Public health I.

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

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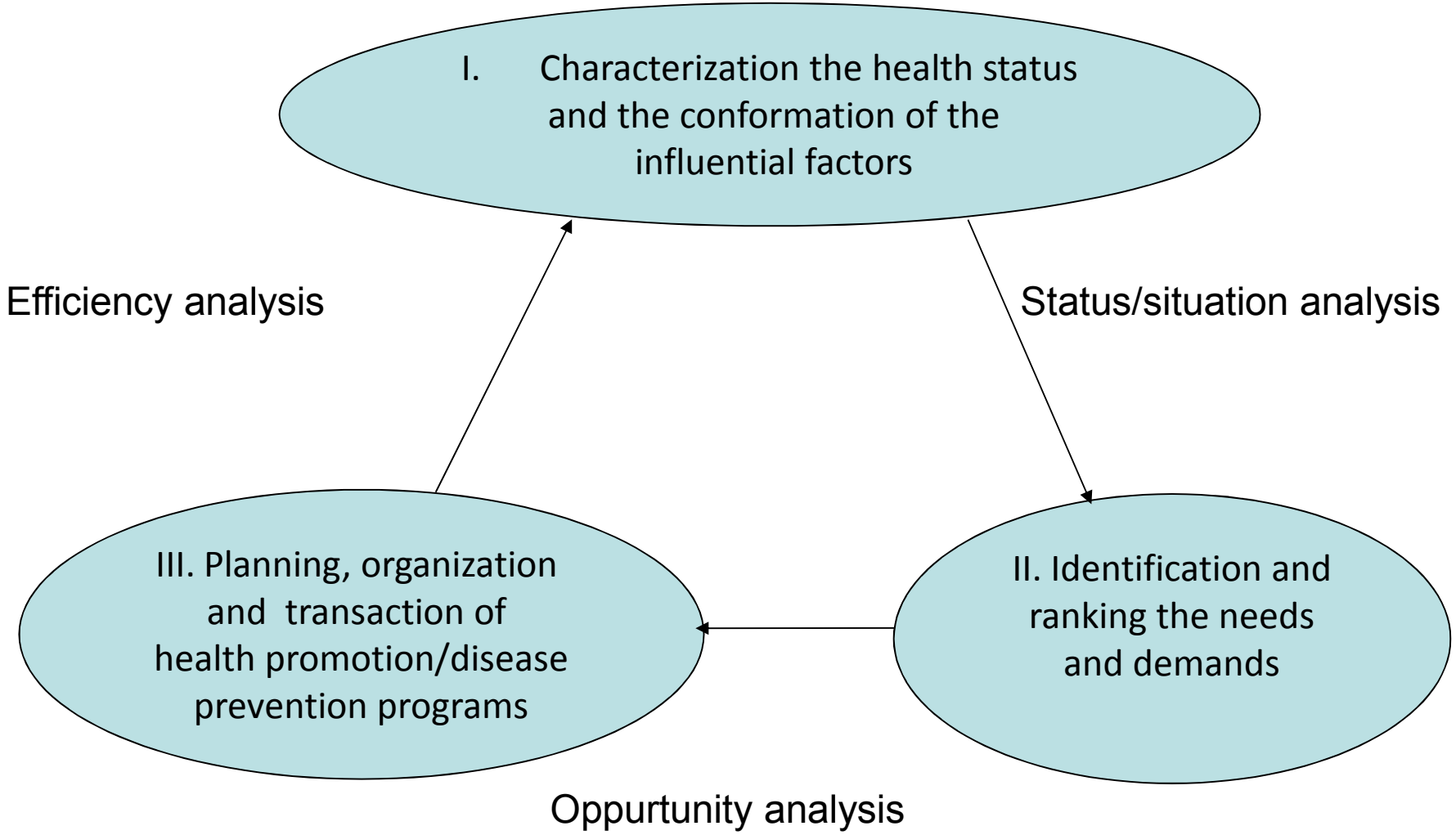
- Definition of preventive medicine and public health
- The main functions of public health
- The elemental tasks of public health

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*

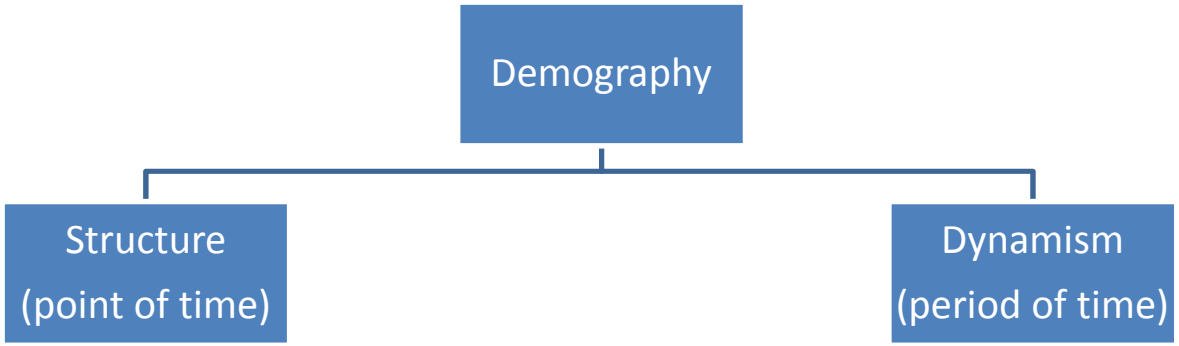
Public health cycle



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

Vital statistics

- births (natality)
- fertility
- deaths (mortality)
- reproduction
- marital status

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

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

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

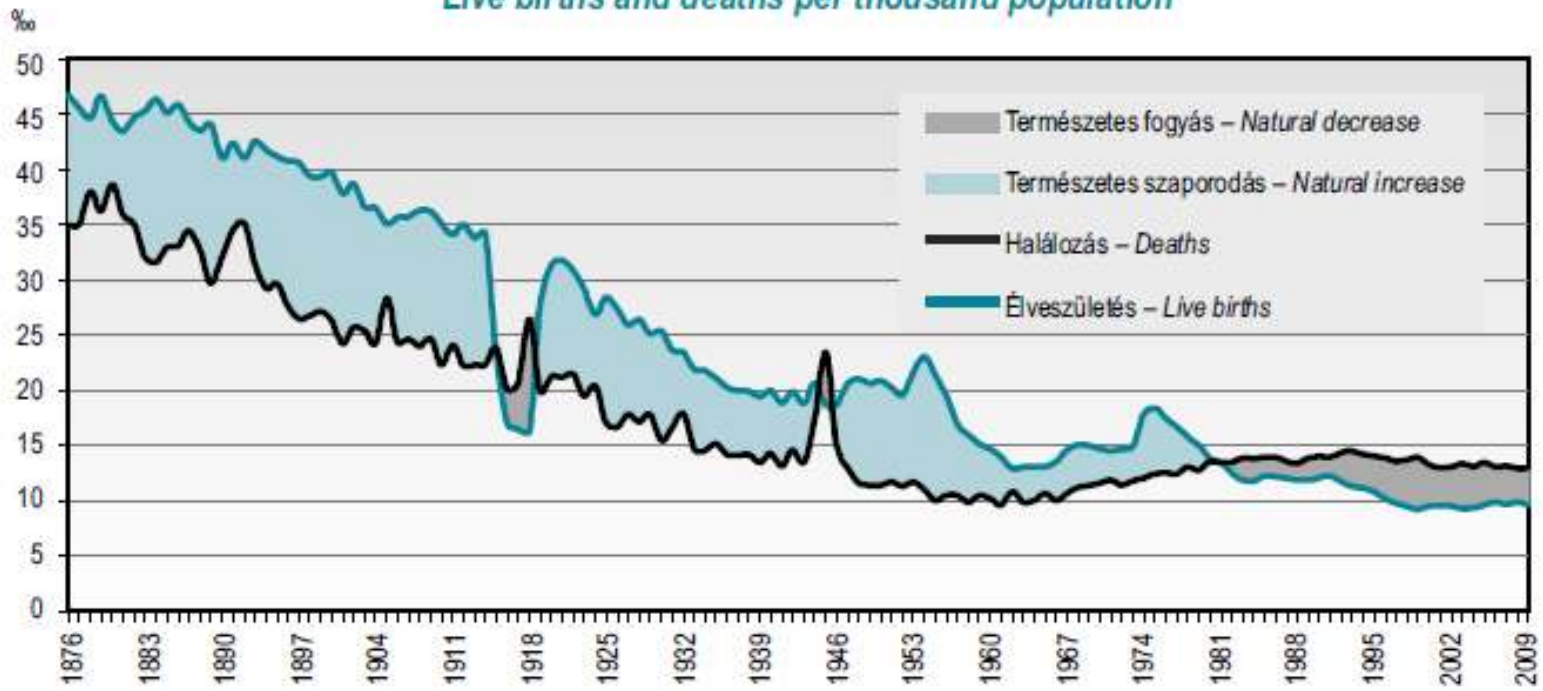
Population growth

PG=CBR-CDR

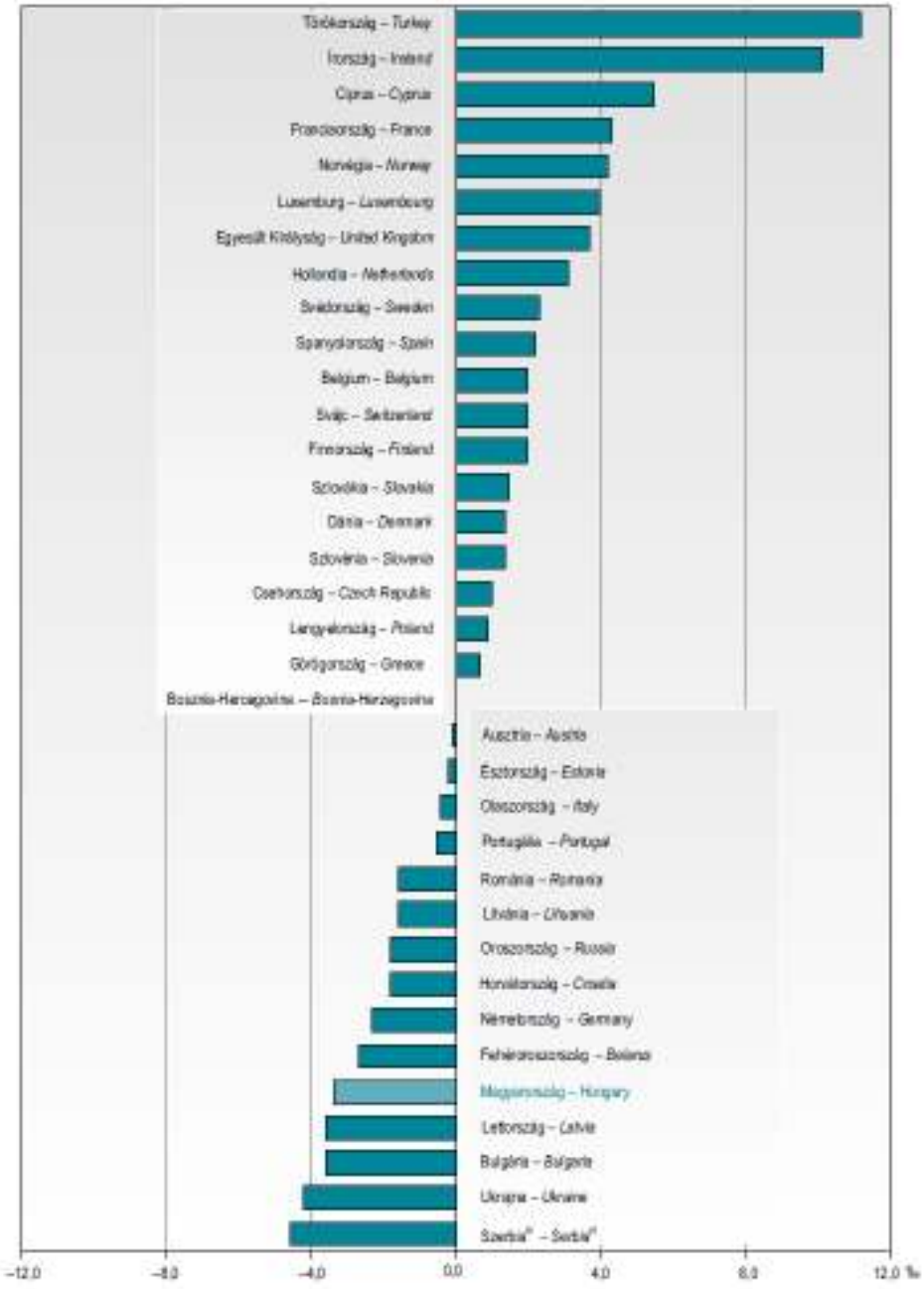
+ natural increase

- natural decrease

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

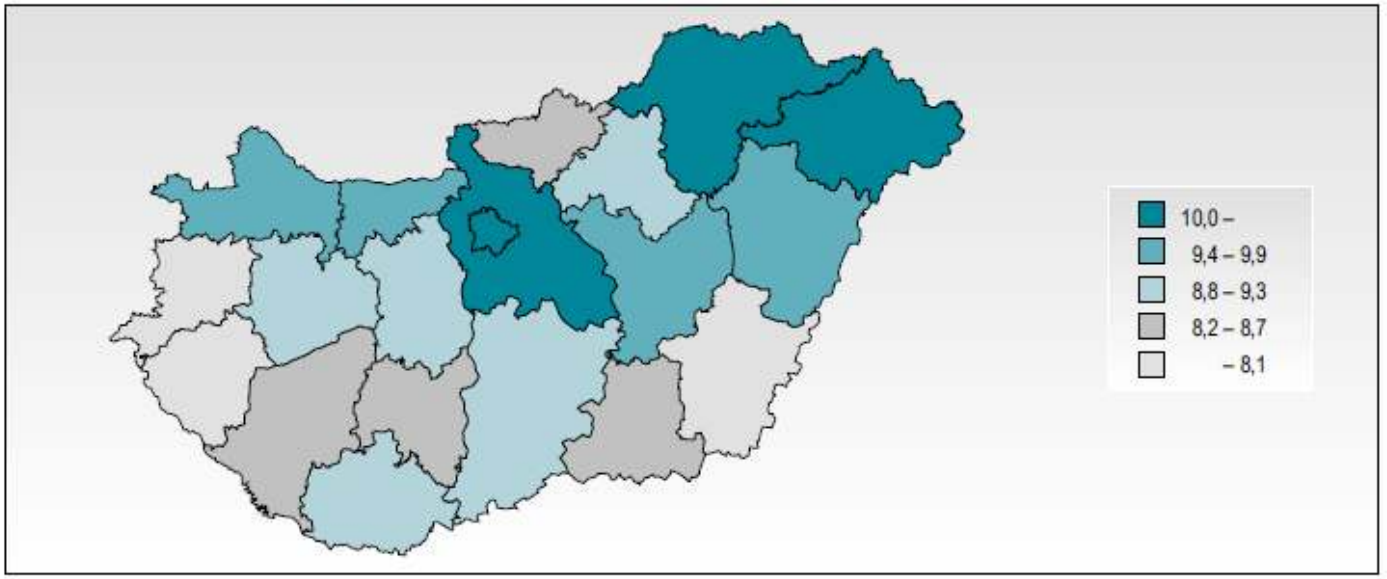


G.44. Ezer lakosra jutó természetes szaporodás, fogyás nemzetközi összehasonlításban, 2009
International comparison on natural increase, decrease per thousand population, 2009

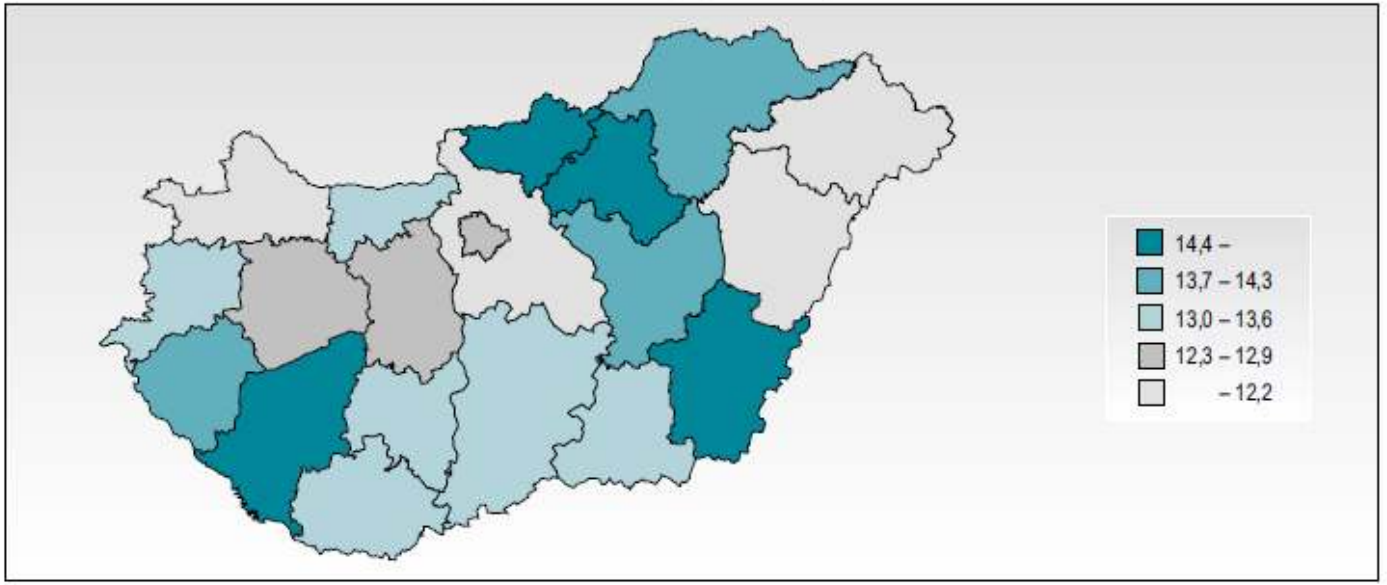


e) 2008.

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

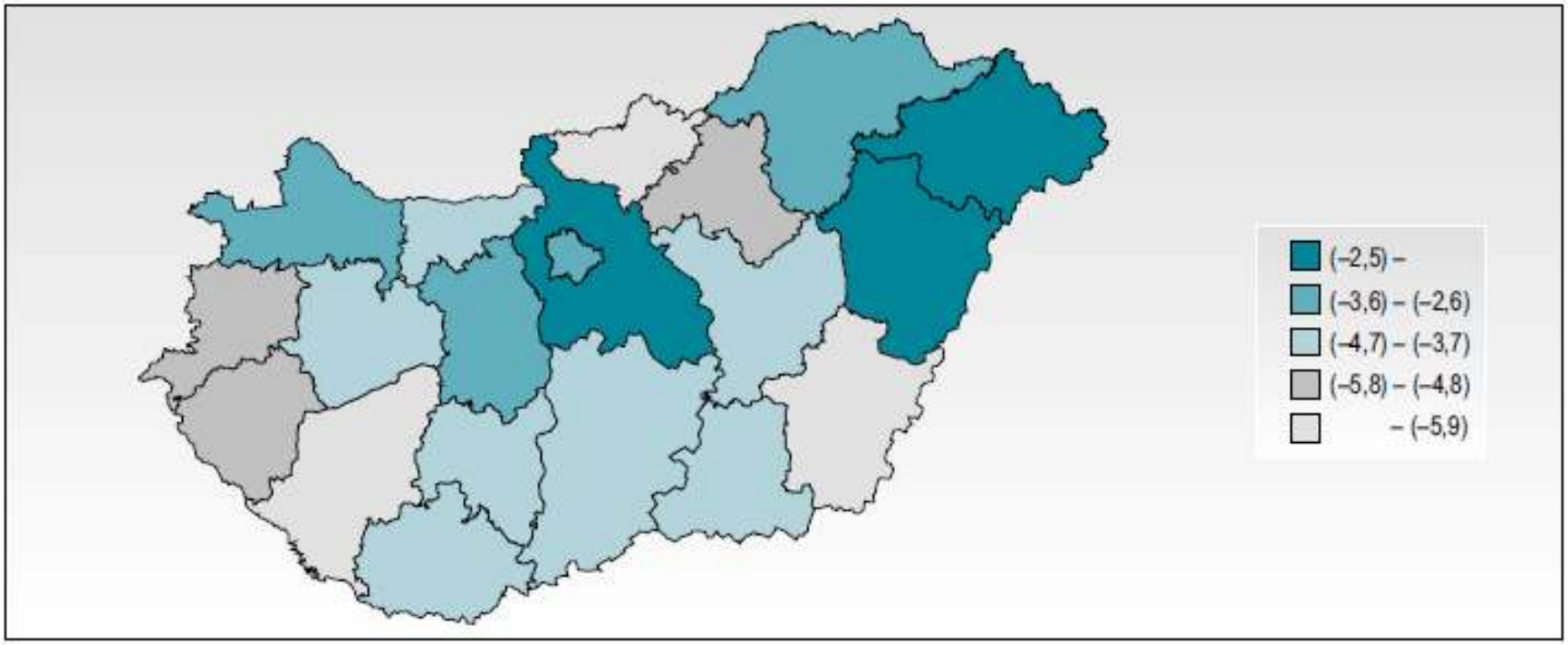


G.9. Ezer lakosra jutó halálozás megyénként, 2009
Deaths per thousand population by counties, 2009



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

Natural increase, decrease per thousand population by counties, 2009



The measurement of fertility

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

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

General fertility rate (GFR): Births to women aged 15-49 in a year/period per 1000 women aged 15-49 in the same period.

$$\text{GFR} = \frac{number\ of\ births\ to\ women\ aged\ 15\text{-}49}{mid\text{-}year\ population\ of\ women\ aged\ 15\text{-}49} \times 1000$$

The measurement of fertility

Age-specific fertility rate (ASFR): Number of births to women aged x (or x to x + n) per 1000 women aged x (or x to x + n). 'n' refers to the length of an age interval. ASFRs are frequently calculated for five year age groups from 15-19 to 45-49

$$\text{ASFR} = \frac{births\ to\ women\ aged\ x}{mid\text{-}year\ population\ of\ women\ aged\ x} \times 1000$$

Total (period) fertility rate (TFR/TPFR): The sum of the age-specific fertility rates for all reproductive age groups for a particular period (usually a year), conventionally expressed per woman. The TFR indicates how many children a woman would have if throughout her reproductive life, she had children at the age specific rates prevalent in the specified year or period

$$\text{TFR} = \sum_{x=15}^{45-49} fx$$

where 'fx' is the age-specific fertility rate at age x. If rates for age groups, rather than single years, are used then the sum of the age-specific rates must be multiplied by the number of single ages included in the group (usually five).

$$\text{TFR} = 5x \sum_{x=15-19}^{45-49} fx$$

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

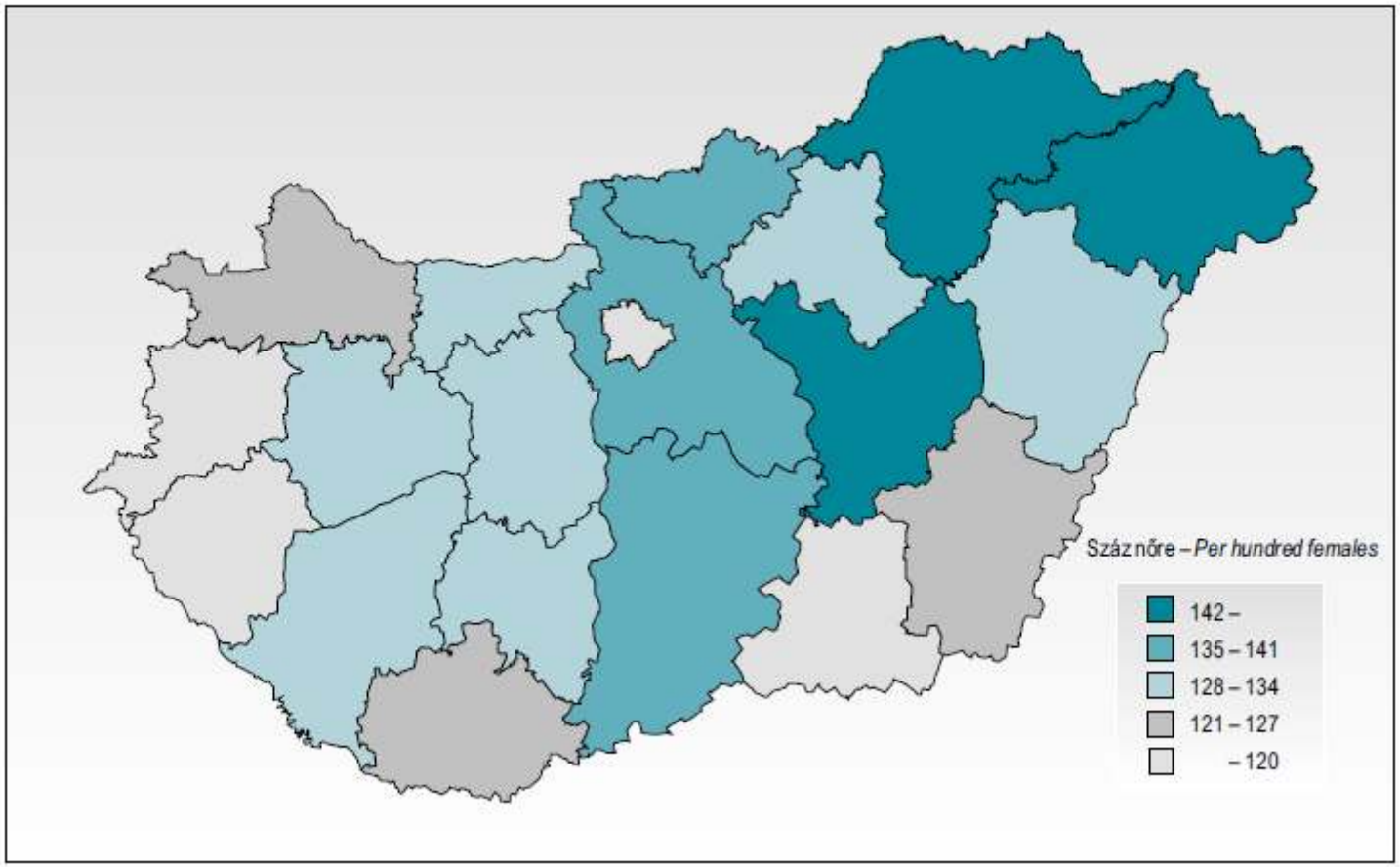
The proportion of female births can be taken as 0.488 (100/205) in the absence of more detailed information.

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

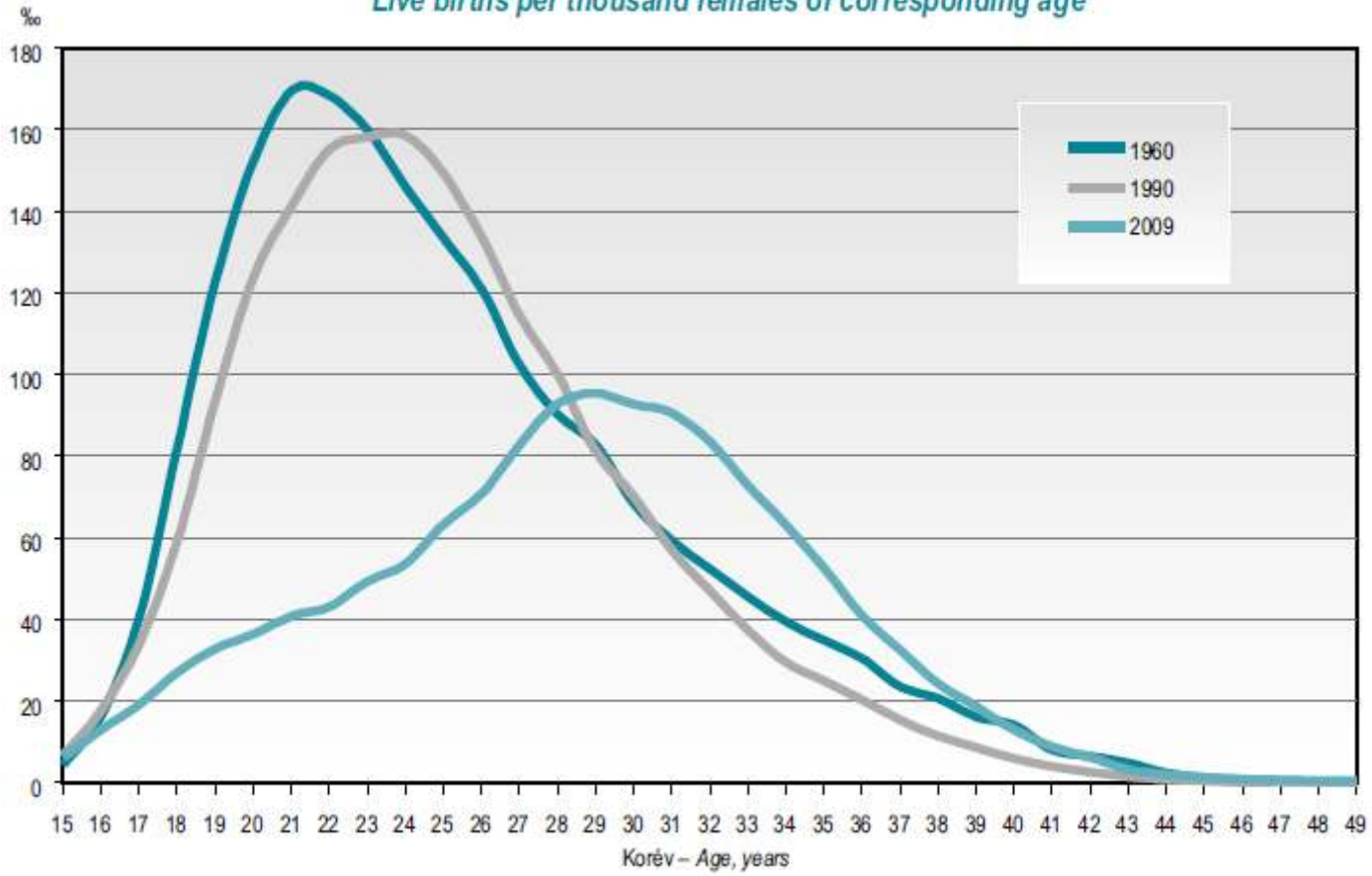
Év *Year*	Élveszületések száma *Number of live births*	Teljes termékenységi arányszám *Total fertility rate*	Reprodukciós együttható *Reproduction rates*		Ezer – *Live births*			
			nyers *crude*	tisztított *net*	15–49 éves nőre jutó élveszületés *per thousand females aged 15–49*	15–49 éves házas nőre 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

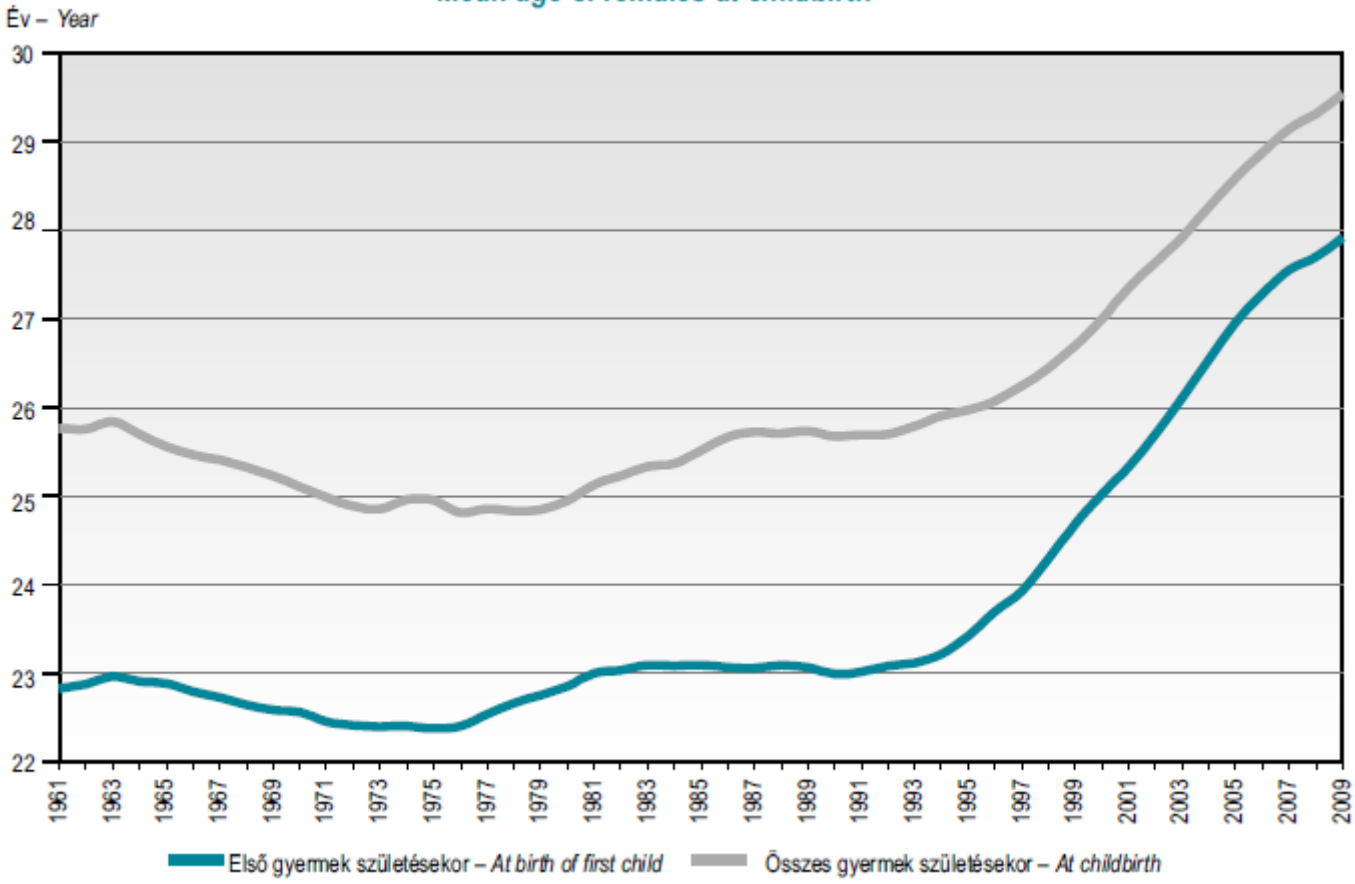


G.13. Ezer megfelelõ korú nõre jutó élveszületés

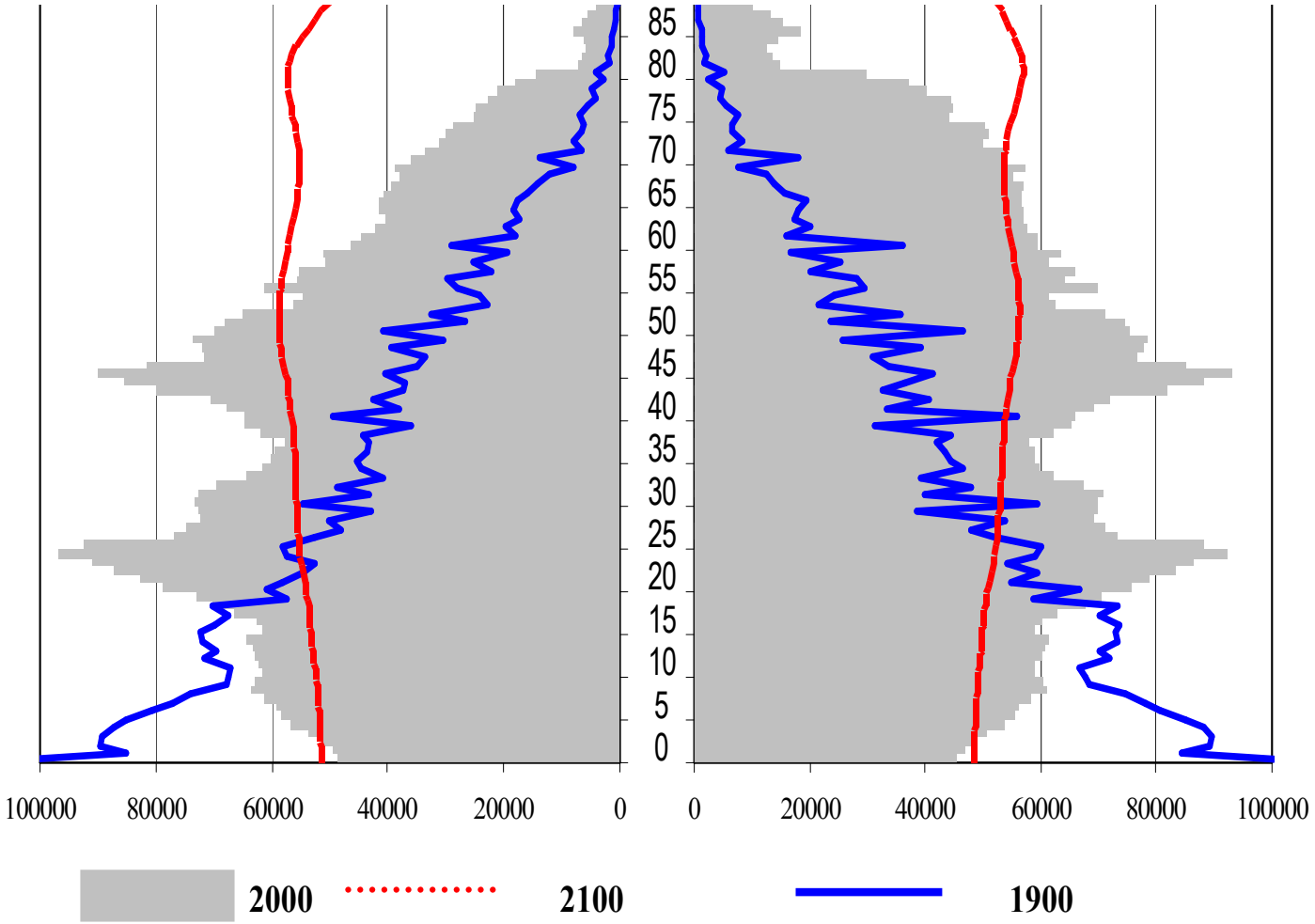
Live births per thousand females of corresponding age



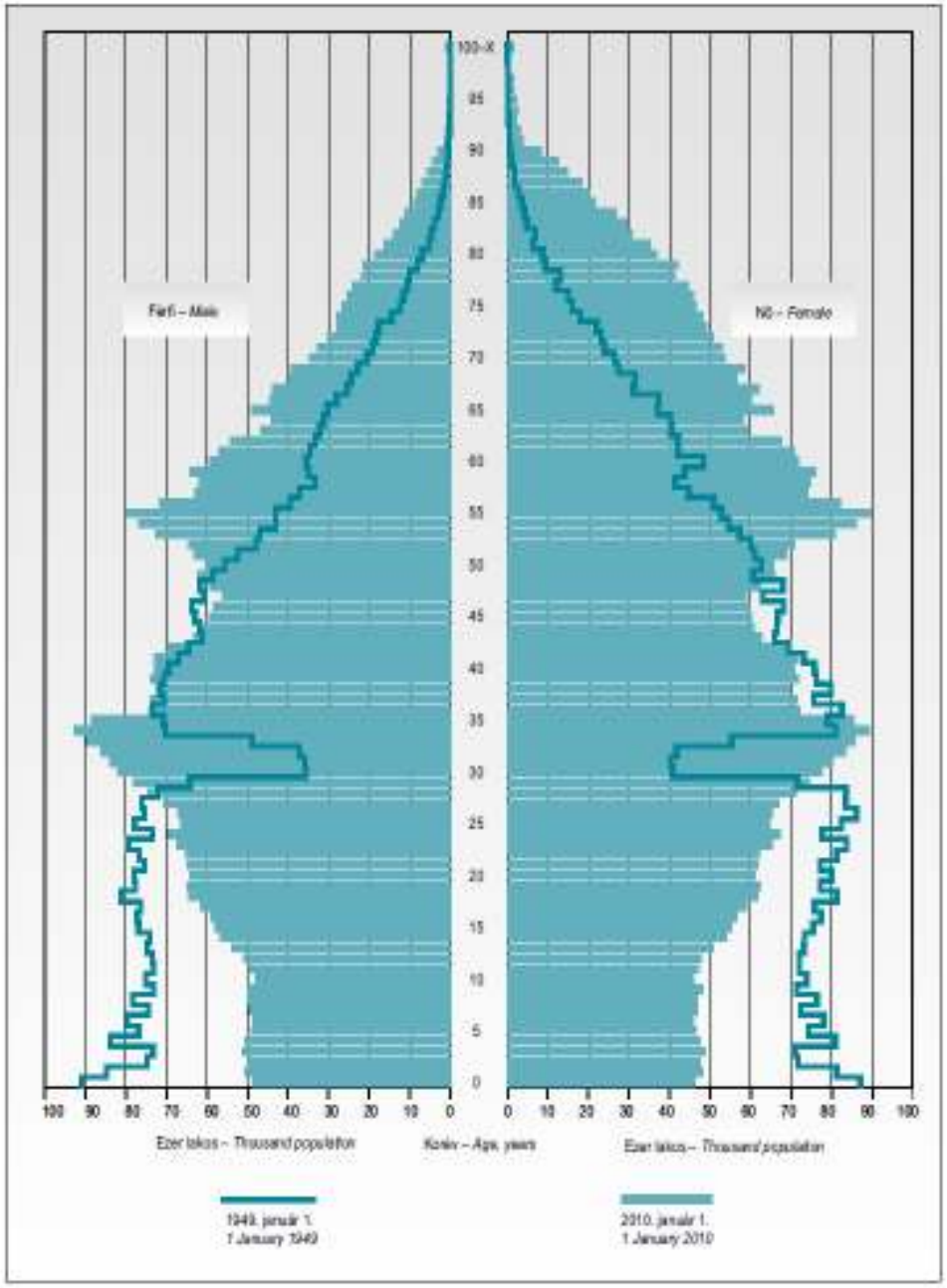
G.14. A nők átlagos kora gyermekük születésekor
Mean age of females at childbirth



Population pyramid

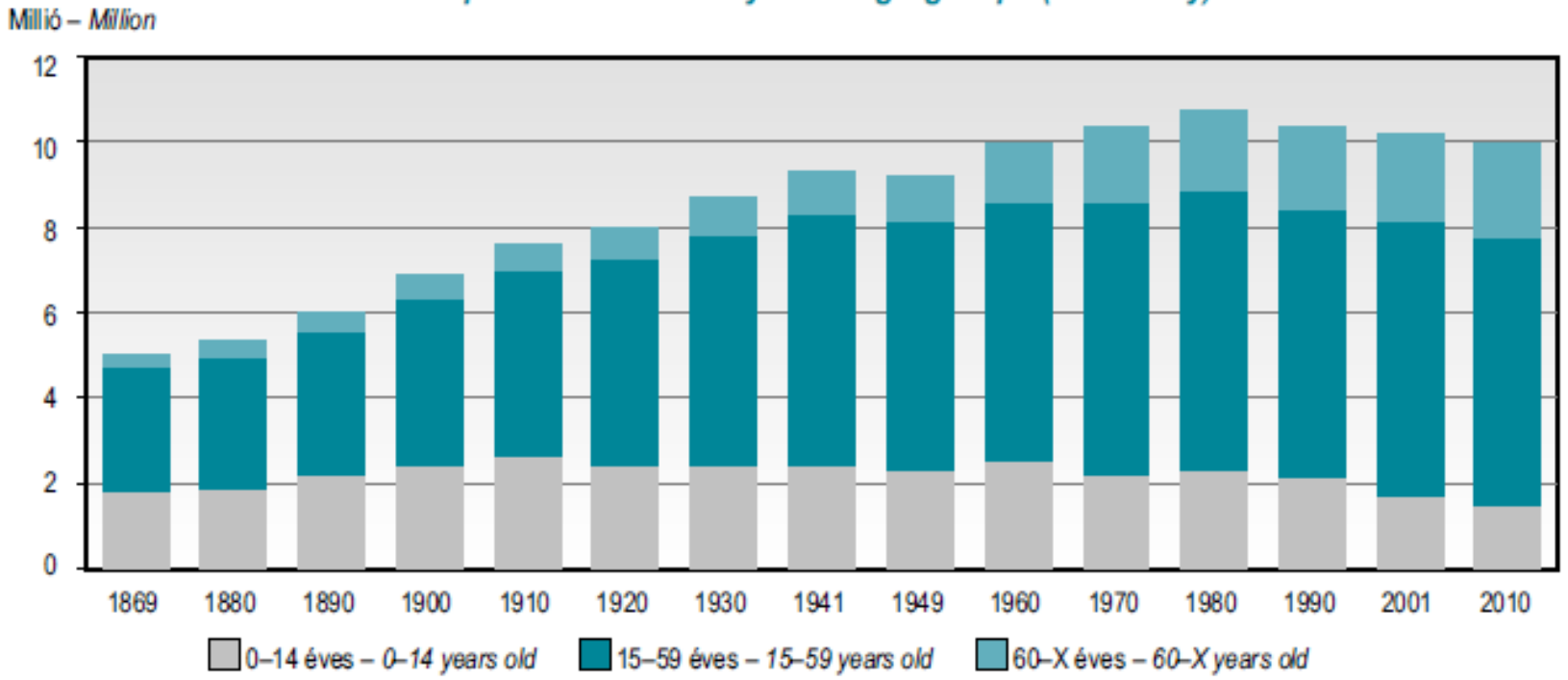


G.1. A népesség száma nem és életkor szerint
Population number by sex and age

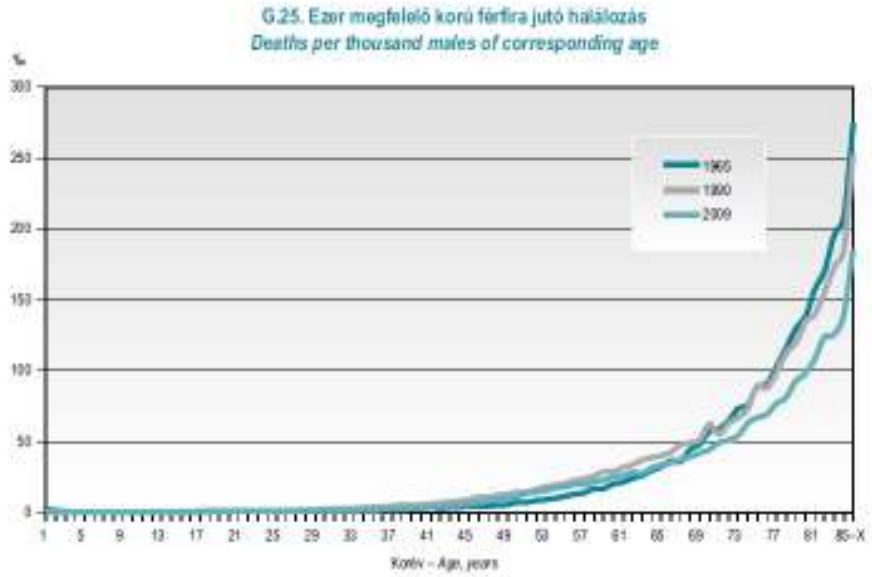


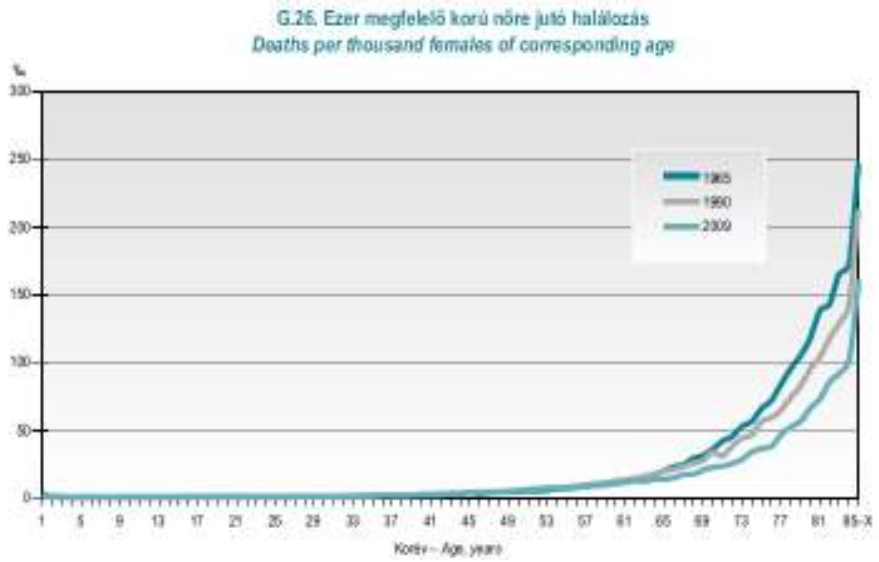
G.3. A népesség száma főbb korcsoportok szerint (január 1.)*

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



Frequency of deaths by age

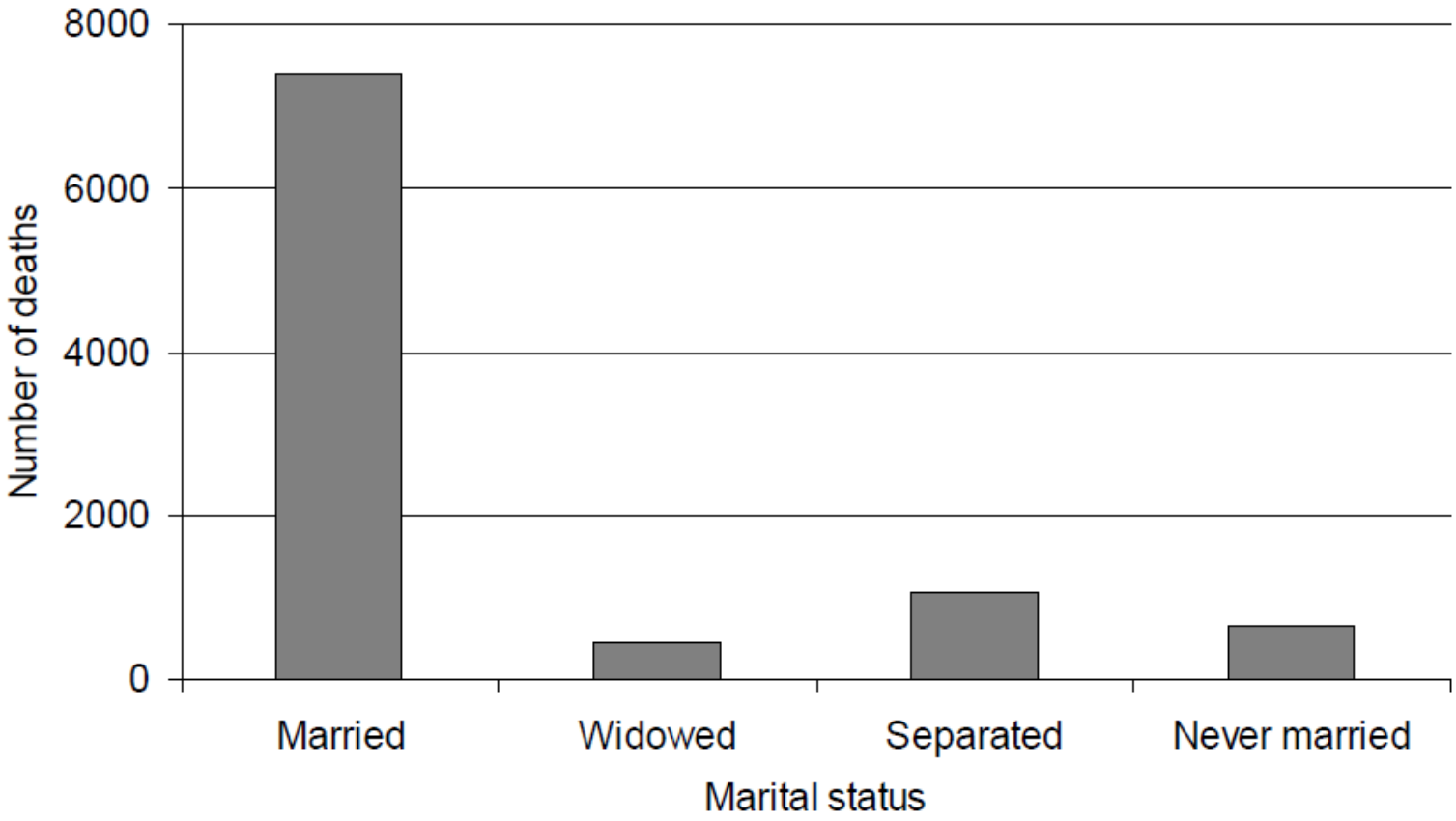




Comparing population figures I.

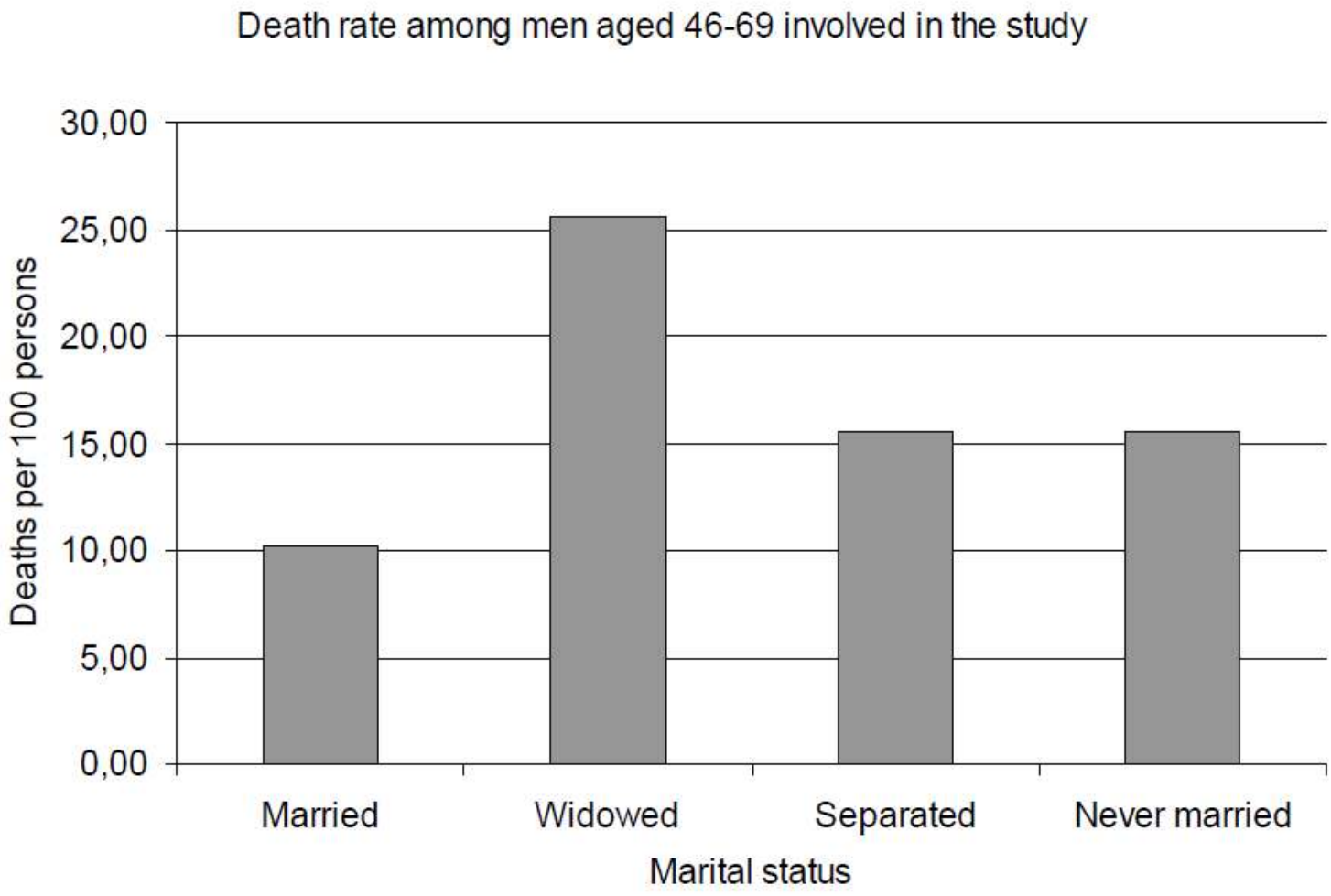
Plain numbers: Is marriage bad for your health?

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?



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

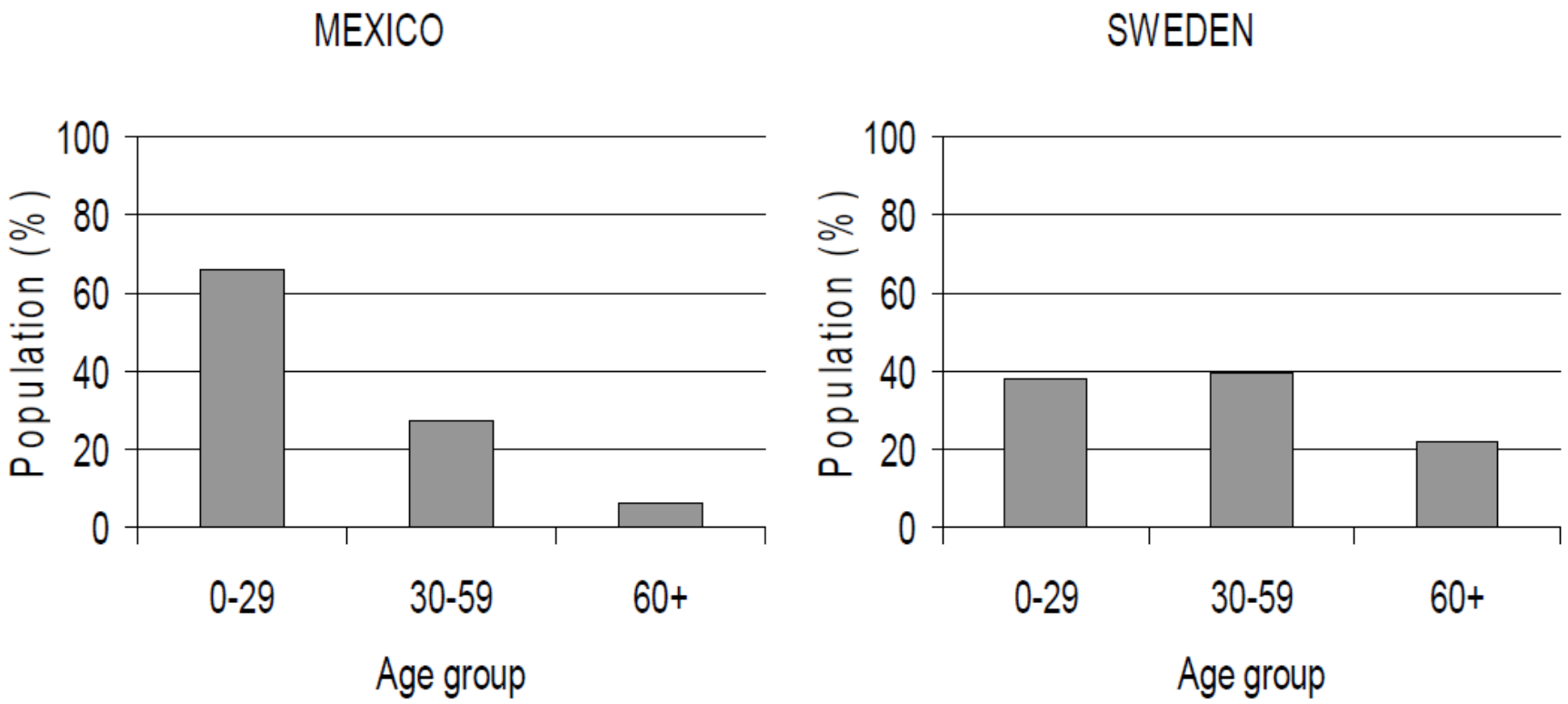
	Mexico			Sweden		
Age	Population	Deaths	Mortality	Population	Deaths	Mortality
0-29 yrs	60198200	99542	1,7 ‰	3385000	1387	0,4 ‰
30-59 yrs	25172800	101884	4,1 ‰	3497100	8304	2,4 ‰
60+ yrs	5774500	228675	39,6 ‰	1944900	83950	43,2 ‰
Total	91154500	430101	4,7 ‰	8827000	93641	10,6 ‰

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

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

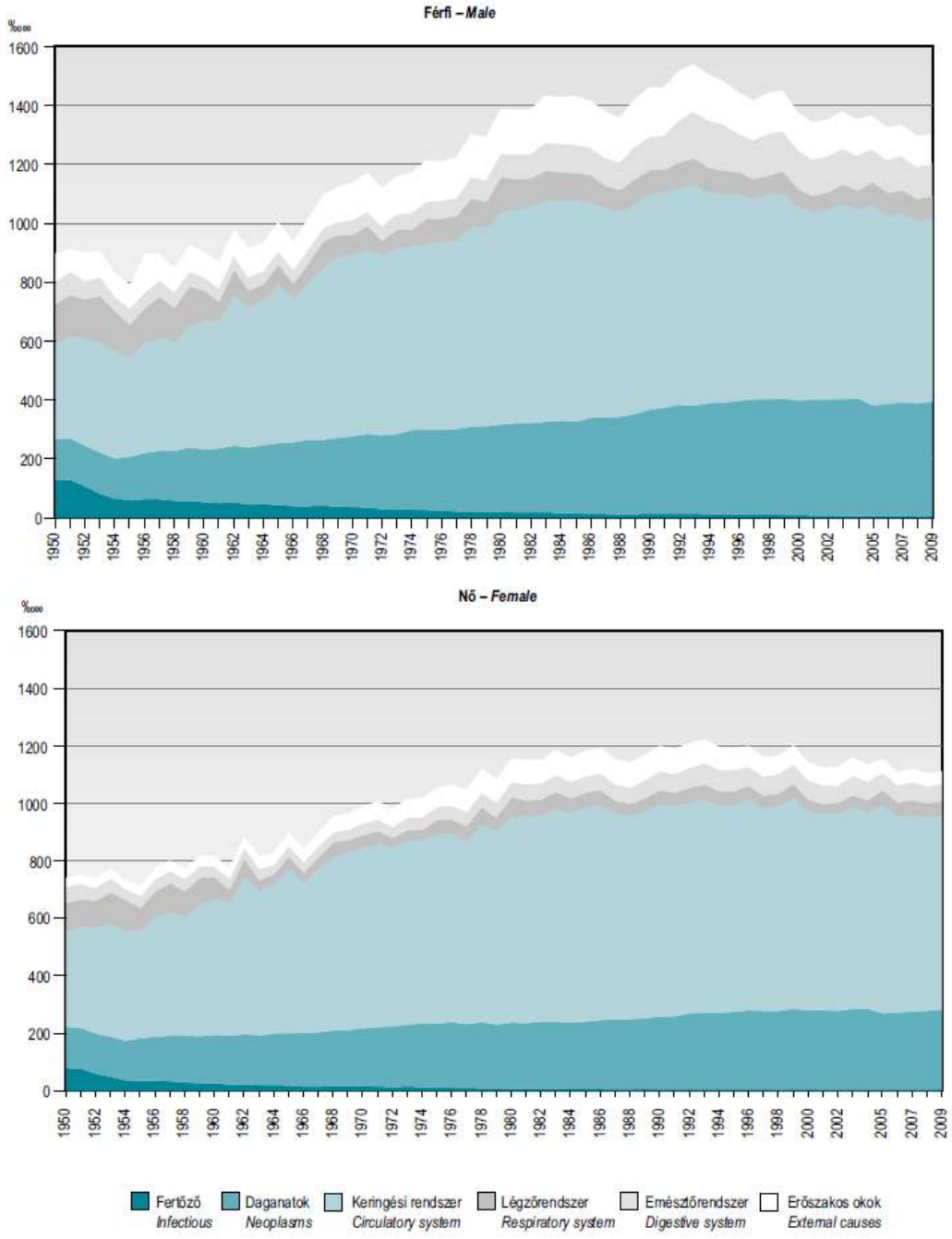
Advantages

- Summarizes stratum-specific rates
- Unconfounded comparison of populations

Disadvantages

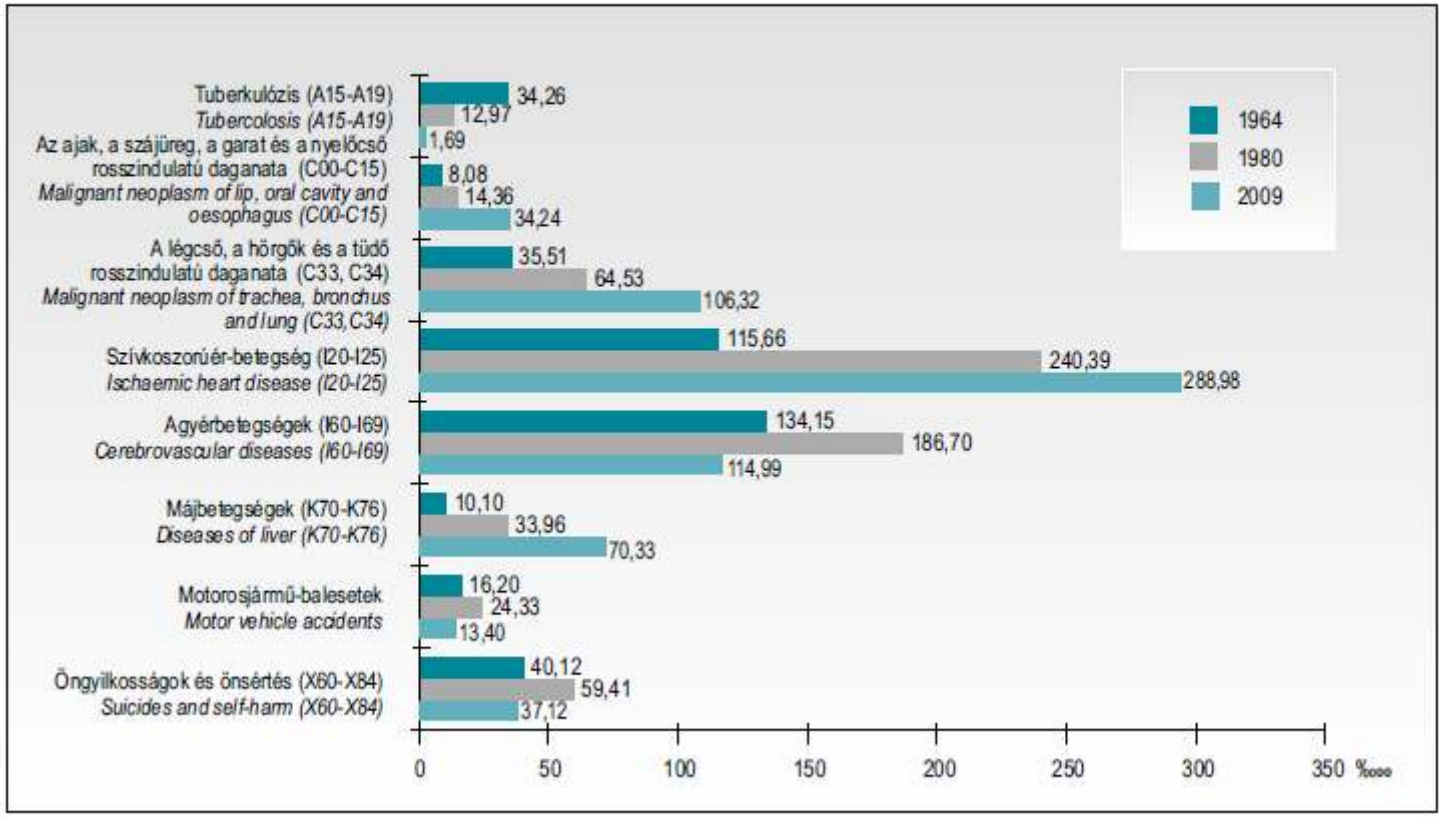
- Fictitious values
- Value depends on choice of standard

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



Causes of death

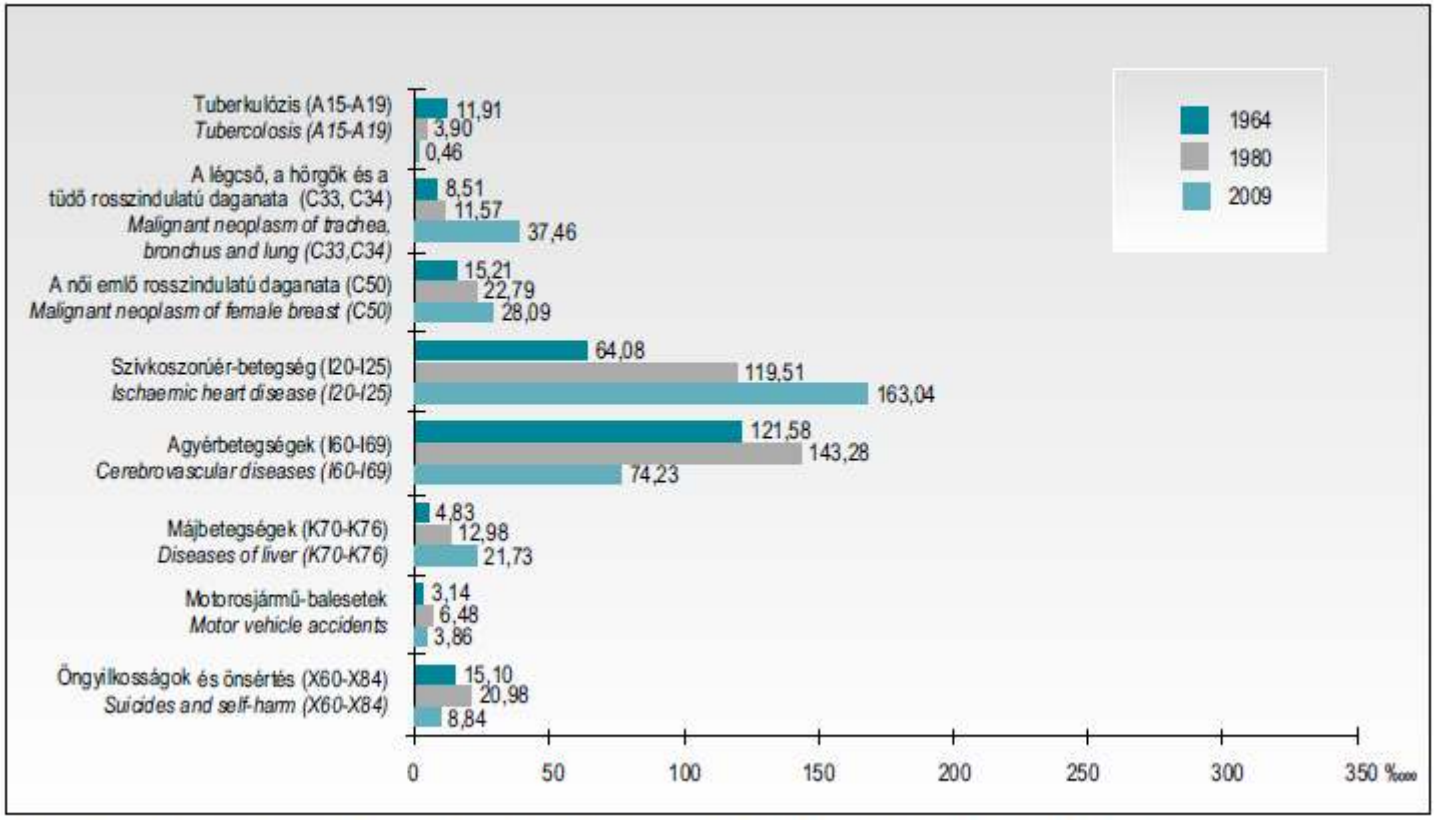
G.34. Százezer férfira jutó halálozás kiemelt halálokok szerint
Deaths per hundred thousand males by selected causes of death



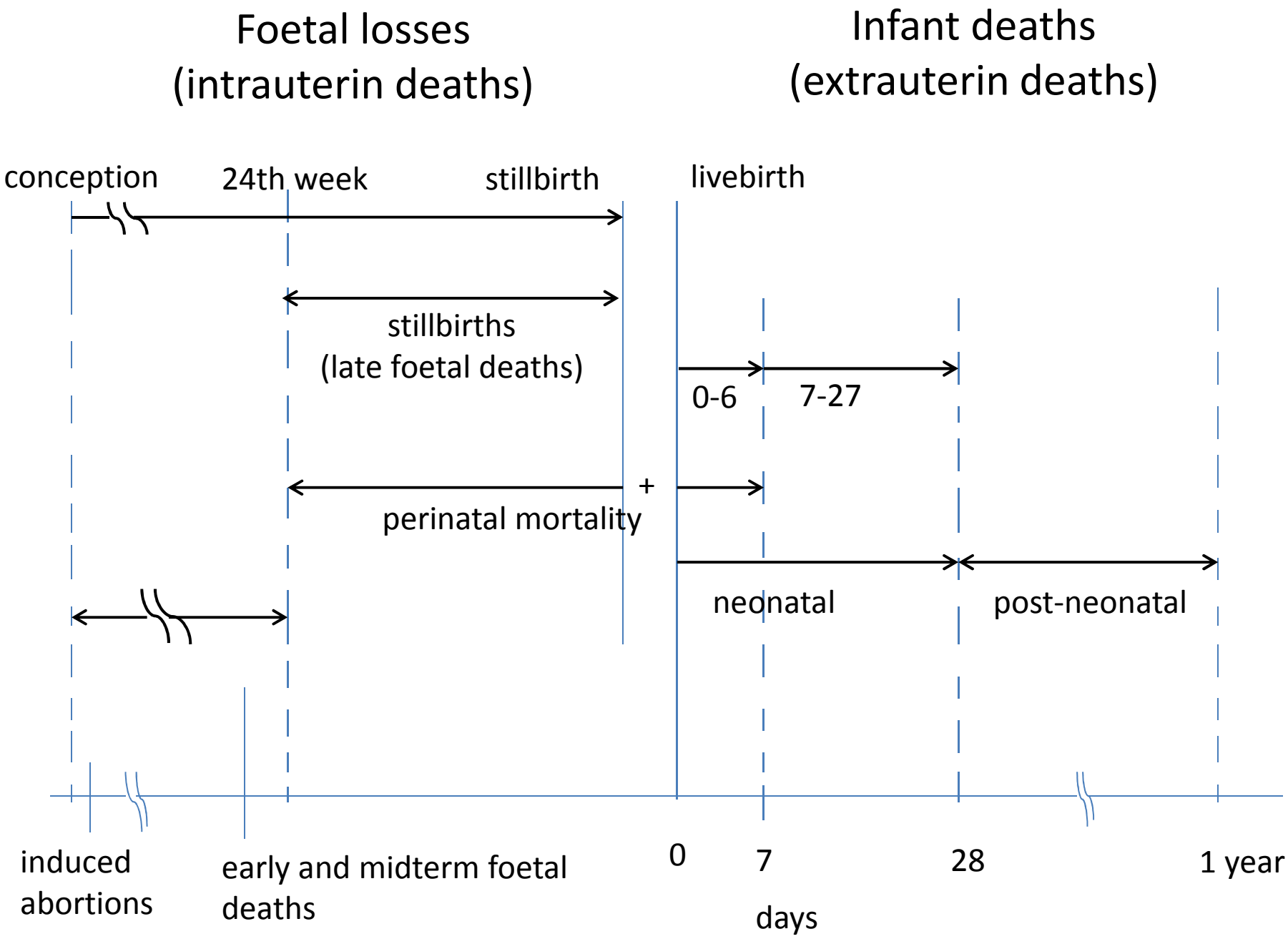
Megjegyzés: A Betegségek Nemzetközi Osztályozása X. Revíziója szerint. 1964-ben a májbetegségek csak a májzsugorodás adatait tartalmazzák.
Az európai népesség kormegoszlására standardizált arányszámok.

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.


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

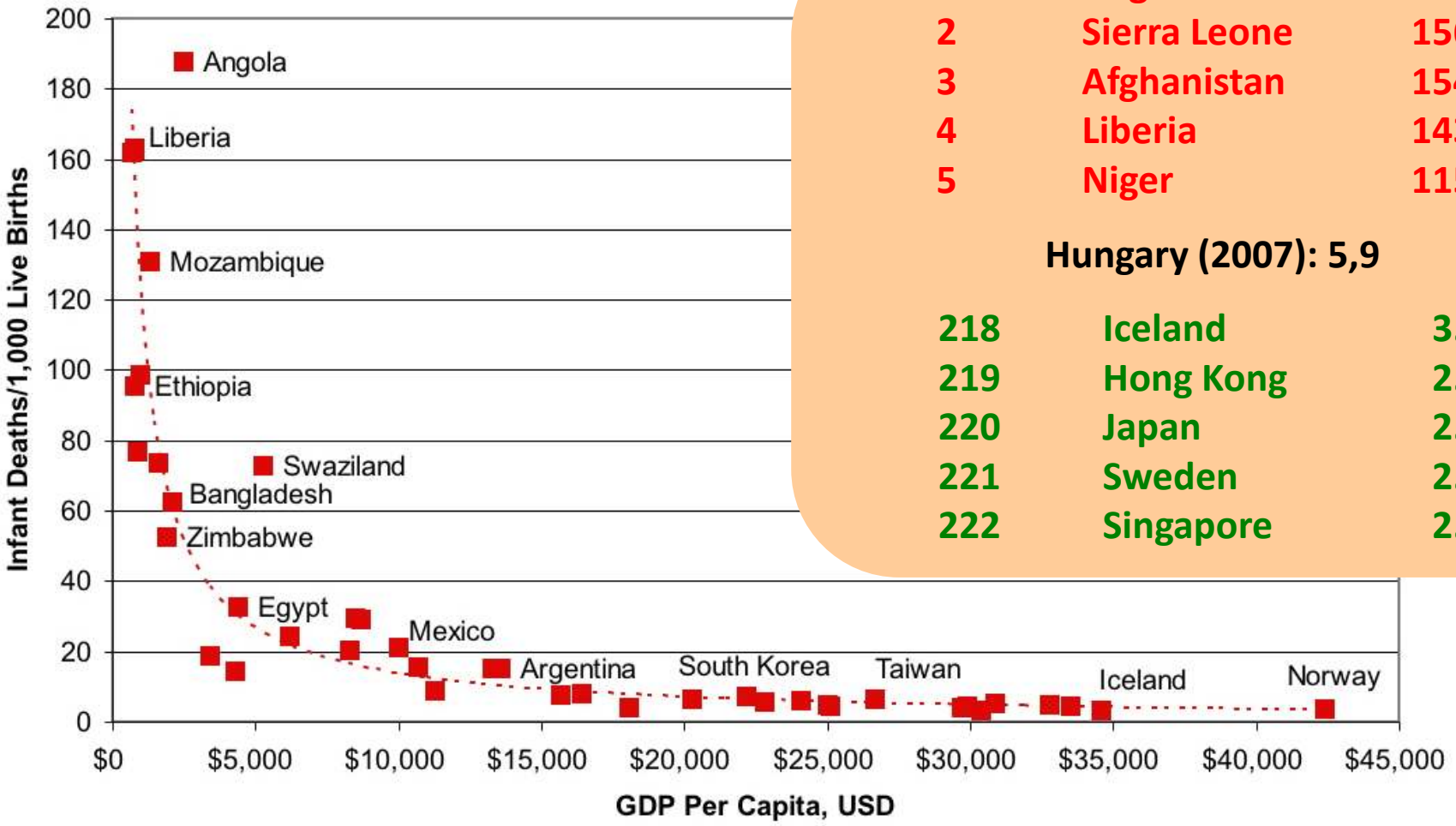
Infant mortality rate (IMR): sometimes decomposed into neonatal mortality rates (deaths of live born infants during the first 4 weeks) and post-neonatal mortality (from 4 to 52 weeks)

$$\text{IMR} = \frac{number\ of\ deaths\ to\ infants\ ages{<}1\ year\ in\ year\ x}{number\ of\ life\ births\ in\ year\ x} \times 1000$$

Perinatal mortality rate: measures late foetal deaths (stillbirths) and early neonatal deaths relative to live births. Stillbirths used to refer to deaths of foetuses of 28 or more weeks' gestation, however an earlier threshold of 24 weeks is now more generally used.

$$\text{PMR} = \frac{stillbirths + deaths\ under\ 1\ week}{stillbirths + live\ births} \times 1000$$

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

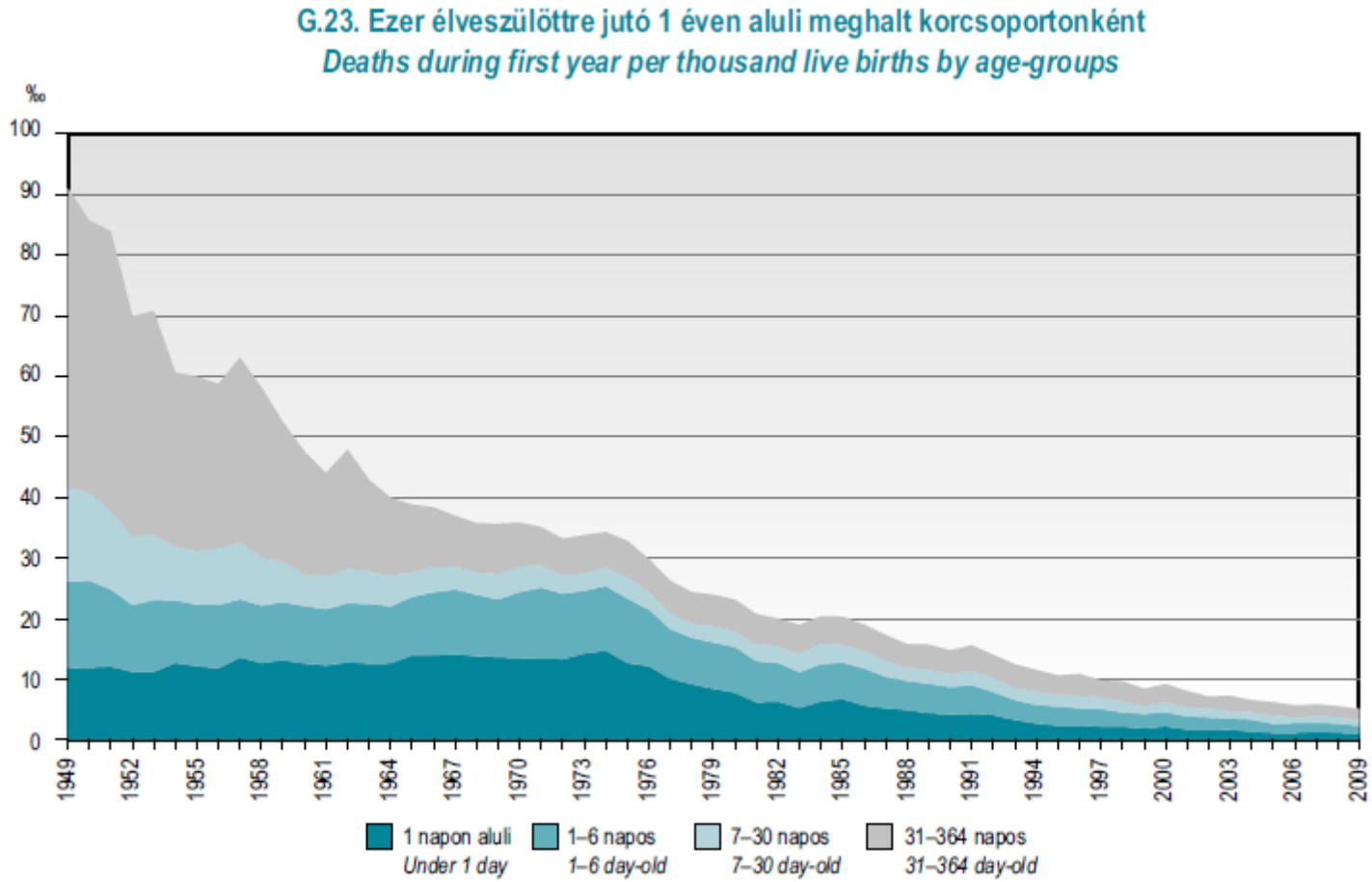
218	Iceland	3.25
219	Hong Kong	2.93
220	Japan	2.80
221	Sweden	2.75
222	Singapore	2.30

Infant mortality rate

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

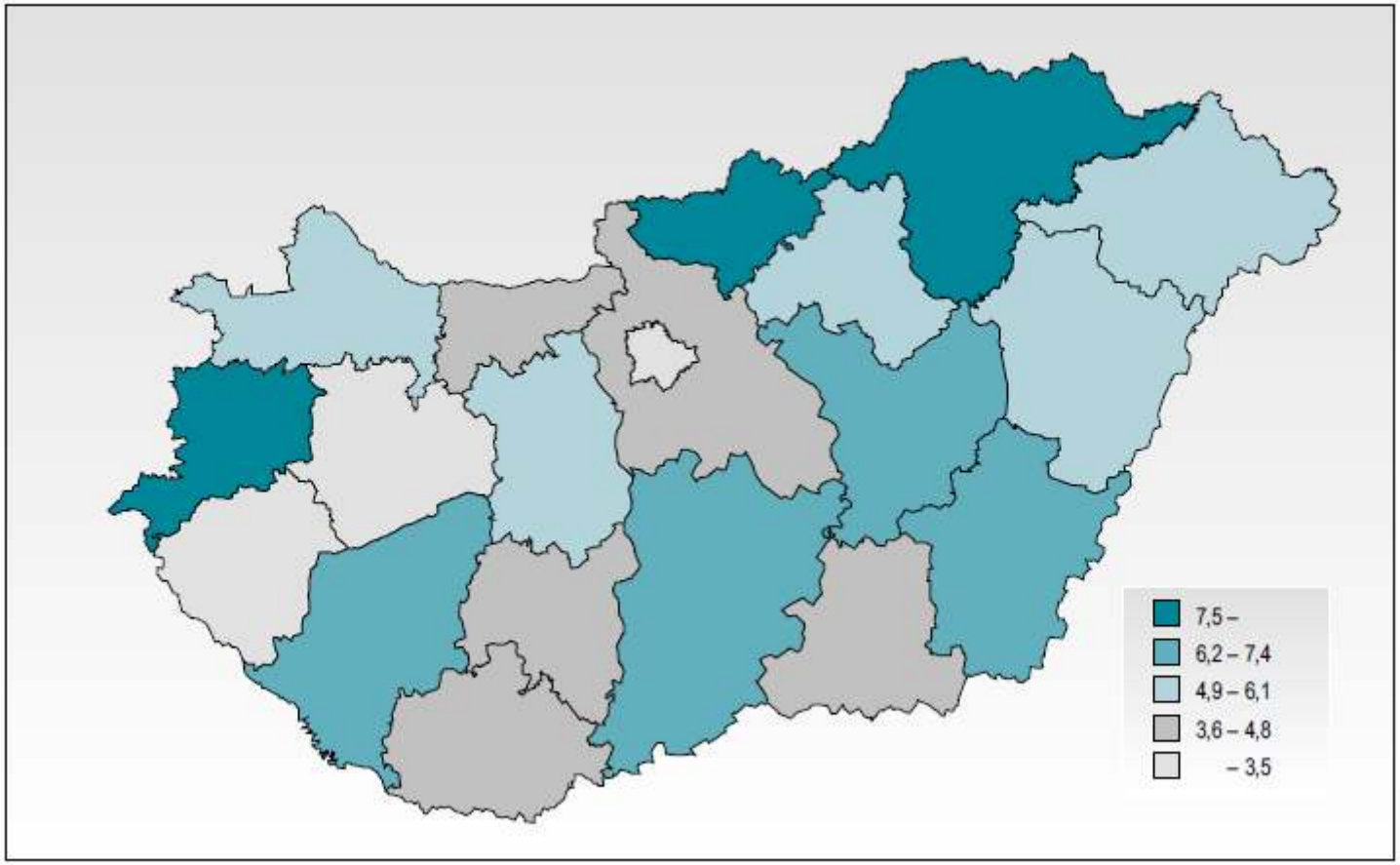
- *Post-neonatal (from day 28 – to 1 year)*

Infant mortality rate



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



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

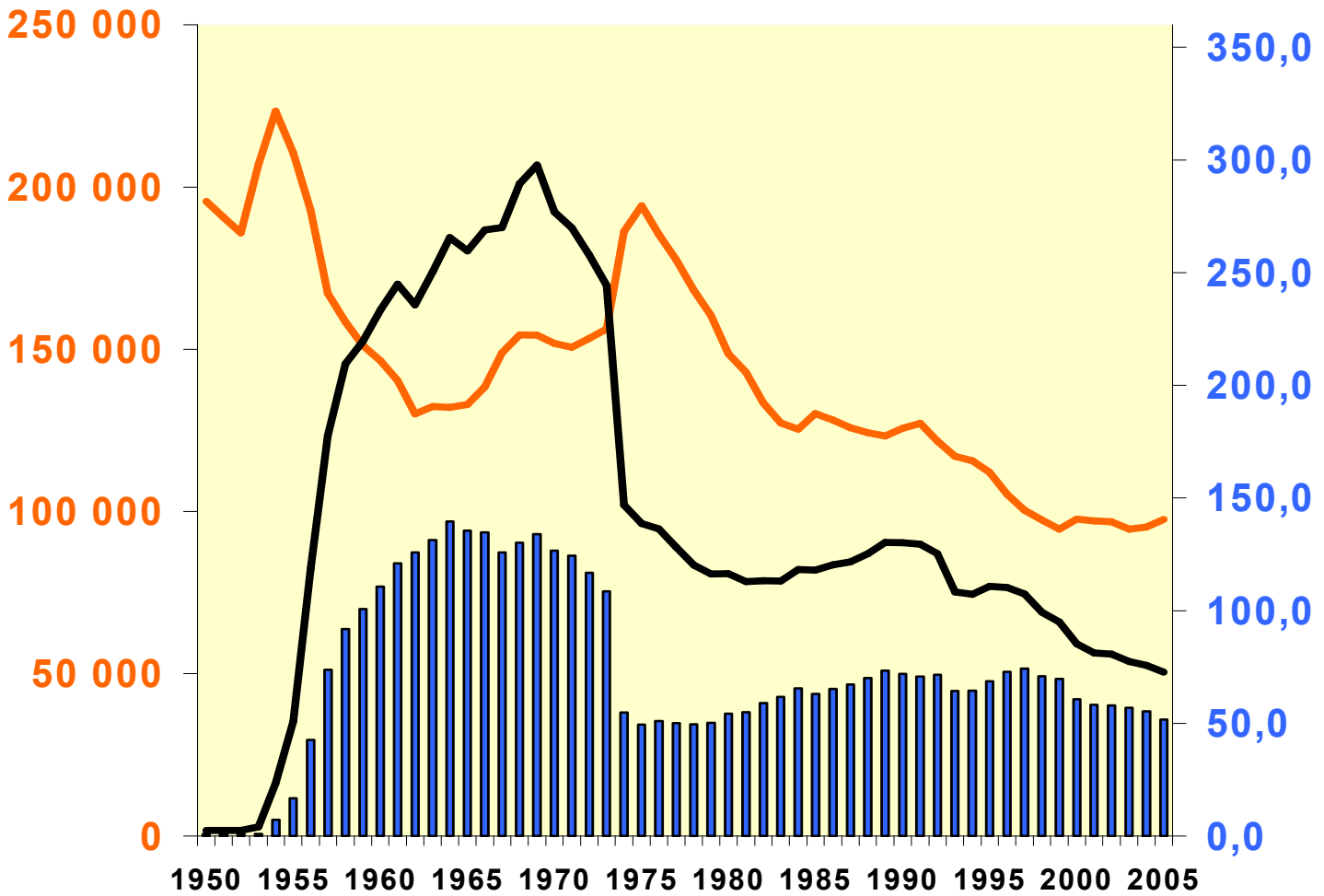
Number of conceptions: number of live births(96442)+
number of foetal losses(61066) = 157508

61,2 %

Number of deaths: 130414

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

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

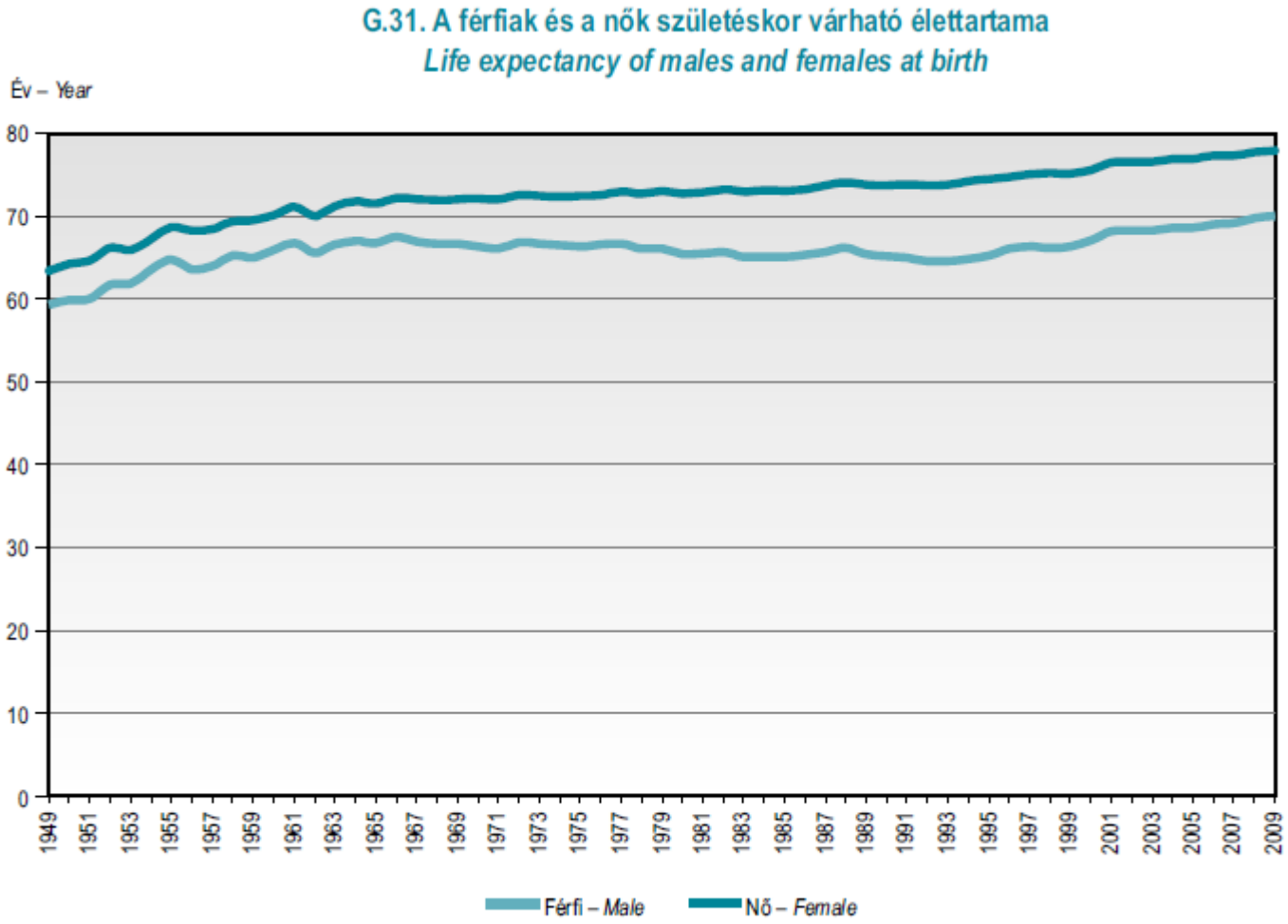
Life expectancy

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.

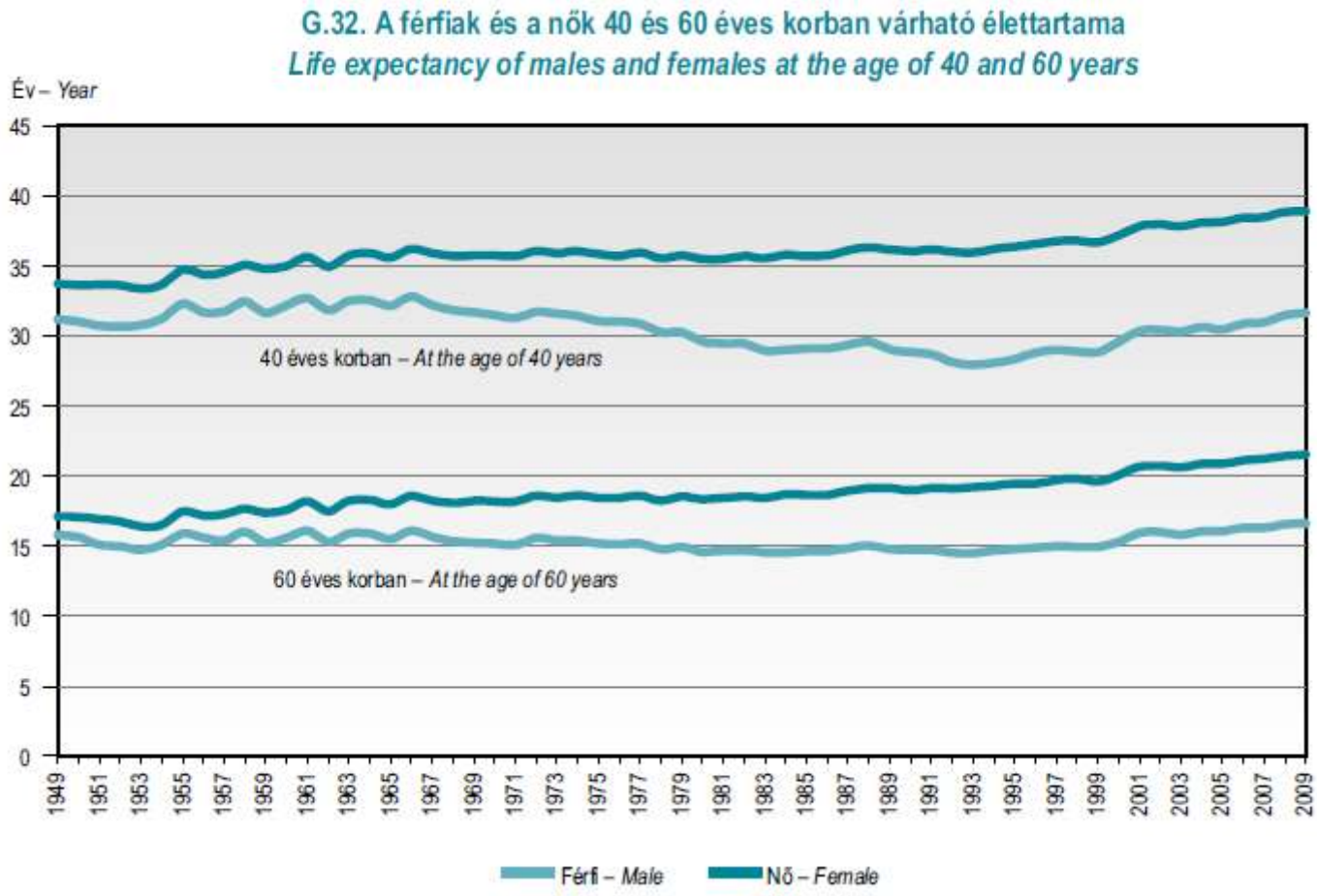
Life expectancy at birth:
Average number of years a newborn is expected to live if current mortality structure persists.

Life expectancy is a hypothetical measure and indicator of current health and mortality conditions.

Life expectancy



Life expectancy



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

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: