population), expressed per 1000

$$\text{CDR} = \frac{number\ of\ deaths}{mid\text{-}year\ population} \times 1000$$

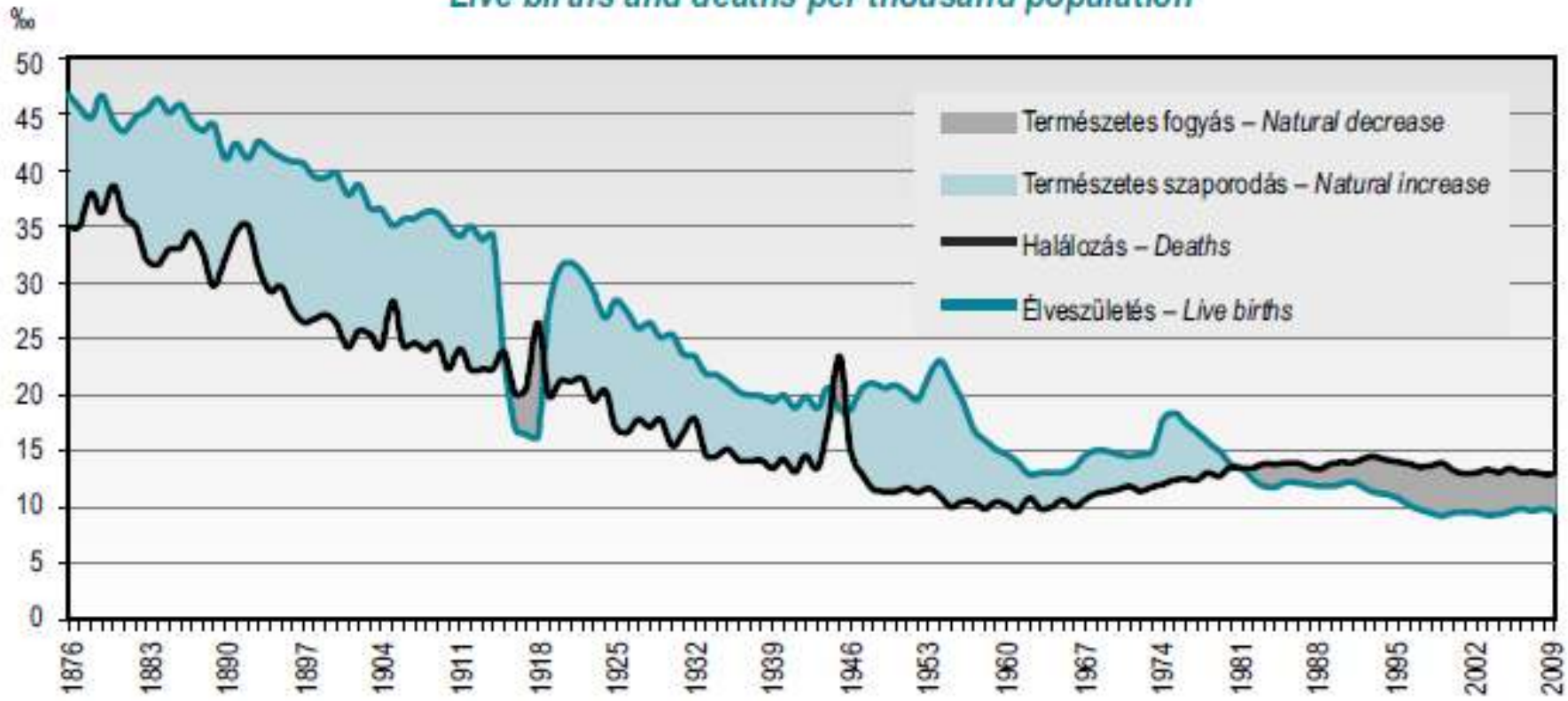
Population growth

PG=CBR-CDR

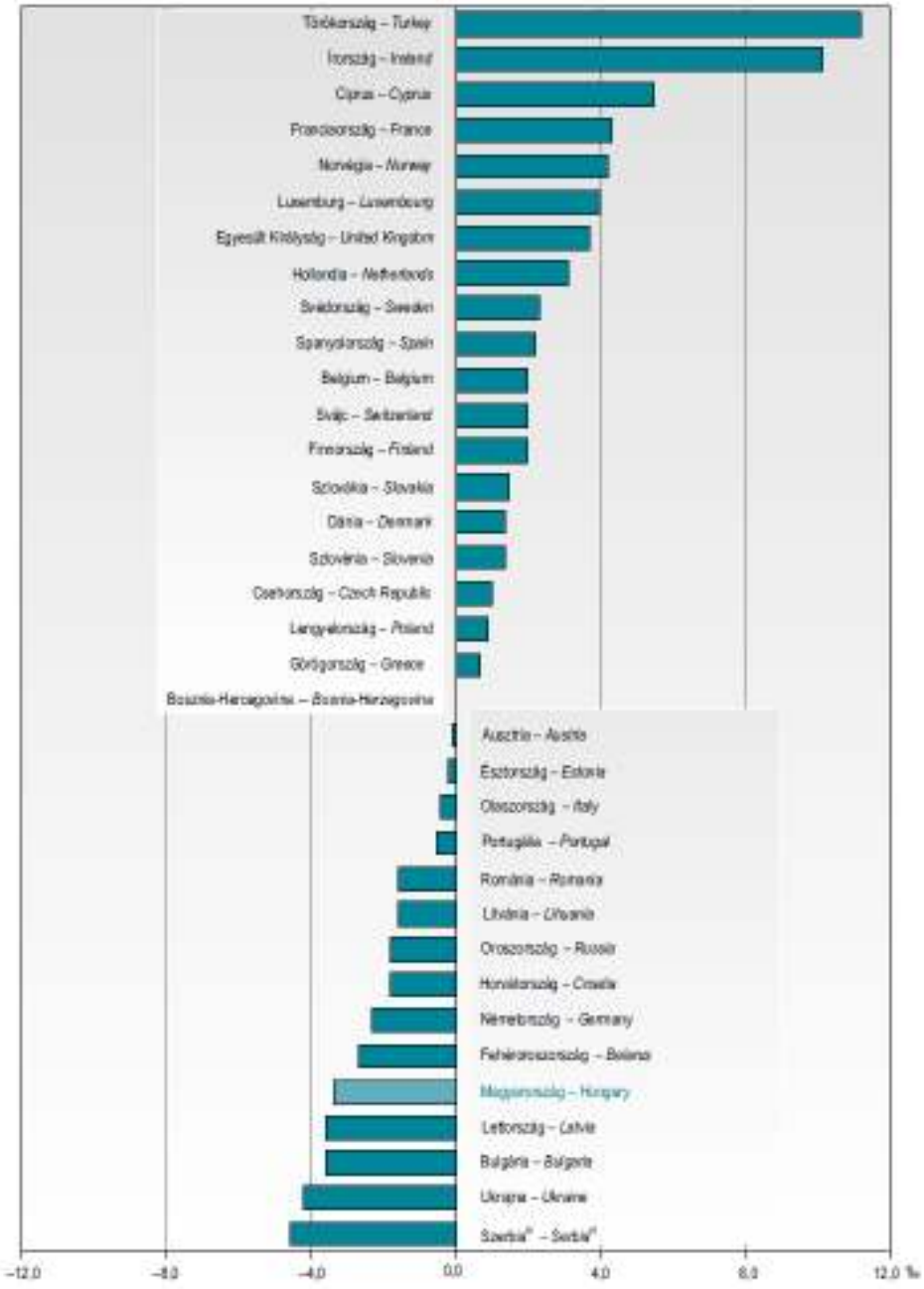
+ natural increase

- natural decrease

G.5. Ezer lakosra jutó élveszületés és halálozás
Live births and deaths per thousand population

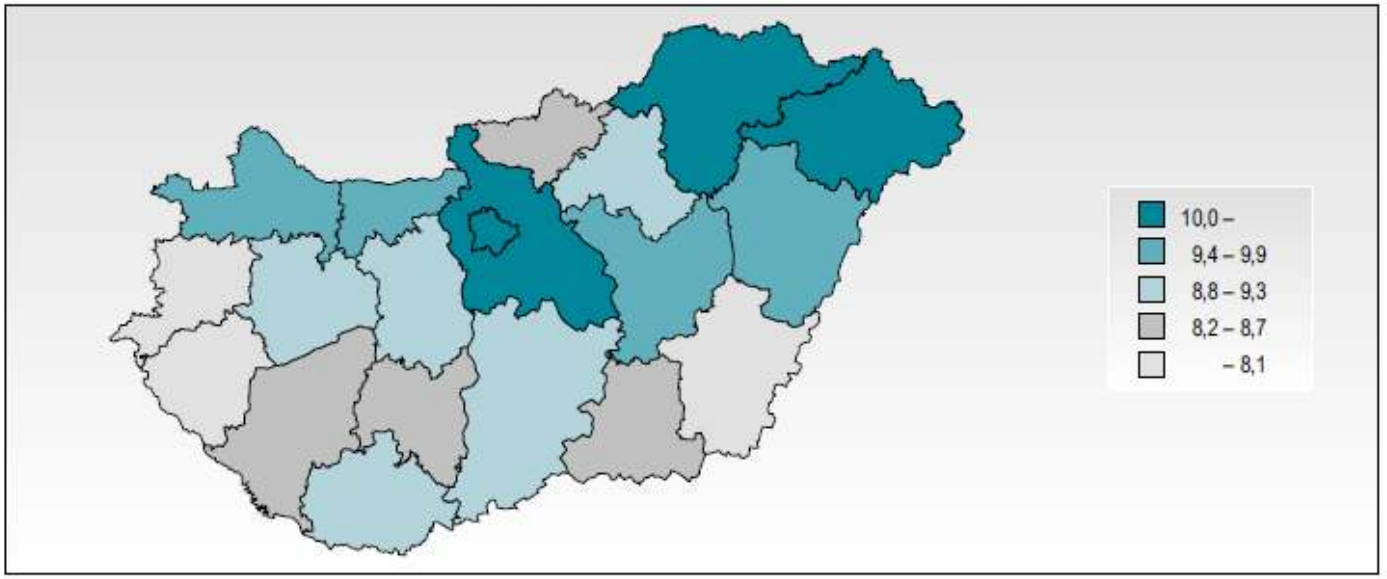


G.44. Ezer lakosra jutó természetes szaporodás, fogyás nemzetközi összehasonlításban, 2009
International comparison on natural increase, decrease per thousand population, 2009

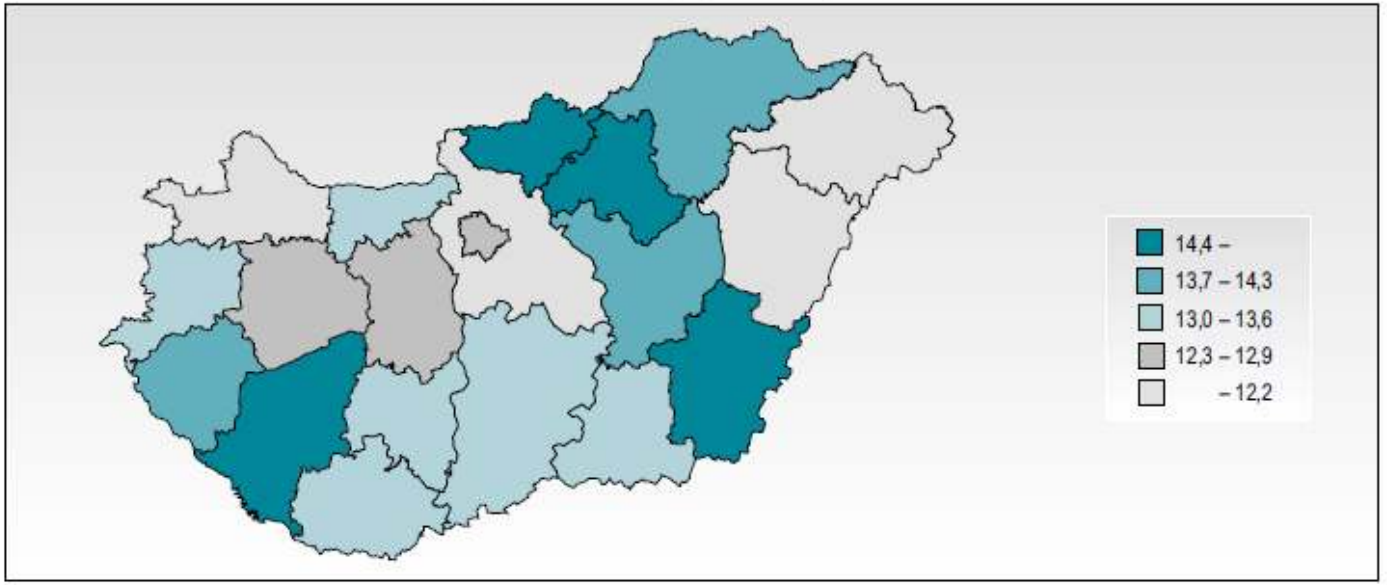


e) 2008.

G.8. Ezer lakosra jutó élveszületés megyénként, 2009
Live births per thousand population by counties, 2009

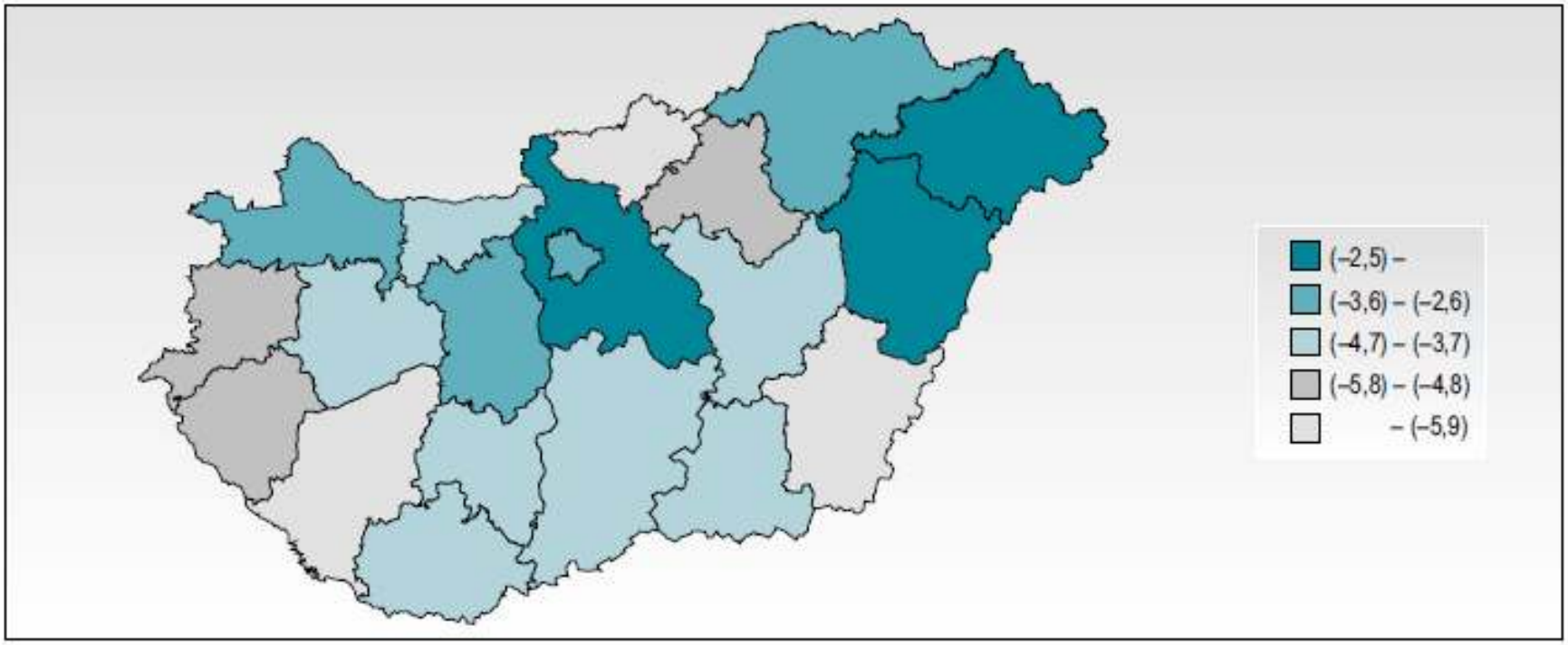


G.9. Ezer lakosra jutó halálozás megyénként, 2009
Deaths per thousand population by counties, 2009



G.10. Ezer lakosra jutó természetes szaporodás, fogyás megyénként, 2009

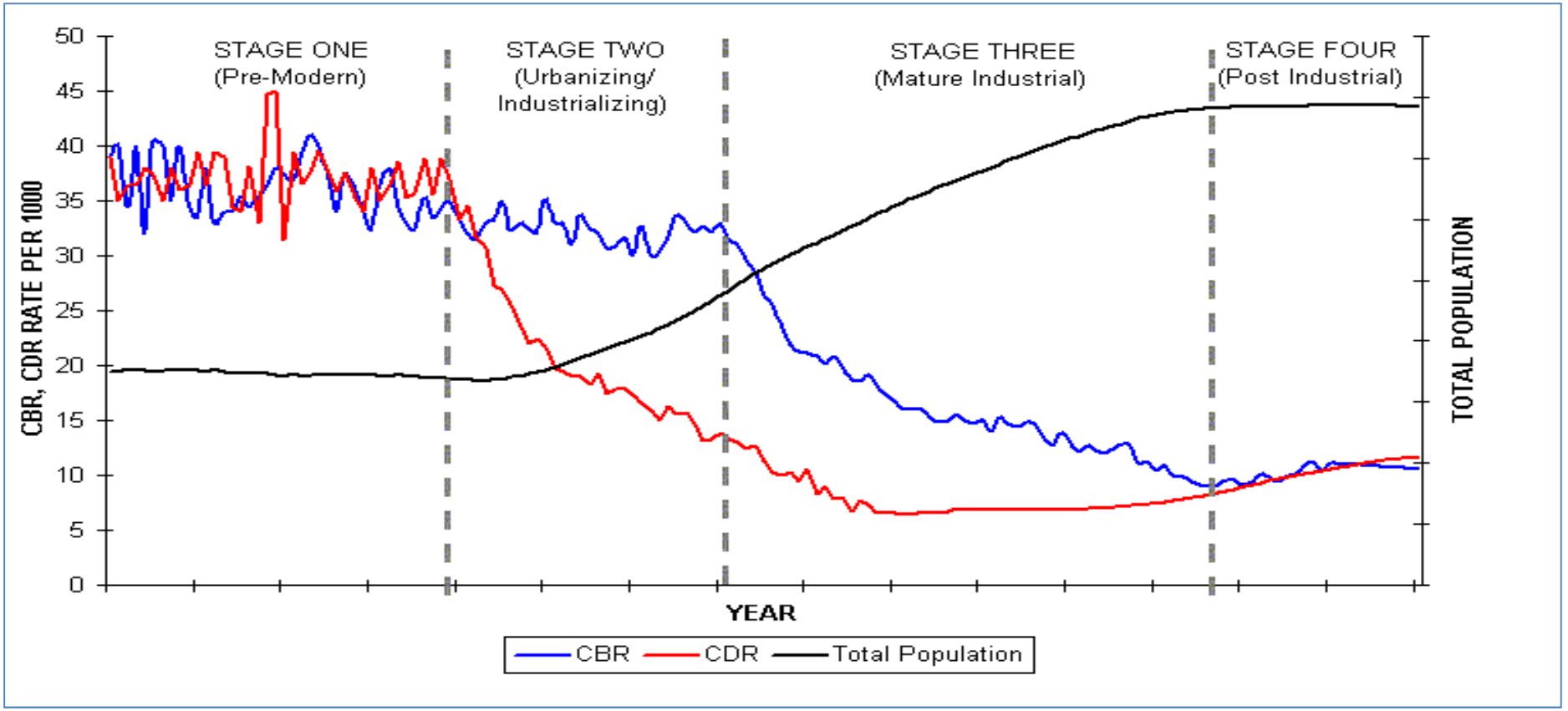
Natural increase, decrease per thousand population by counties, 2009



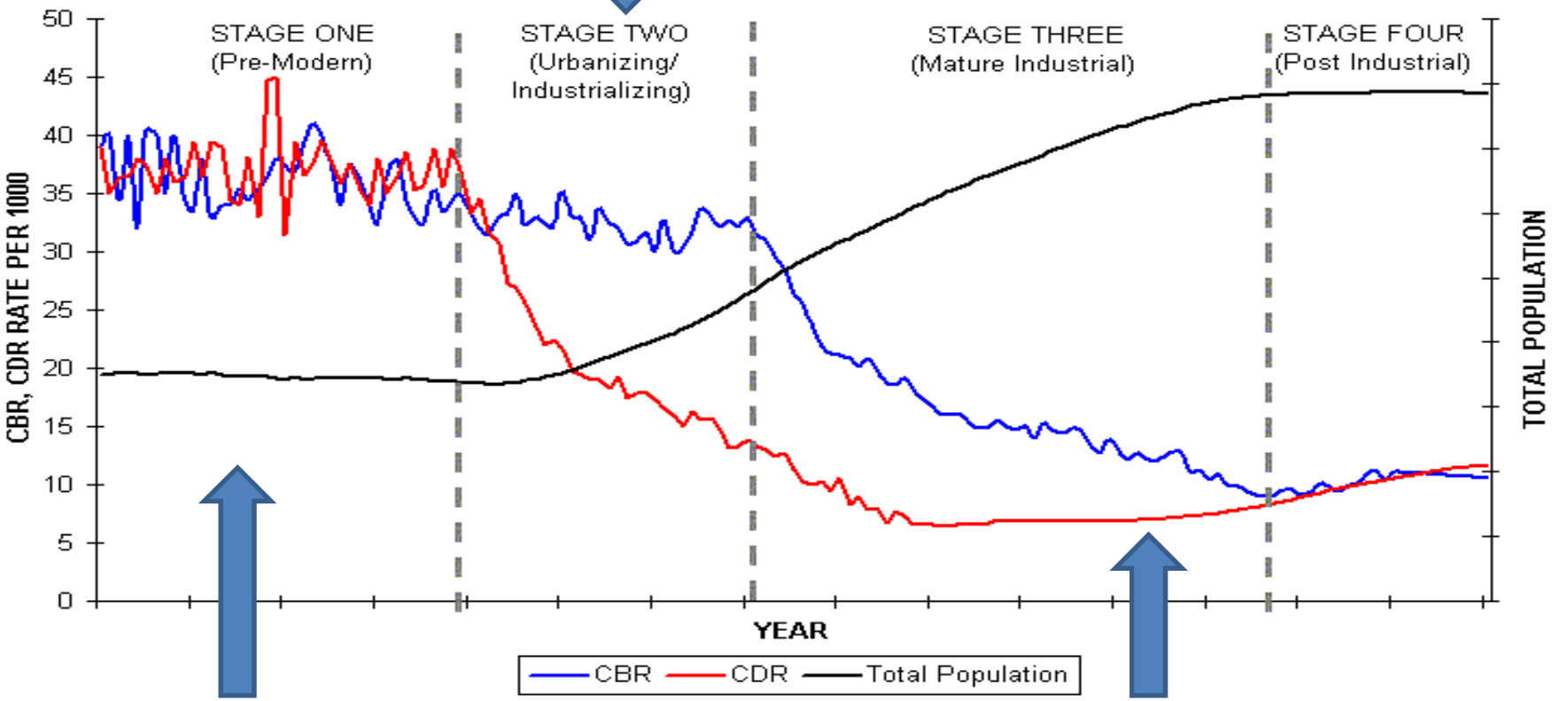
Demographic transition

1944. F. W. Notenstein: american demographer; created the **theory of demographic transition** as it is accepted even today.

- A scientific model presenting the *transition from high mortality and high fertility to conditions of low mortality and low fertility*.



Last 300 years, the western type industrial revolution.
Death rates were reduced: better and regular food supplies, improved sanitations (water supply, sewage systems and waste management) medical knowledge and care.
Later, birth rates also begin to fall. Delayed response of the birth rate: social response.



Societies lived in agrarian-based economic systems.
Variations in harvests (poor diet and famine periods) and the incidence of epidemics.
Primitive conditions of the sanitation and lack of preventive and curative medical and public health measures.
Death rates are open ended, birth rates were high.

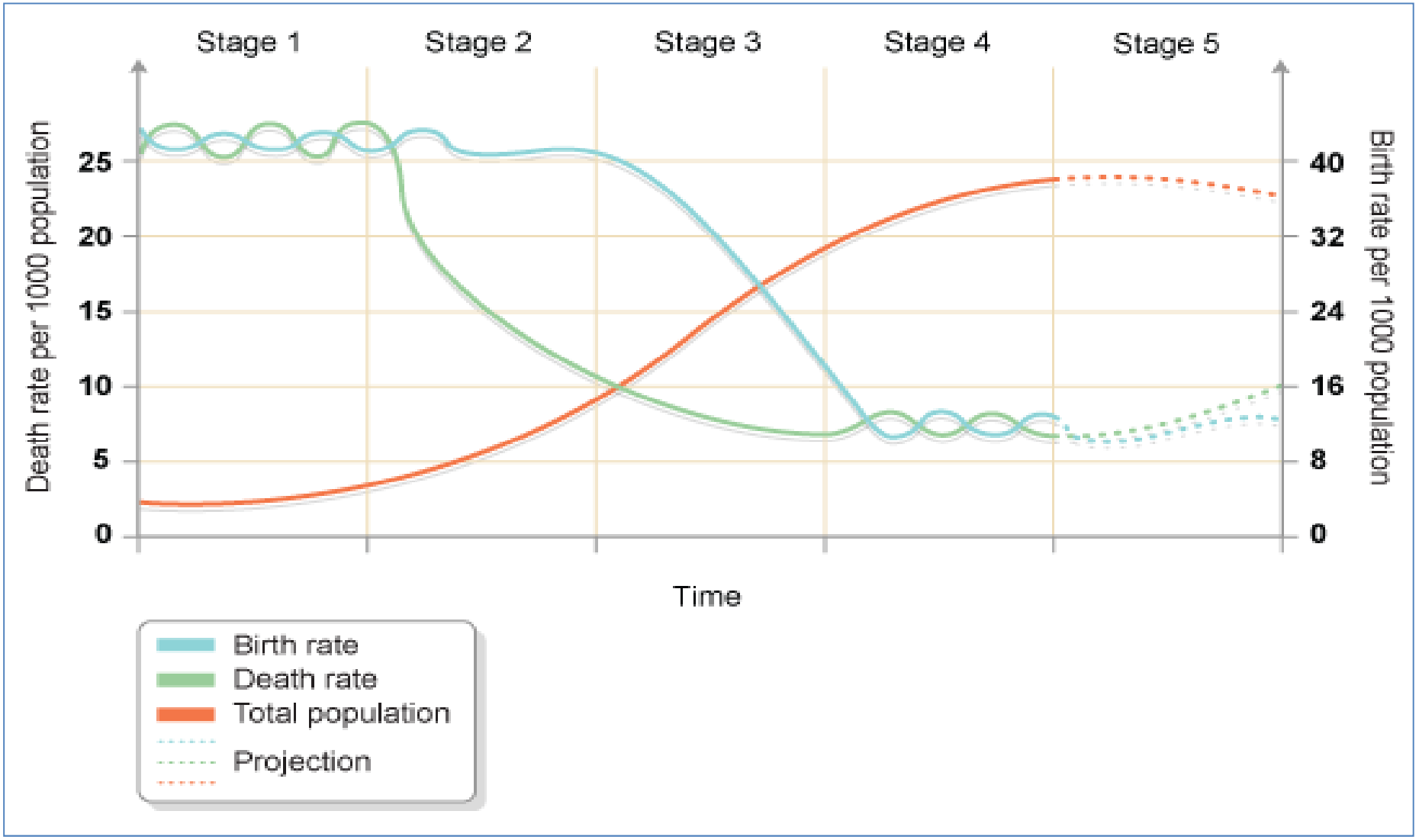
The ideal of a small family size were provided first by the urbanized life style of wealthy citizens. This ideal spread gradually to the smaller cities, lower-income groups and eventually to rural areas.
Moderate increase in the number of population.

Demographic transition

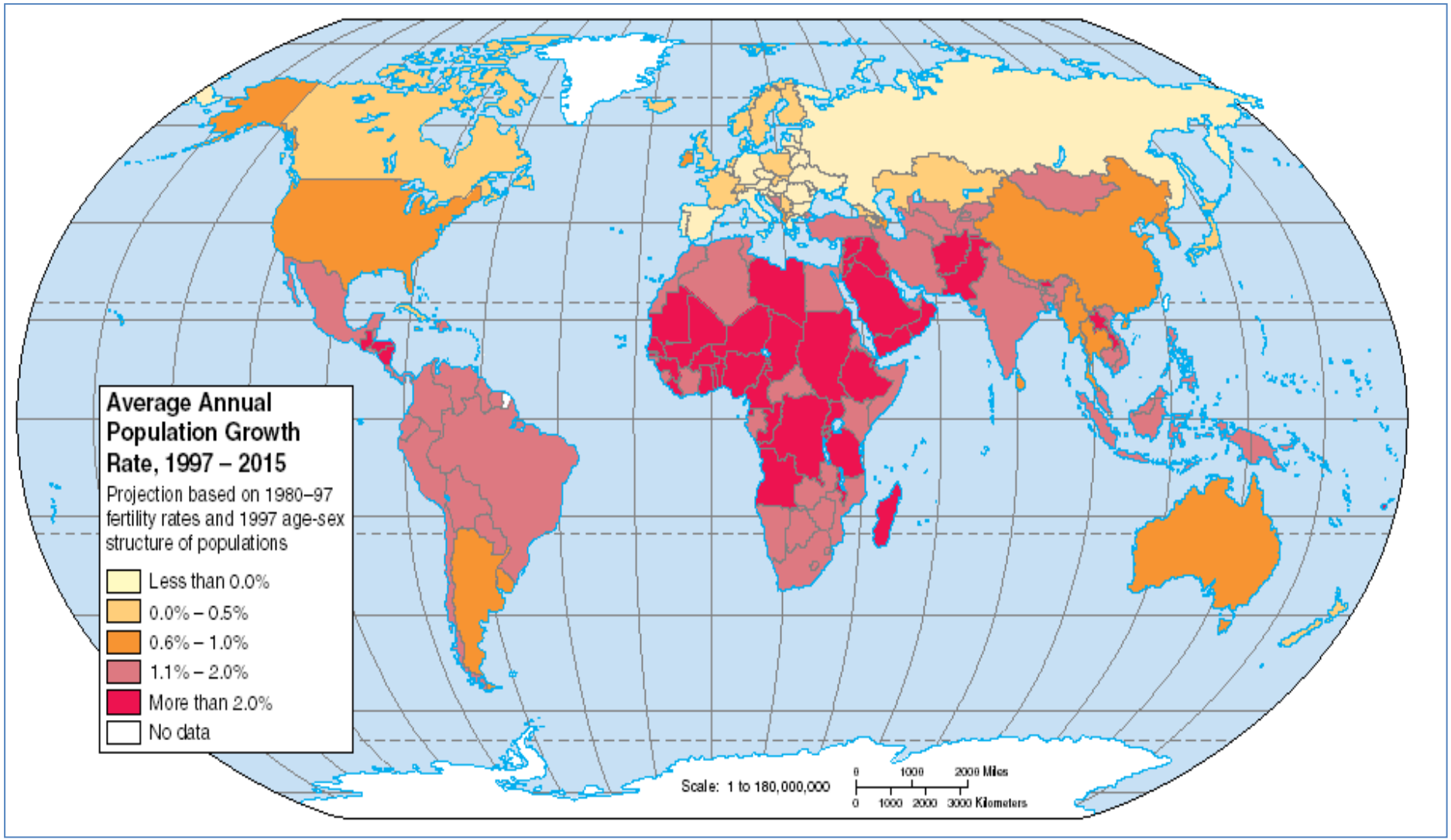
The modern demography is using five stages of the demographic transition:

1. Total population is low, however in a balanced state because high death rates are compensated by high birth rates.
2. Total population rises rapidly (population explosion) as death rates fall due to economic development, improvements in health care and sanitation, but parallel the birth rates remain high.
3. The rise of the total population becomes moderate, the gap between birth and death rates narrows (decreasing need of working force, emerging new family patterns, availability of contraception)
4. Total population is levelled off high, but it is balanced by a low birth rate and a low death rate. Birth control is generally accepted
5. Birth rates may drop below replacement level. Start of the decline of the total population by ageing. People opting to have children later in life, leading to a shrinking population.

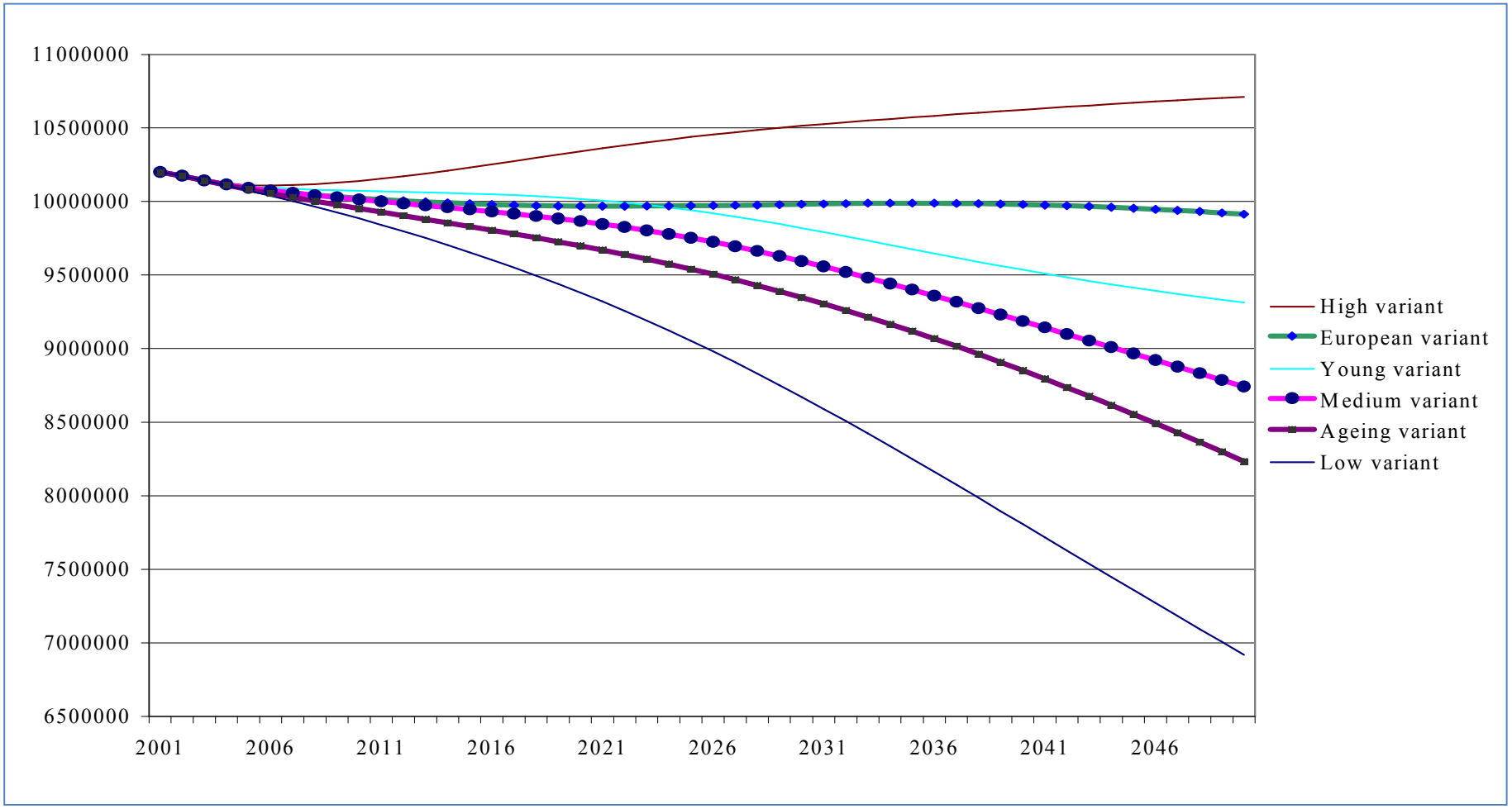
Demographic transition



Projected population growth of the world 1997-2015



Hungary’s projected population by six variants 2001-2050



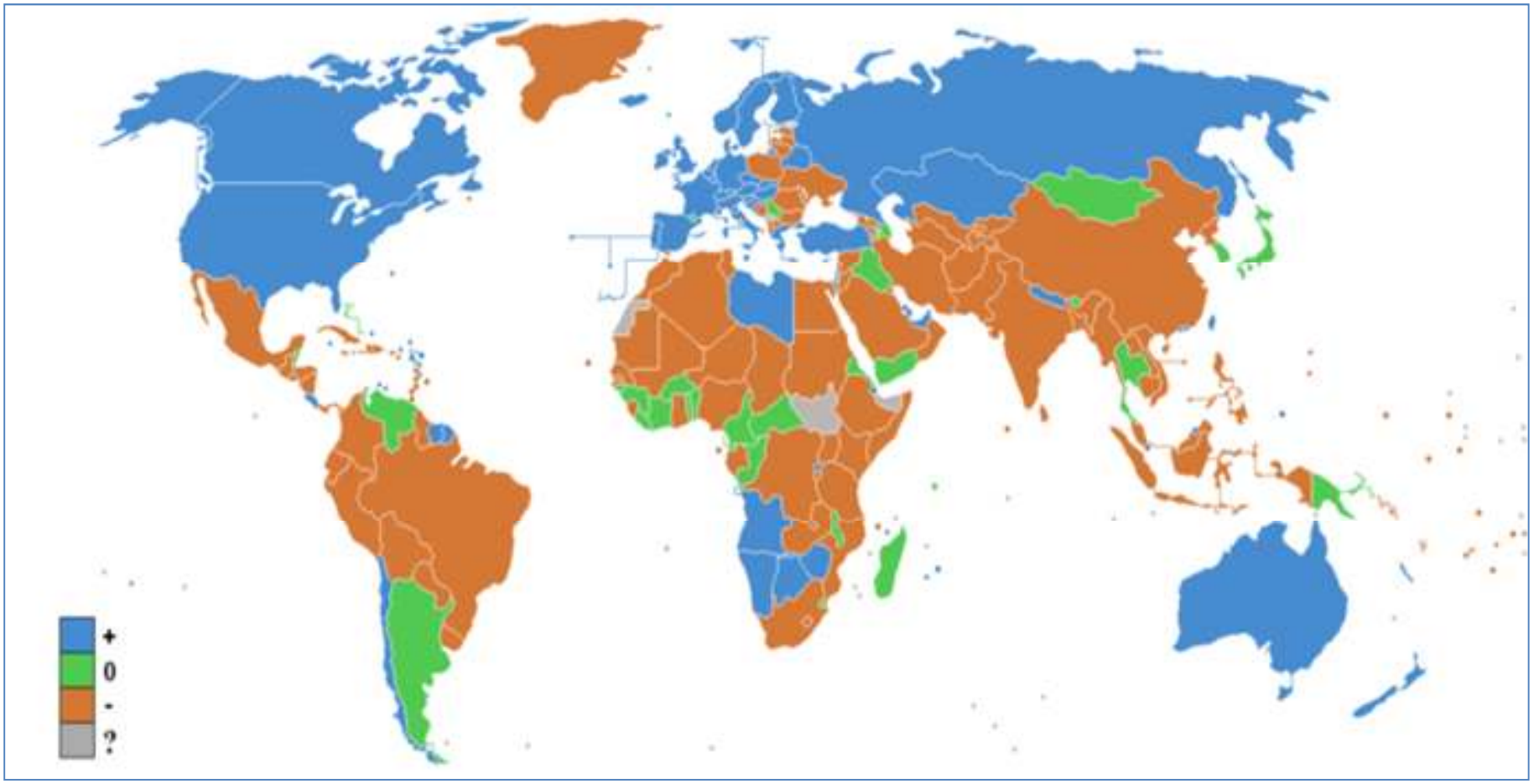
Migration

Number of inhabitants in a given territorial unit depended not only on the balance of birth and death cases but also that of the migration (immigrants and emigrants).

Migration is change of residence by leaving (emigration) or entering (immigration) a specific territory as

- ***voluntary*** (by own deliberation of moving persons e.g. colonization, tourism, workforce) or
- ***involuntary*** (forced) migration (by factors outside of deliberation of moving persons as expulsion → refugees, or transportation → slave trade, holocaust in the WWII)

The World's net migration rates for 2008:
positive balance (blue), negative balance (orange),
unchanged (green), and no data (gray)



Main demographic data

	2000	2007	2009
Per 1000			
Live births	9,6	9,7	9,6
Deaths	13,3	13,2	13,0
Marriage	4,7	4,1	3,7
Divorce	2,3	2,5	2,4
Infant mortality rate(per 1000 live births)	9,2	5,9	5,1
Total fertility rate	1,33	1,32	1,33
Life expectancy at birth	71,3	73,3	74,03
Male	67,1	69,2	70,05
Female	75,6	77,3	77,89

Demographic data 2009.

• **Population (2010. 01.01.)**		**10014000**
• **Life expectancy at birth:**	**Male:**	**70,05 év**
	Female:	**77,89 év**
• **Live births:**		**96442**
• **(Crude) birth rate:**		**9,6 /1000**
• **Induced abortions:**		**43181**
• **Deaths:**		**130414**
• **(Crude) mortality rate:**		**13,0/1000**
• **Infant mortality rate:**		**5,1 /1000**

Causes of death, 2009.

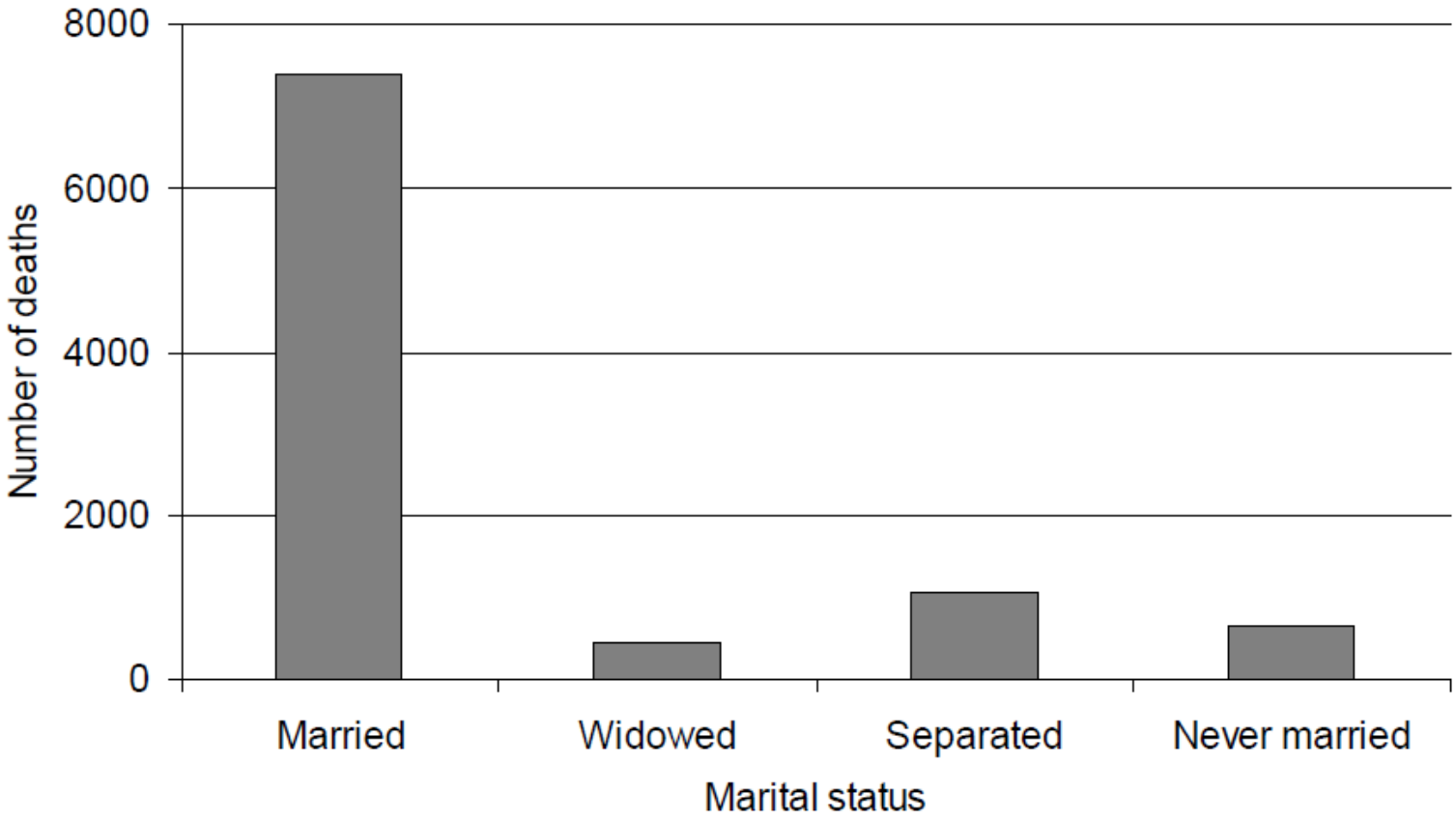
(ICD.)

Cardiovascular diseases	64921 (49,8%)
Cancers	33174 (25%)
Diseases of digestive organs	8217
Diseases of respiratory system	6466
Accidents	4401
Suicide	2461
Communicable diseases	493
Egyéb	10281
	Σ:130414

Comparing population figures I.

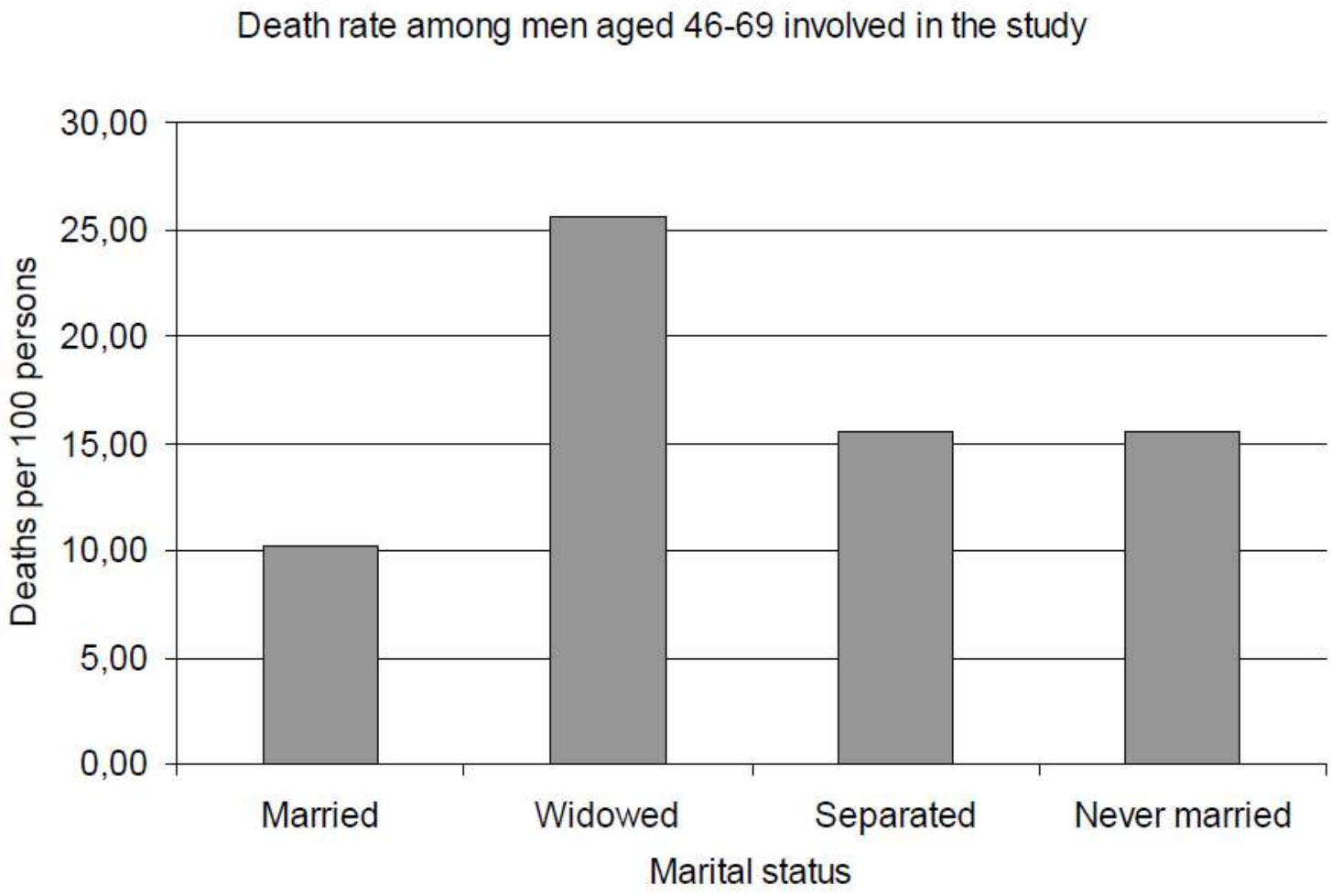
Plain numbers: Is marriage bad for your health?

Deaths in men aged 46-69 by marital status in the National Longitudinal Mortality Study between 1979 and 1983



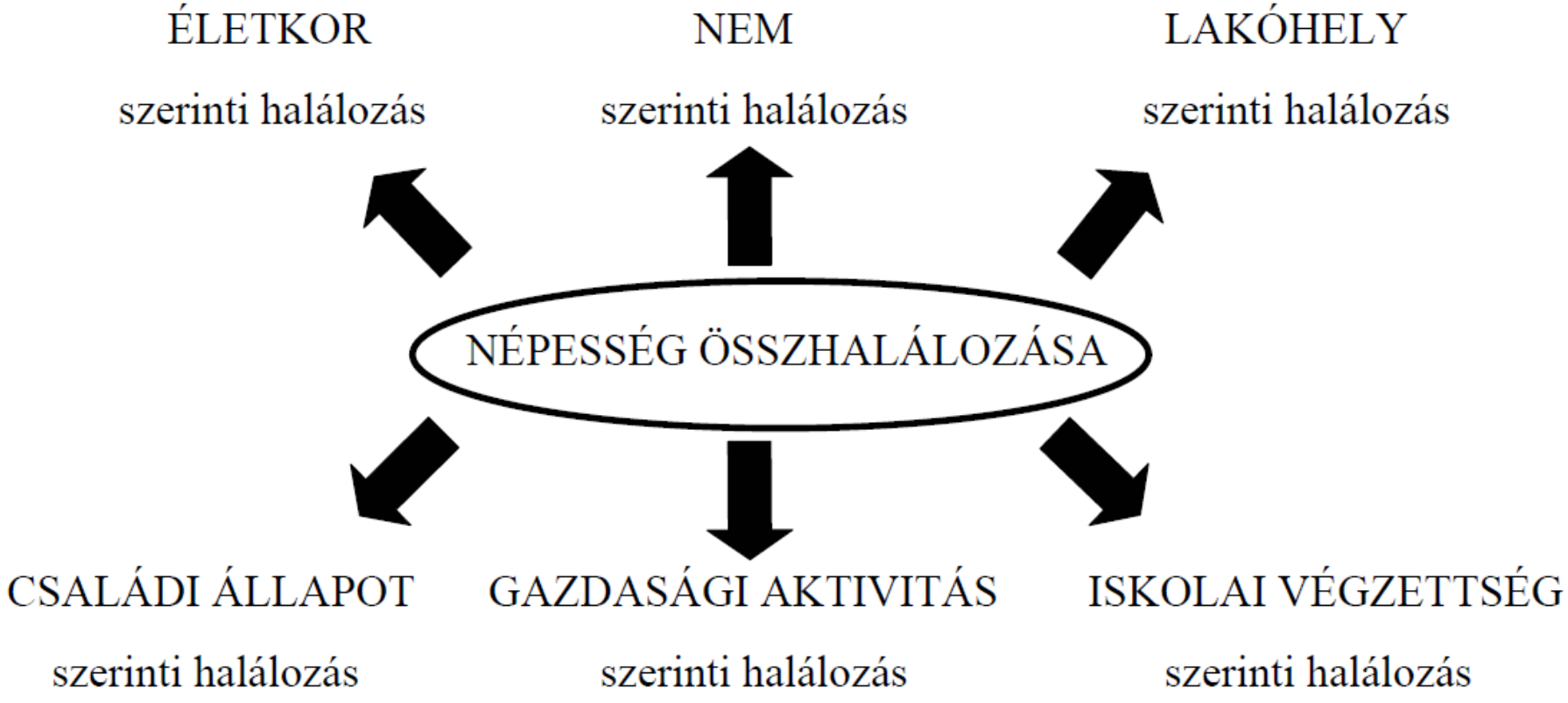
Comparing population figures II.

Death rates: Is marriage bad for your health?



Milyen tényezők befolyásolhatják a populációs összhalálozást?

Általános és (réteg)specifikus mutatók



Comparing population figures III.

Death rates: Mexico & Sweden

1995	Mexico	Sweden
Average life expectancy at birth:	72,6 yrs.	79,0 yrs.
Infant mortality:	33‰	4‰
Gross domestic product per cpta. (GDP):	~2700 $	~26000 $
% GDP spent on healthcare:	5,6%	8,1%
Population living with sanitary facilities:	70%	100%

WHICH COUNTRY WOULD YOU EXPECT TO HAVE HIGHER MORTALITY?

Mortality:	**4,72 / 1000 pers.!**	**10,61 / 1000 pers.!**

Comparing stratum-specific death rates

The role of age in comparing Mexico & Sweden

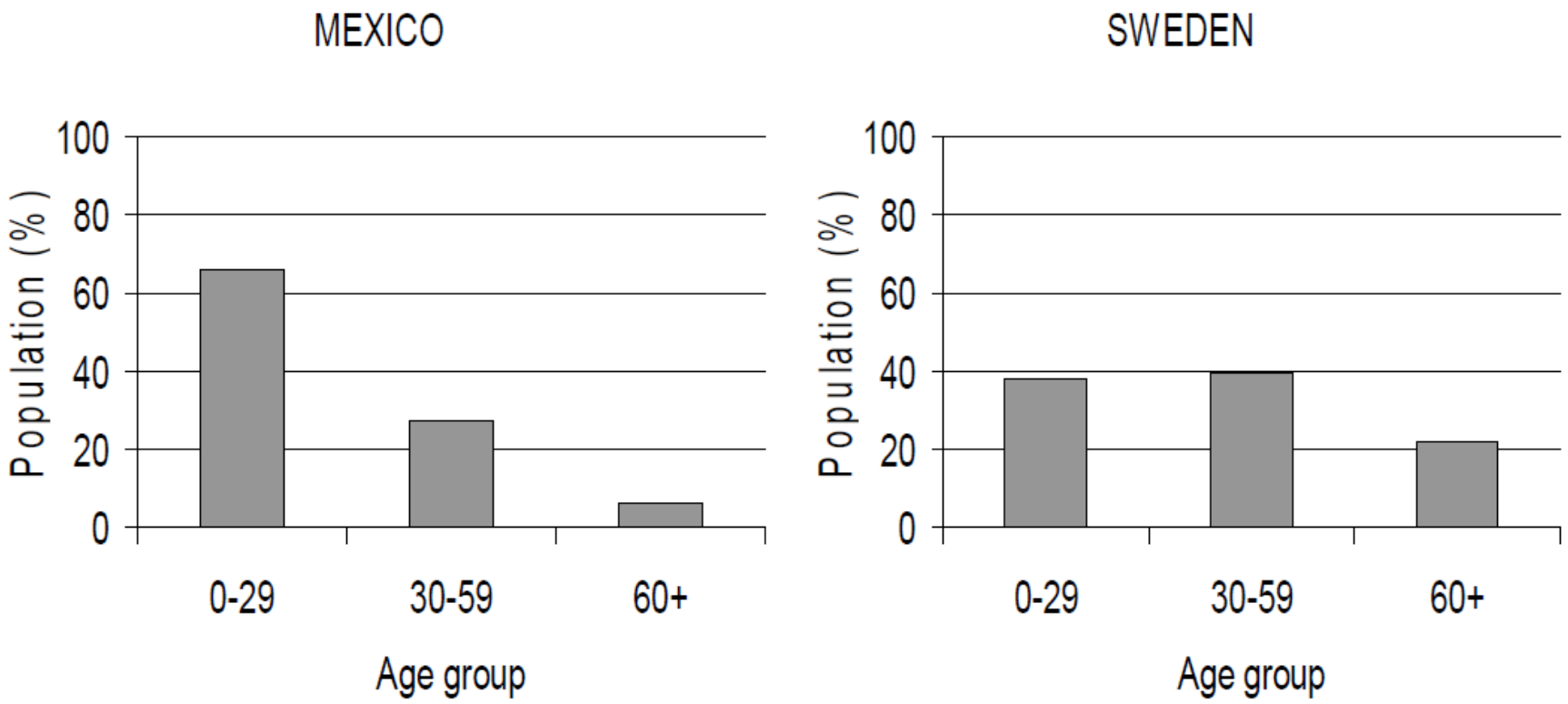
	Mexico			Sweden		
Age	Population	Deaths	Mortality	Population	Deaths	Mortality
0-29 yrs	60198200	99542	1,7 ‰	3385000	1387	0,4 ‰
30-59 yrs	25172800	101884	4,1 ‰	3497100	8304	2,4 ‰
60+ yrs	5774500	228675	39,6 ‰	1944900	83950	43,2 ‰
Total	91154500	430101	4,7 ‰	8827000	93641	10,6 ‰

How do stratum-specific death rates of the two countries compare to each other?

WHICH COUNTRY HAS MORE FAVOURABLE MORTALITY?!?

How do stratum-specific death rates determine overall death rates?

The population distribution of Mexico & Sweden



Standardization

„…a set of techniques used to remove as far as possible the effects of differences in age or other confounding variables when comparing two or more populations"

Last 1995

In case of standardization of CMR values, it means to use a common age distribution pattern for re-computing crude mortality rates to get SMRs or age adjusted mortality rates.

City A = 2000		**City B = 2000**	
0-50 yrs	51- yrs	0-50 yrs	51- yrs
1500	500	500	1500
9	10	3	30
19 Deaths out of 2000		33 Deaths out of 2000	
19 / 2000		33 / 2000	
CMR = 9.5 ‰		**CMR = 16.5 ‰**	

Direct age-standardization

Correcting for varying age-distribution of populations

Basic question: *what would mortality figures in the two countries be if BOTH COUNTRIES HAD THE SAME AGE-DISTRIBUTION & THEIR ORIGINAL STRATUM SPECIFIC MORTALITY RATES?*

Same age distribution *(STANDARD POPULATION - WHO 2000):*

Age group	Population proportions	In case of 100000 persons
0-29 yrs	51%	51000
30-59 yrs	37%	37000
60+ yrs	12%	12000

Age group	Mortality - Mexico	Mortality - Sweden
0-29 yrs	1,7 ‰	0,4 ‰
30-59 yrs	4,1 ‰	2,4 ‰
60+ yrs	39,6 ‰	43,2 ‰

Cases in which direct standardization is not applicable...

Indirect standardization

Basic question: If STRATUM-SPECIFIC DEATH RATES OF THE STANDARD POPULATION were applied to our study population, HOW MANY DEATHS WOULD WE EXPECT?

Consequently: How does the OBSERVED NUMBER OF DEATHS COMPARE TO THE EXPECTED NUMBER OF DEATHS?

Fictitious chemical factory in Mexico

Age group	Number of workers	Number of deaths	Mortality
0-29 yrs	1000	1	0,001
30-59 yrs	4000	4	0,001
60+ yrs	3000	12	0,004

Standardization

Advantages

- Summarizes stratum-specific rates
- Unconfounded comparison of populations

Disadvantages

- Fictitious values
- Value depends on choice of standard

20 years after the American National Health And Nutrition Examination Survey – NHANES, 1971-75 Gu et al was trying to find out if there was a difference in mortality between 1971 and 1993 of those claimed themselves diabetic in 1971 compared to the healthy population. The following table shows some of their results:

Male	Diabetic		Non-diabetic	
	Population	Number of death	Population	Number of death
25-44 years	454	10	34461	154
45-64 years	1222	60	28412	706
65-74 years	1484	157	18189	1371

The standard population of 1990:

Age-group	Population
25-44 years	325,000
45-64 years	186,000
65-74 years	73,000

1. Calculate the standardized mortality of the diabetic population (per thousand)!
2. Calculate the relative mortality risk of the diabetic compared to the non-diabetic population!

A study examined the prevalence of diabetes in two villages (A and B). The result is shown by the table:

	A village		B village	
Age group	**Population**	**No. of diabetic**	**Population**	**No. of diabetic**
15-39	4200	42	500	20
40-59	3000	450	600	240
60+	1200	300	900	540
Total	**8400**	**792**	**2000**	**800**

Calculate the prevalence of diabetes in both villages!

Prevalence A:

Prevalence B:

Standardize the data using the following standard population and calculate prevalence again.

Age gorup	**Population**
15-39	6500
40-59	5500
60+	3000

Standardized prevalence A:

Standardized prevalence B:

A study examined if visiting disco regularly can be an exposition factor for drug-usage. The result is shown by the table:

	Non-visiting population		Regular disco visitors	
Age group	**Population**	**Have ever tried a drug**	**Population**	**Have ever tried a drug**
15-20	25000	525	7750	1248
21-25	35000	1190	12250	2217
26-30	10000	300	2000	216
31-35	10000	200	2000	200
Total	**80000**	**2215**	**24000**	**3881**

Calculate the prevalence of drug usage in both population!

Prevalence among those not attending disco:

Prevalence among those visiting a disco regularly:

Standardize the data using the following standard population and calculate prevalence again.

Age group	**Population**
15-20	71000
21-25	76000
26-30	86000
31-35	88000

Standardized prevalence among those not attending disco:

Standardized prevalence among those visiting a disco regularly:

The following table presents the mortality rate of two villages (A and B).

	A village		B village	
Age group	**Population**	**No. of death**	**Age group**	**No. of death**
18-35	20000	40	12000	36
36-65	40000	300	30000	300
66+	24000	1200	20000	800
Total	**84000**	**1540**	**62000**	**1136**

Calculate the crude mortality in both villages!

Mortality A:

Mortality B:

Standardize the data using the following standard population and calculate mortality again.

Age group	**Population**
18-35	65000
36-65	55000
66+	30000

Standardized Mortality A:

Standardized Mortality B:

Topics suggested for students' oral presentations:

1. Demographic situation in my home country, birth, death rates and age-sex pyramid
2. Migration, related problems and changing population in my home country