Chapter 4

Demography and Reproductive Health

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4.1. Basics of Demography

Demography is a part of the social sciences concerning objectively measurable mass phenomena of the human population. Demography does not encompass medical conditions at a community level. The relevant science in this regard is → the Epidemiology (see chapter 2). Ethnography is also concerning human populations but it is using phenomena in qualitative terms of whichever communities.

Topics of demography are

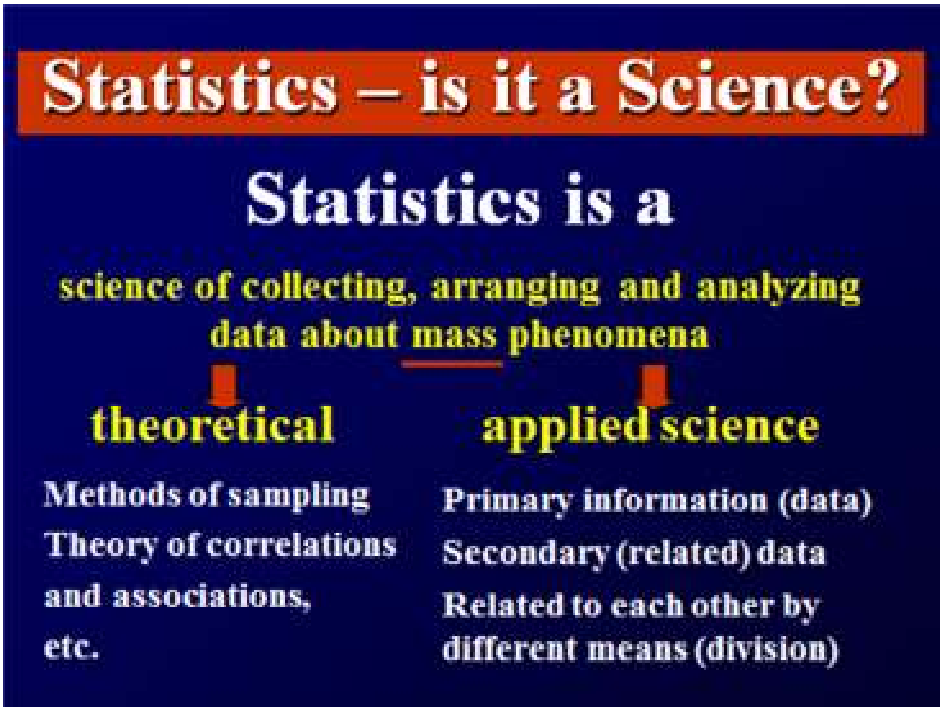
1) structure of the population by age and sex
2) reproduction (natality, fertility, mortality, demographic transition)
3) migration (internal residential mobility and international migration)
4) marriage
5) divorce

Marriage and divorce are primarily social phenomena thus only topics 1)-3) are linked immediately to the health sciences.

Demography in health sciences means

- structure by age and sex of the population an
- dynamic changes of the population by birth, death and migration

Demography and Statistics



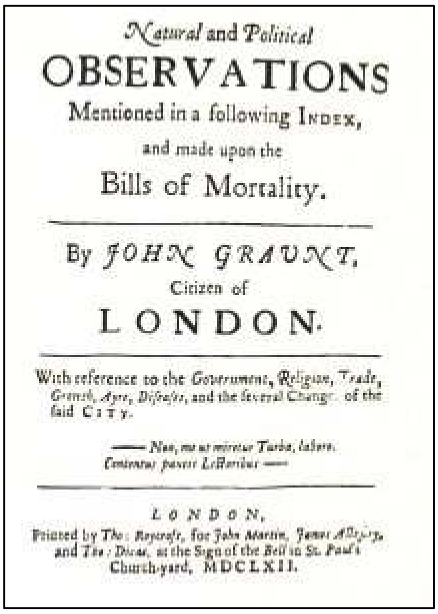
Demography is collecting, arranging and analyzing data about mass phenomena thus it is using the methods of statistics. These methods, as parts of the applied statistics are present in all social, natural and physical sciences.

Statistics as a science in itself is

1) a theoretical science (e.g. sampling strategy, theory of associations)
2) an applied science
    a. collecting data = primary information
    b. processing primary information and producing secondary data

History of statistics

Origin of the modern statistics goes back to John Graunt's (1620-1674) publication of *Natural and Political Observations upon the Bills of Mortality* in 1663 (more about the author: http://en.wikipedia.org/wiki/John_Graunt).
Graunt developed early human statistical methods collecting data about death cases in London. Thus the birth of the modern statistics goes back on primary demographic data. Therefore, Graunt is considered the first modern scientist also of the demography. Based on these data, he created the first secondary data as a life table for probabilities of survival in different age groups.
Additionally, Graunt's work provided the first scientific (statistically based) estimation of the population of London.
From the onset of the Industrial Revolution, in the late 1700s, the first applications of statistical data aimed to support policy of states' administration on economic development. However, statistics in its infancy and later on too was also misused by political parties. Statistics was coupled with deception and desinformation.


Natural and *Political*
OBSERVATIONS
Mentioned in a following INDEX,
and made upon the
Bills of Mortality.

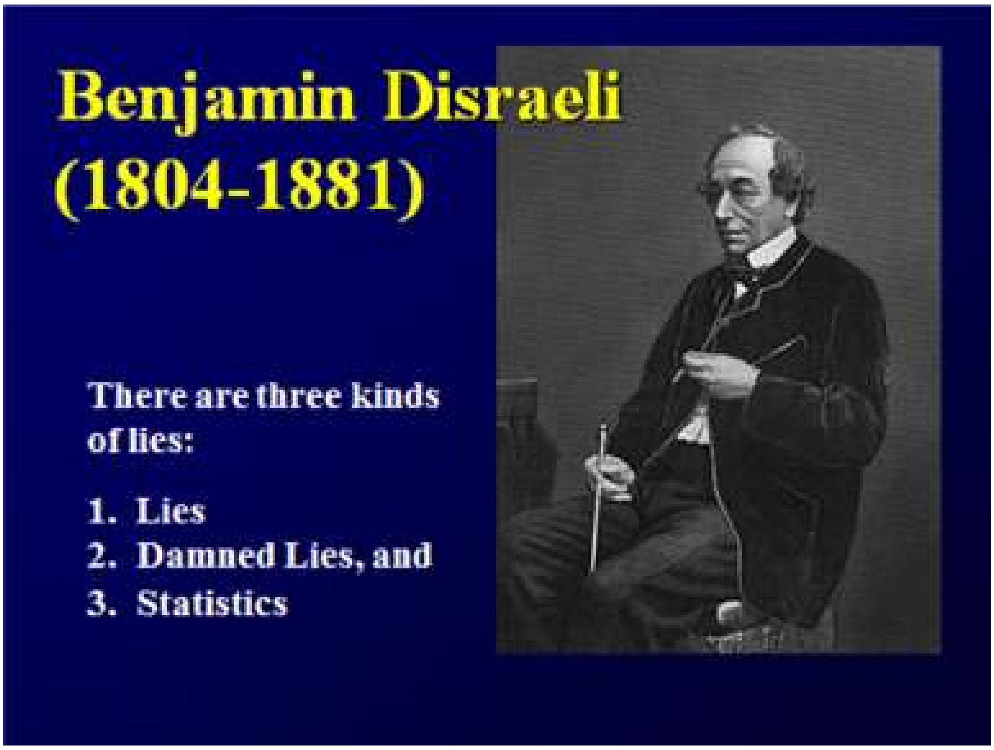
By *JOHN GRAUNT*,
Citizen of
LONDON.

With reference to the *Government*, *Religion*, *Trade*, *Growth*, *Ayre*, *Diseases*, and the several Changes of the said CITY.

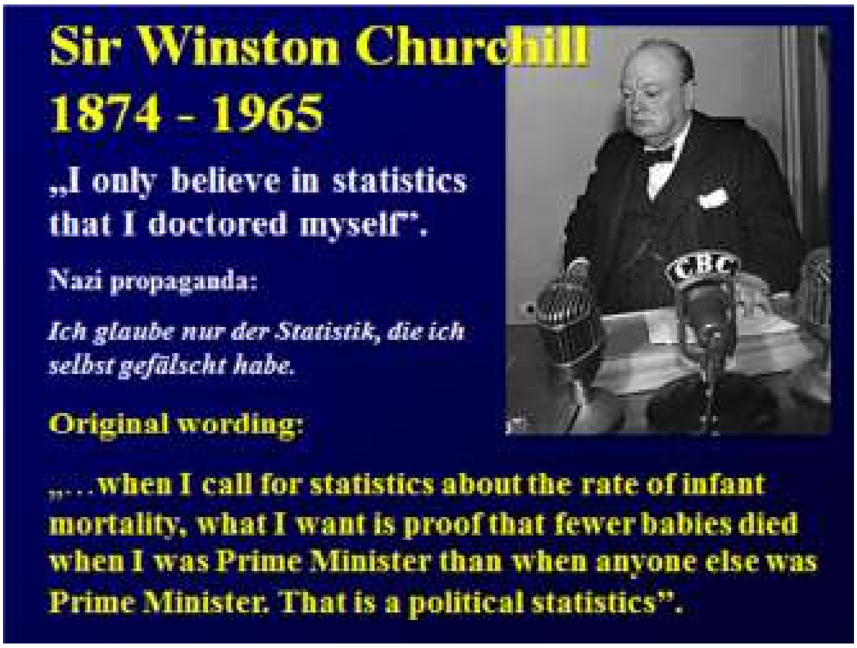
—— *Non, me ut miretur Turba, laboro, Contentus paucis Lectoribus* ——

LONDON,
Printed by *Tho: Roycroft*, for *John Martin*, *James Allestry*, and *Tho: Dicas*, at the Sign of the *Bell* in *St. Paul's* Church-yard, MDCLXII.

The most typical saying in this regard is attributed to the Prime Minister Benjamin Disraeli (in office 1774-1880) of the United Kingdom.
(http://en.wikipedia.org/wiki/Benjamin_Disraeli)



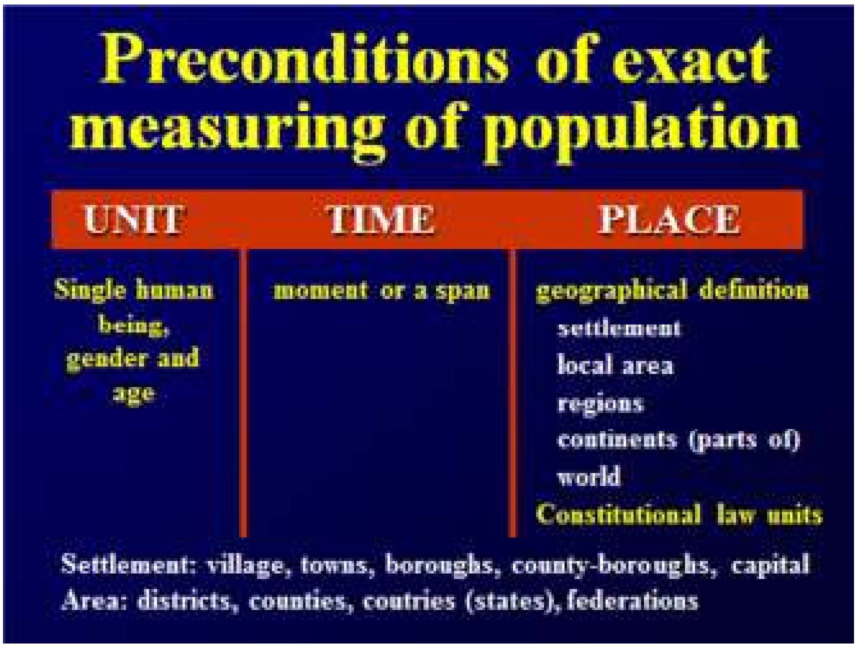
The most popular saying is attributed to Winston Churchill, Prime Minister of the United Kingdom (two times in office: 1940-1945 and 1951-1955). However, the original wording was manipulated by the Nazi propaganda during the World War 2.



Determinants of primary demographic data

In order to identify exactly the statistical data, there are three basic criteria:

1) statistical unit = a single human being
2) temporal criteria
   a. moment (specific day)
   b. span or length of time (week, month, year, decade, century)
3) spatial criteria, place as a constitutional law or geographical unit



Creating processed data

Primary (or raw) data are always original produced by demographic investigation. Reliability of these data should be positive because they had to be systematically collected.

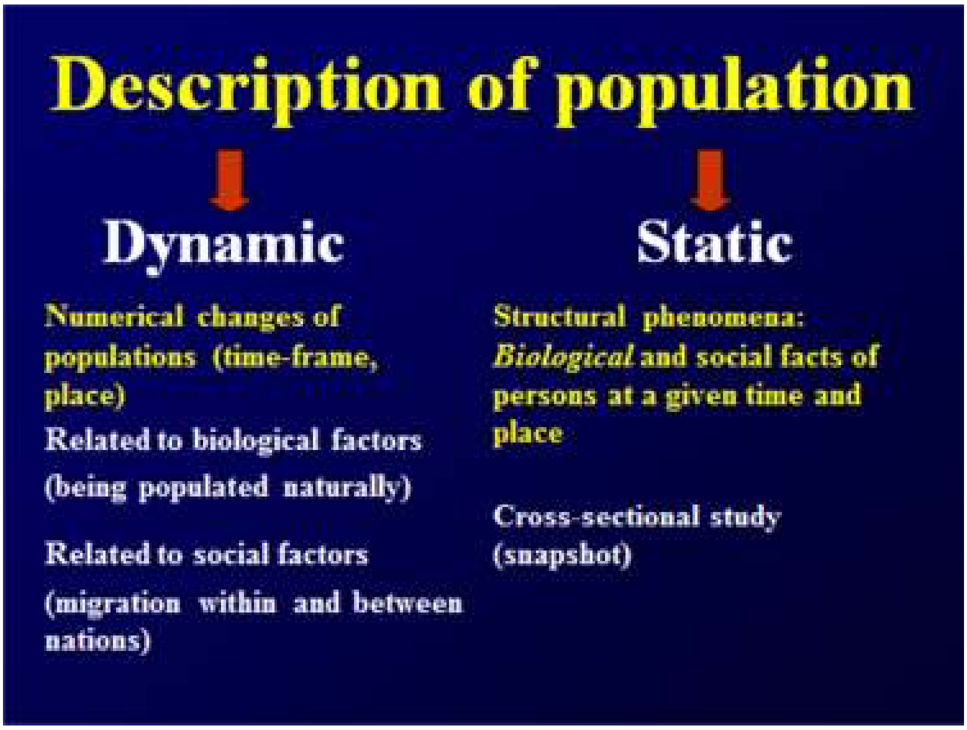
Processed data are created by relating primary data to each other (typically by division). The simplest processed data used typically in demography are

- Ratios = primary data of different quality divided by each other. E.g. number of women divided by the number of men.
- Proportions = primary data of the same quality are determined as part of the whole unit. E.g. age distribution of the population.

Ratios may be converted to proportions if the distinct primary data are of common qualitative nature (see below e.g. the ageing index).

4.2. Demographic structure of the population

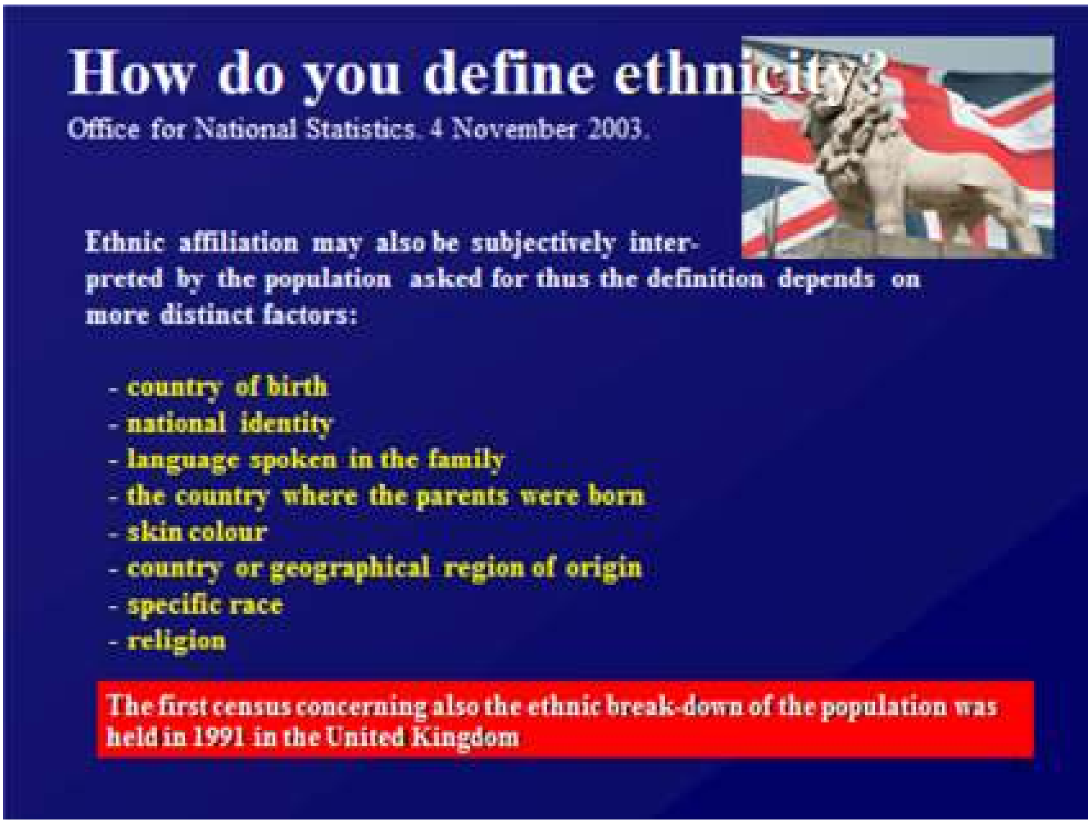
Using demography in health sciences, the structure of the population is presented by age and sex. Dynamics is related to the changing number of the population determined by the balance of birth and death cases and the migration.



Demographic structure is presented as

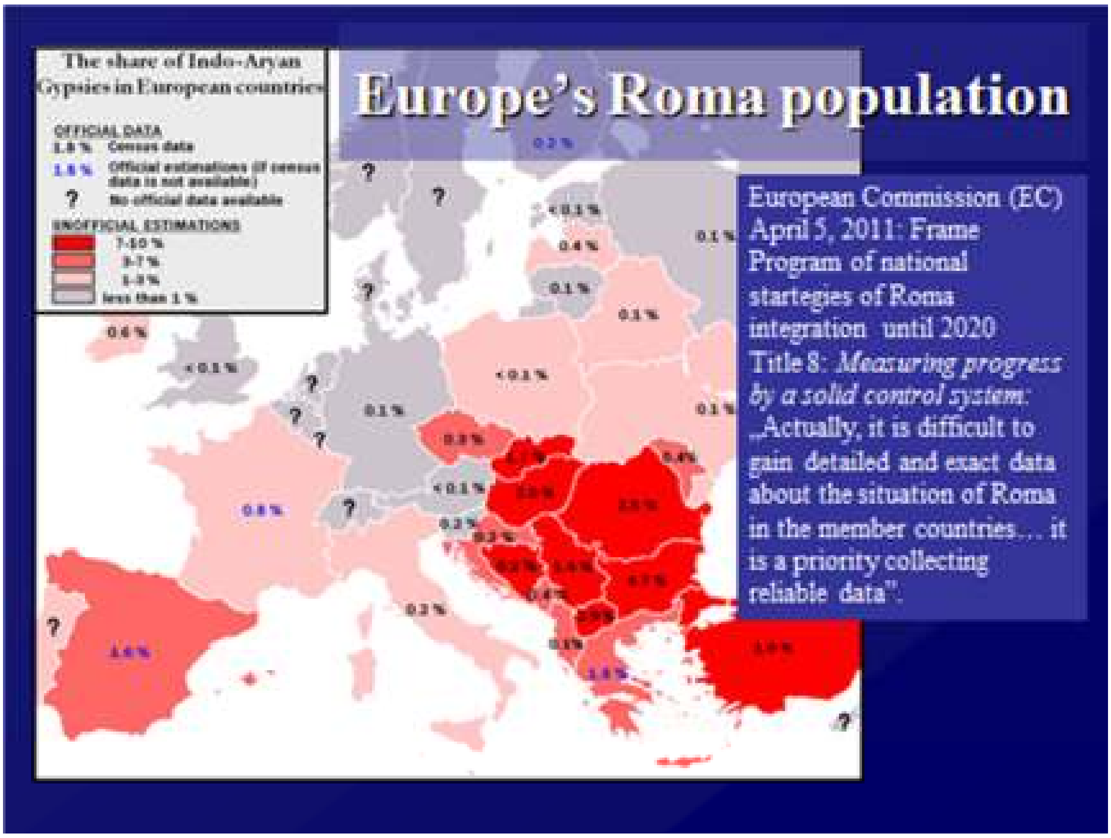
- sex distribution (females and males) and sex ratio
- population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- female population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- male population by main age-groups (0-14, 15-39, 40-59, 60-X) and mean age
- age structure of population 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, nationality) is also a part of the demographic structure. Contrasted to the USA, collecting relevant data has only a short history in Europe.
The first census concerning also the ethnic break-down of the population was held in 1991 in the United Kingdom.

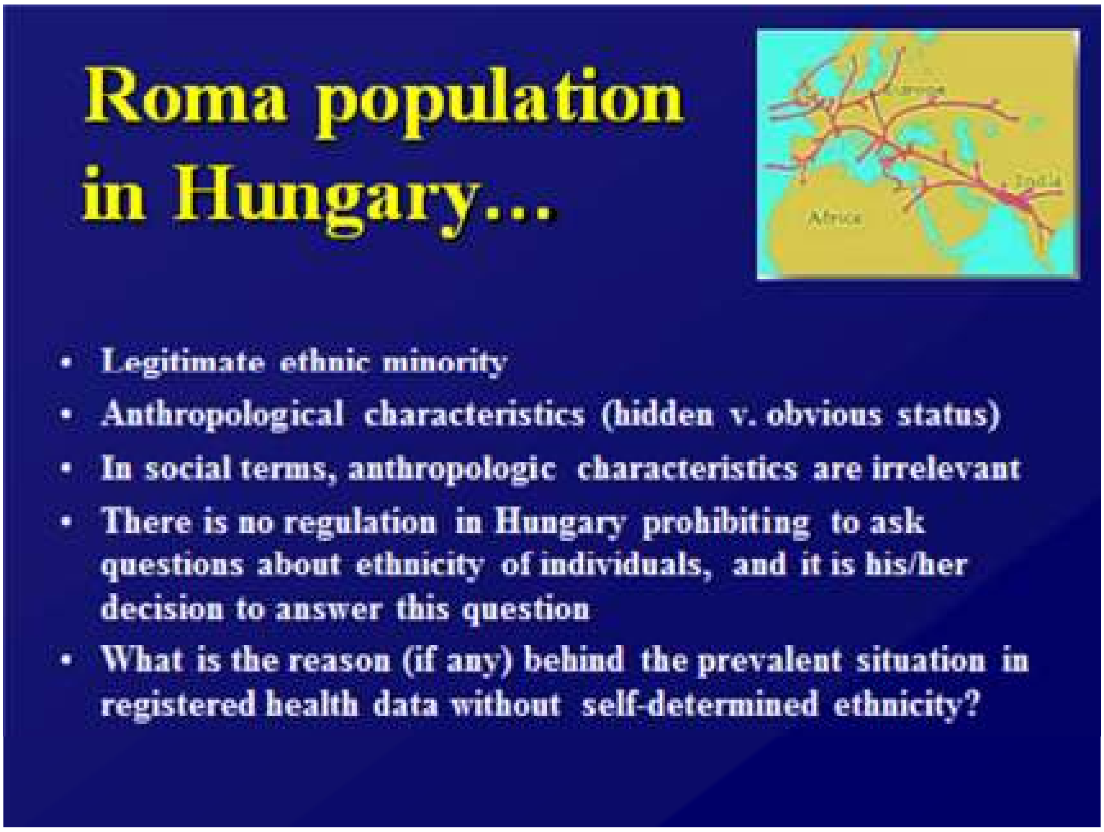


Hungary' Central Statistical Office collects data about nationality/ethnicity of the population.

Roma are Europe's greatest ethnic minority without a national state behind.



Public health concerns about the Roma population in Hungary



Data of demographic structure may be demonstrated as tables or graphs. The following table shows Hungary's sex distribution and gender ratio in a time frame from December 31, 1869 to January 1, 2011.

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

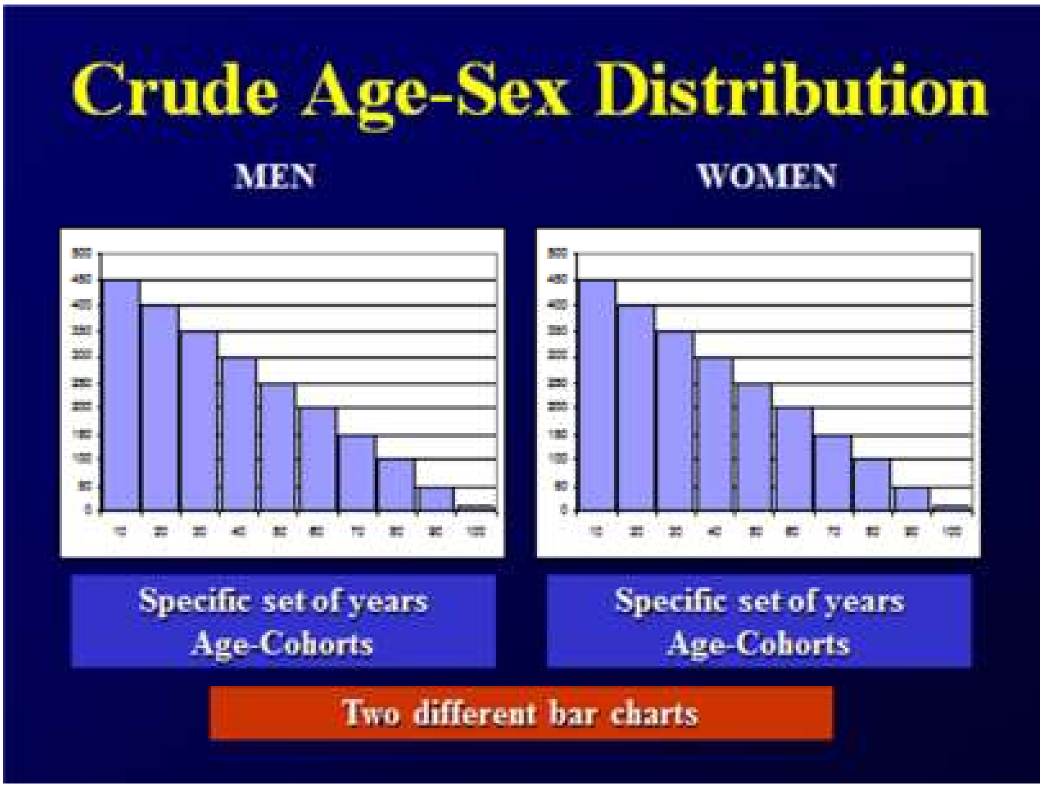
4.2.1. Age-sex pyramid is the most commonly used demonstration about the demographic structure of the society. The pyramid is a classic form of this distribution and is characteristic for the growing population.

It is a composed graph created as it follows:

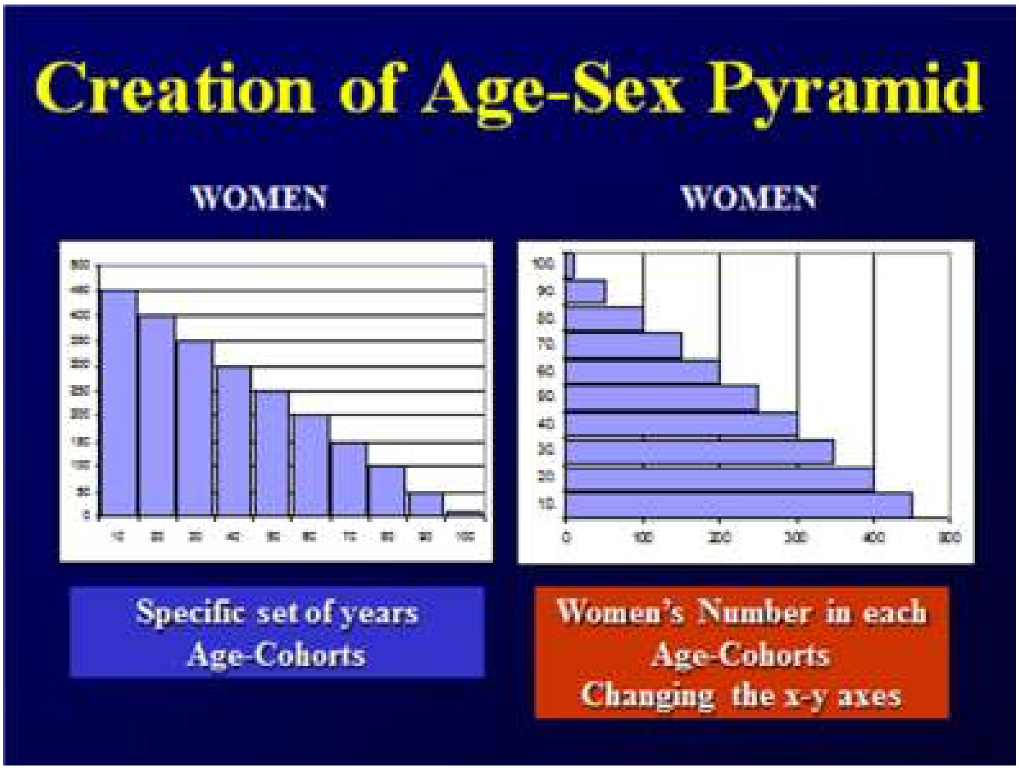
1) In the first stage two distinct bar charts have to be set up. Horizontal x-axes represent the life years of women and men alike. The basic unit of this category may be a single year or groups of more years. Vertical (value) y-axes represent the number of persons of each age group.
2) The next phase is changing the axes thus the vertical one will show the age categories.
3) The female chart remains unchanged but the male chart will be set up in reverse order along the value x-axis.

4) Finally, the two charts are united by a common category x-axis (back-to-back charts). Females are traditionally on the right males on the left side.

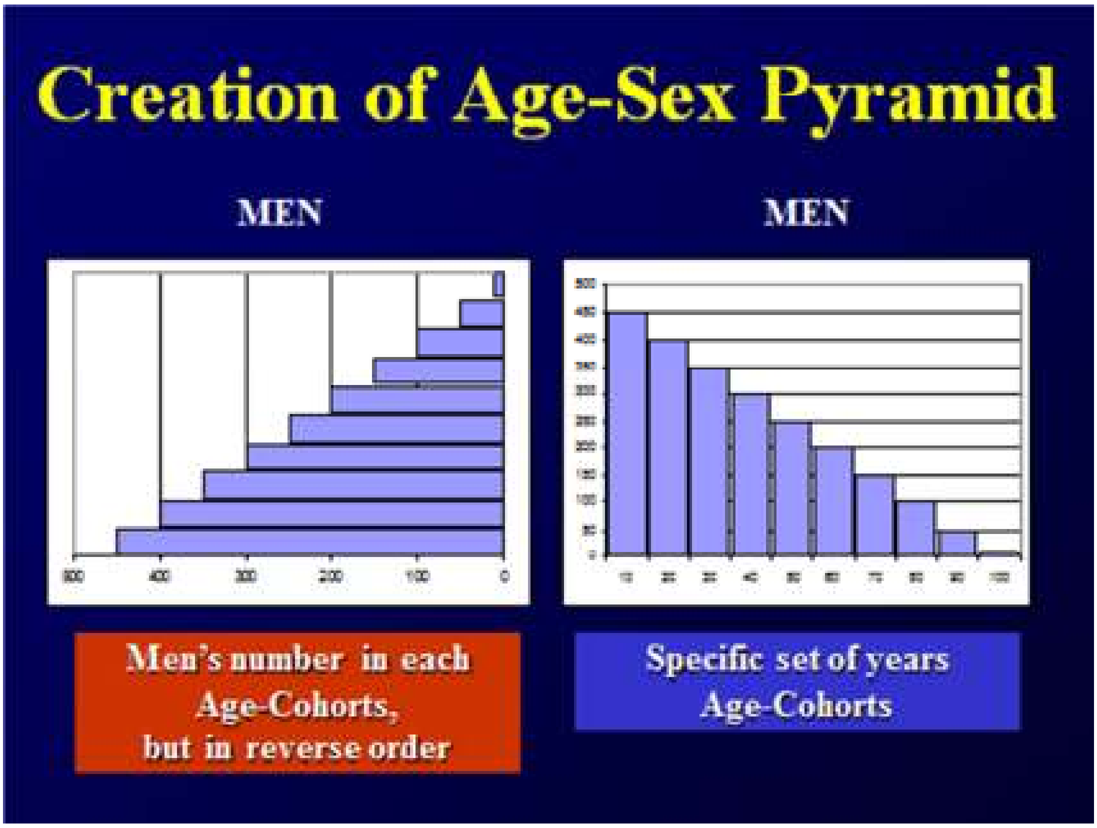
1st step: two charts in usual axis order



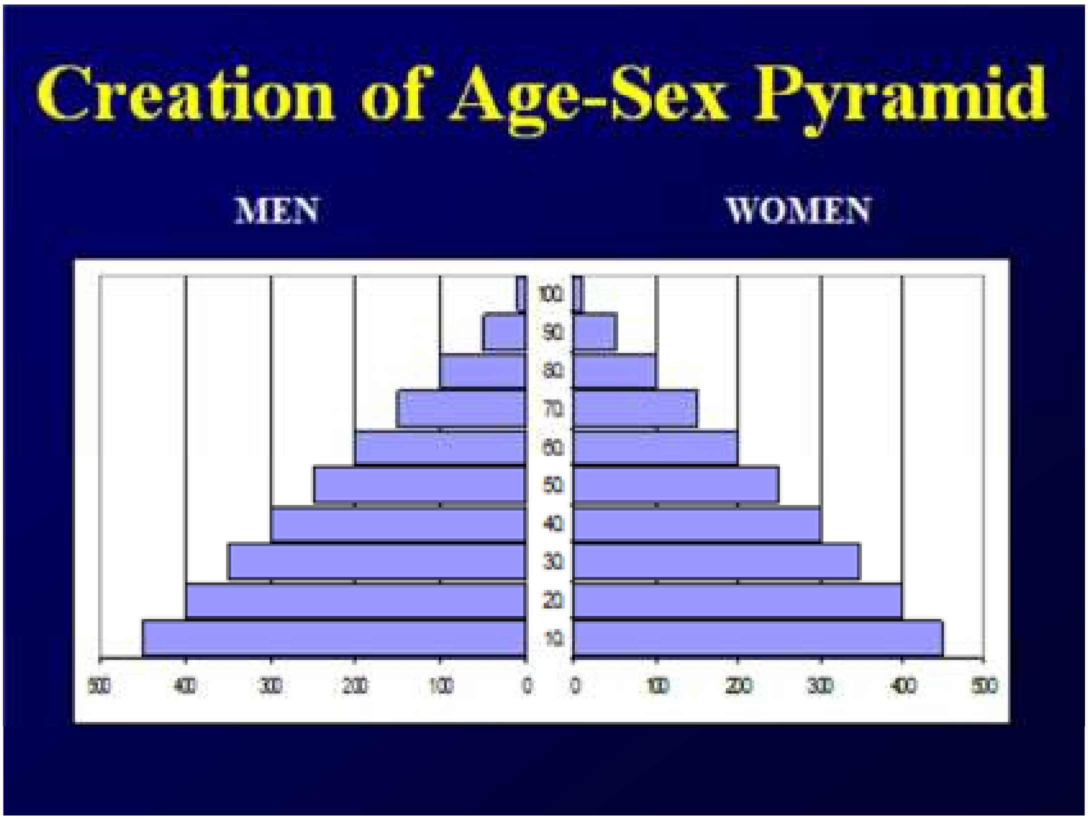
2nd step: changing the axes of the female population



3rd step: changing the axes of the male population but in reversed order



4th step: uniting the charts by a common category x-axis.

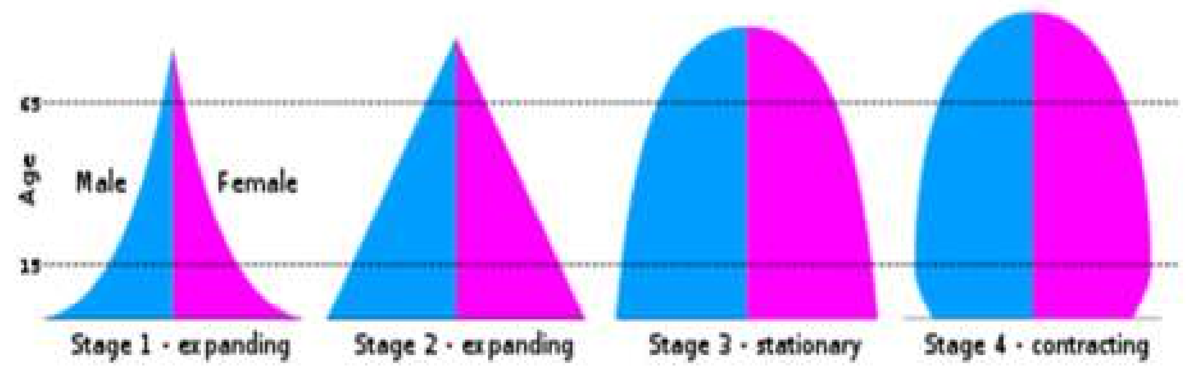


Types of age-sex pyramid

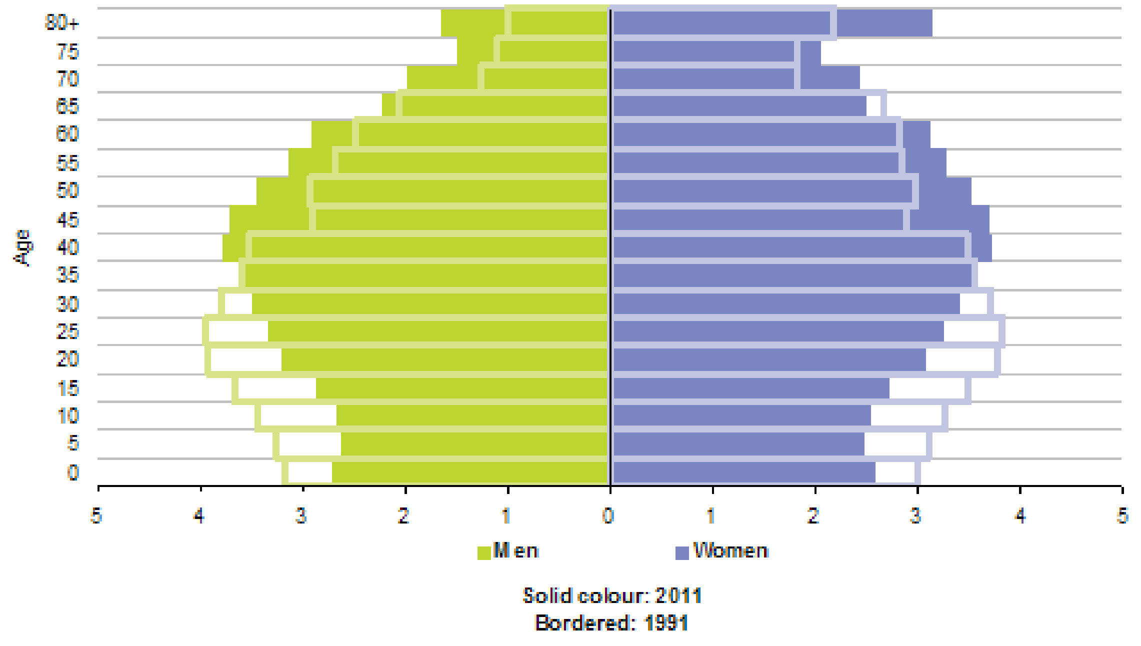
The classic type of the age-sex pyramid shows the age-sex distribution of a continuously growing population.

As a result of the ageing population (see below) four general types have been identified:

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)



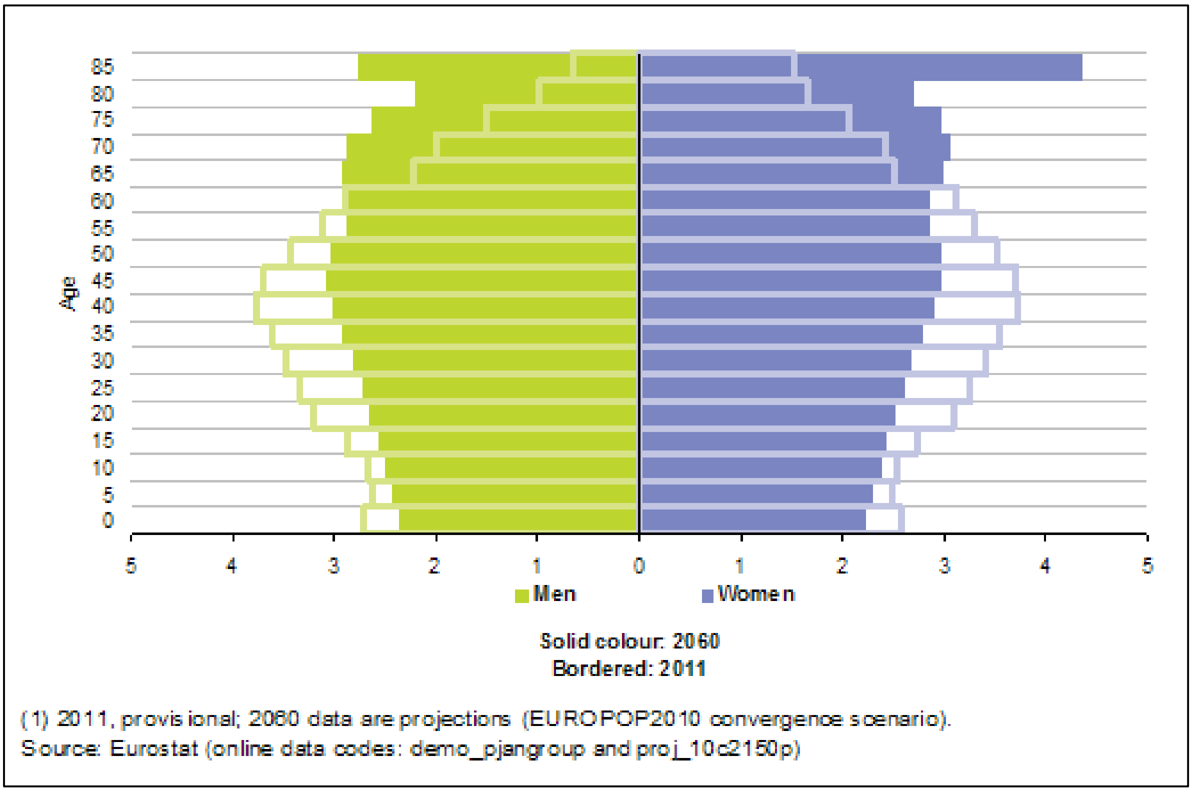
Age-sex pyramid of the EU-27 countries: changes between 1991 and 2011



(1) 2011, provisional.

Source: Eurostat (online data code: demo_pjangroup)

Projected changes 2011-2060 of the EU-27 countries



4.2.2. Ageing of population

This definition indicates the 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 as a demographic phenomenon indicates how much percentage represent the persons ≥ 60 life years if the persons ≤ 14 life years are considered as 100 percent in a given population.

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

While combining the ageing index with socio-economic considerations, the aging of population is often measured by a cutoff value of 65 life years. This age is typical for old age retirement as a part of burdening social security systems in the industrialized nations.

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

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

$0 \leq 14$ years	1,441,842
15-64 years	6,835,357
65 + years	1,680,532
total	9,957,731

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

Dependency ratio is a combined demographic index showing the relationship of socio-economically dependent and independent population.

- Total dependency ratio = the number of persons ≤ 14 years plus ≥ 65 years divided by the number of persons 15 to 64 years
- Youth dependency ratio = the number of persons 0-14 years divided by persons 15- 64 years
- Old age dependency ratio = the number of persons ≥ 65 years divided by persons 15 to 64 years

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

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

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

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

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

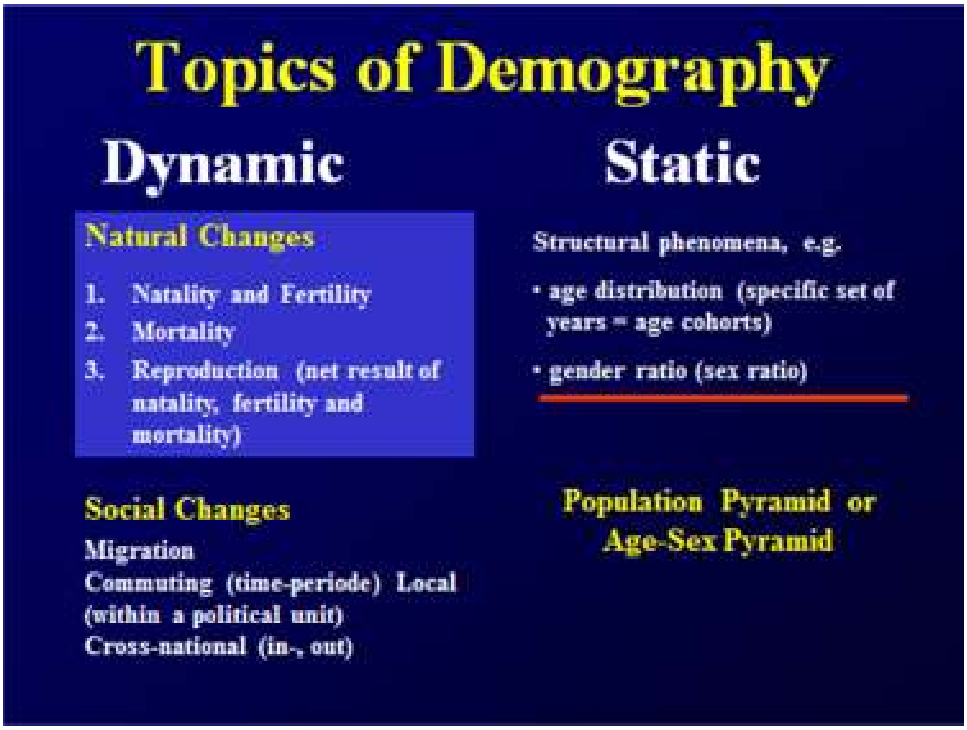
$$Old\ age\ dependency\ ratio = \frac{1{,}680{,}532}{6{,}835{,}357} \times 100 = 24.6\%$$

4.3. Human reproduction

Over the last 25 years, the global population has increased by two billion, thus surpassed the 7 billion mark in late 2011. Beyond this global number, there are unprecedented diversities in demographic situations across countries and regions, as well as within countries. There are two driving forces behind these evolving demographic changes

1) bio-social phenomena
    a. birth = natality if related to neonates, fertility if related to mothers
    b. death = mortality (in scientific terms)
2) social phenomena (internal and international migration)

Population dynamics



4.3.1. Natality

In demographic sense, natality is a relationship of births to the whole population.

Birth in itself has three different meanings:
1) event of being born (related to the neonate)
2) act or process of bearing (related to the mother)
3) medical event (delivery of the fetus)

Birth *(by WHO definition 1950)* ***as a natality event*** means live birth (contrasted to the still-birth) 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
1) Singleton: one offspring produced in the same gestation period
2) Multiple: two or more offspring produced in the same gestation period
3) Preterm: birth of an infant before 37 completed weeks (259 days) of gestation
4) Low weight: the infant's weight is <2500 gram

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.

$$Birth\ rate = \frac{\text{N of live births}}{\text{Midyear population}} \times 1000$$

Mid-year population (at July 1) is also referred to as the mean population. July 1 is assumed to be the point at which half of the changes in the population during the year have occurred.

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

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

It is a basic rule in demography that 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.

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:

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

4.3.2. 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.

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

Example-country's GFR:

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

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.

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

Example-country's fertility rate

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

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

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

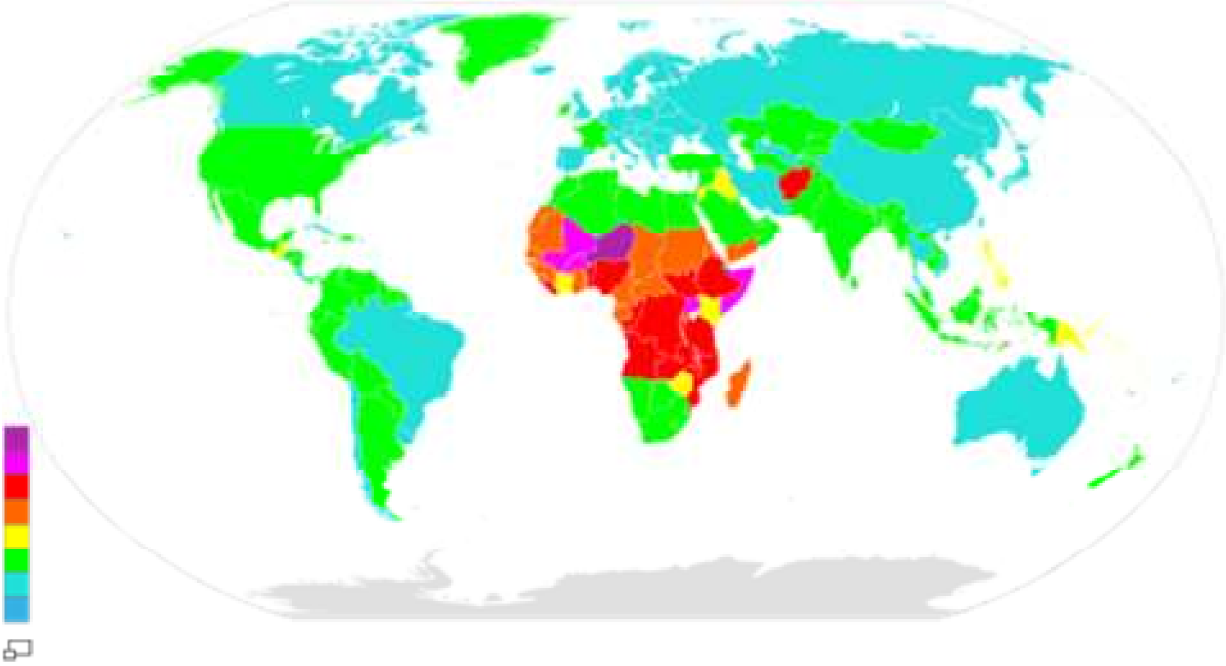
The TFR is the most widely used fertility measure because it provides an easily understandable measure of completed fertility. However, this measure is hypothetical because it is derived from age specific fertility rates of a given year. It means that women of reproductive age at any given time in the future could have completed family sizes considerably different from that computed by a current TFR. In other words, real number of children/women can rise or fall in the future.

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

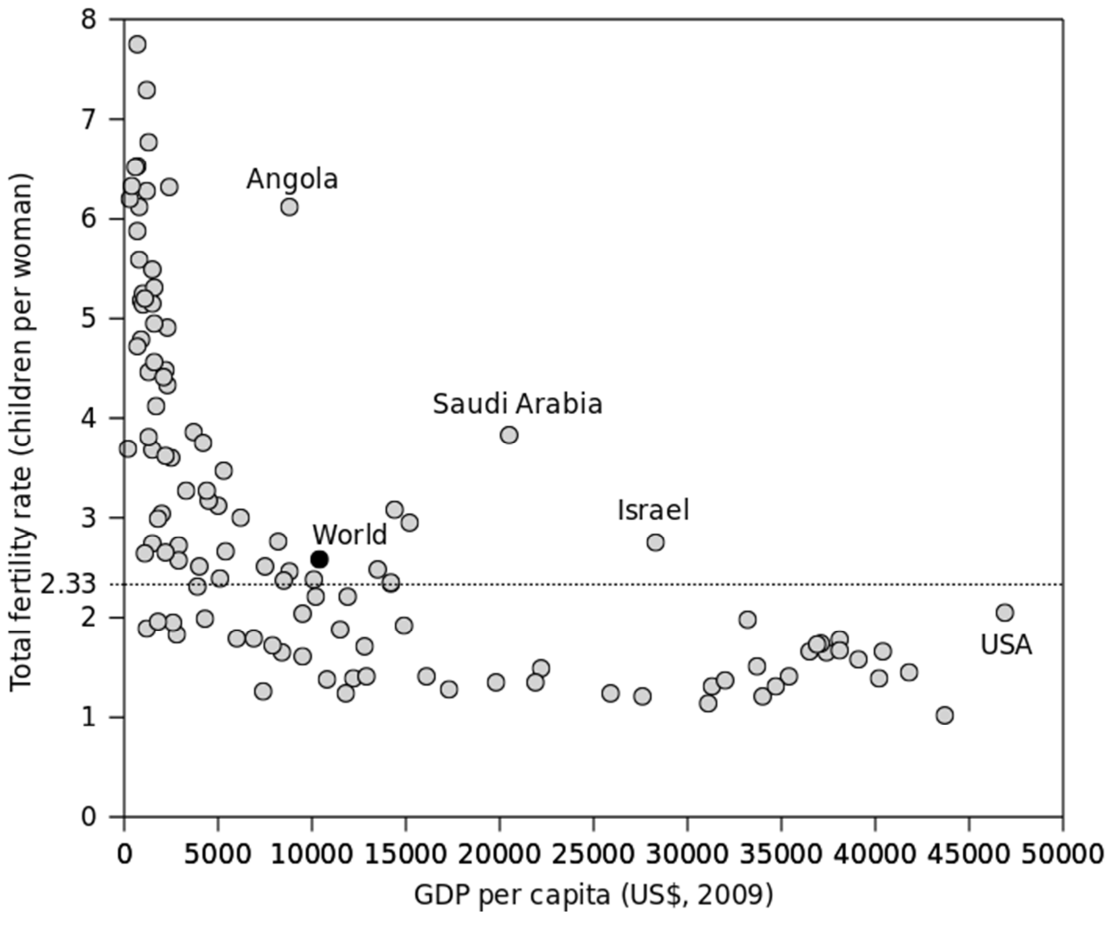
TFR less than 2 means decreasing number of the population

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.

TFR versus GDP per capita of countries with over 5 million inhabitants (2009).
The model shows a regression analysis for two variables. Independent variable is the GDP per capita value, dependent variable is the TFR of countries at specific GDP values.



4.3.3. Mortality

Mortality is a relationship of death cases to the whole population. In demographic sense, death is the irreversible end of human life with cessation of all biological functions.
There are two basic types of mortality:

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

Death rate (or mortality rate) is the number of death cases in a year per 1000 of the population. This rate depends clearly on the age distribution of the given population. In other words, if the age distributions of two populations are very different, general mortality rate will also be very different irrespective of the same socioeconomic and health conditions. Therefore, the general mortality rate, named as **crude mortality rate (CMR)** cannot be used in temporary and spatial comparisons. For comparison the CMR has to be standardized (see below).

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

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

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

Age adjusted mortality rate named also as standard mortality rate (SMR).
Standardization in the broadest sense of the definition is a statistical technique that gives different units of measurement a common base for comparison. 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.
To understand the technique of standardization (age adjustment) let us assume City A and City B with the same amount of population, but extremely different in age distribution. CMR in City A is 9.5 per thousand, in City B 16.5 per thousand.

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		33	
2000		2000	
CMR = 9.5 ‰		**CMR = 16.5 ‰**	

Let us take City A as a standard base for City B. In city B die 3 persons in every 500 aged 0-50 years and 10 persons in every 500 aged 51 or more years. If these proportions are transferred to City A the SMR for City B will be 9.5 per thousand thus there is no difference in standard terms between the two cities.
The procedure is the same when comparing the CMRs of the 28 European Union (EU) member countries. Standard base may be a specific country or the entire population of the EU. It is necessary to notice that SMRs are always fictitious values, but only available for comparison. SMRs may have temporal or spatial dimensions. For example

1) Hungary's yearly SMR values from 1900 to 2000.
2) SMR values of the EU member countries in 2012.

4.3.3.1. 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 (see below 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.

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

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:

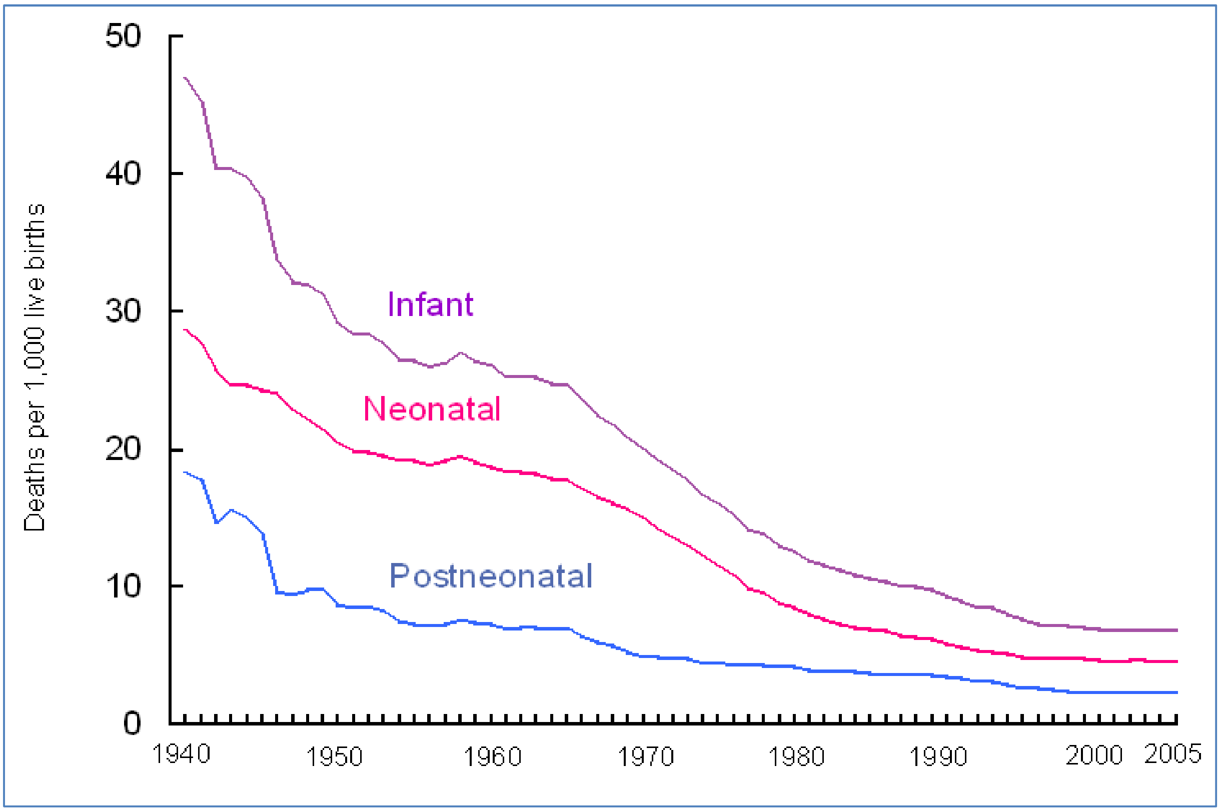
$$CMR_{Males\ 40-49\,years} = \frac{\text{N of death cases of the cohort}}{\text{Midyear population of the cohort}} \times 1000$$

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.

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

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 sub-groups and often used as an indicator of the level of health in a country.

Infant, neonatal, and postneonatal mortality rates: United States, 1940-2005



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: there are different approaches. The WHO defines perinatal mortality as the number of stillbirths and deaths in the first week of life per 1,000 live births, after 24 weeks gestation. It is a comprehensive definition of perinatal (within the first 24 hours) and postnatal (within the first week) mortality.
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:

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

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:

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

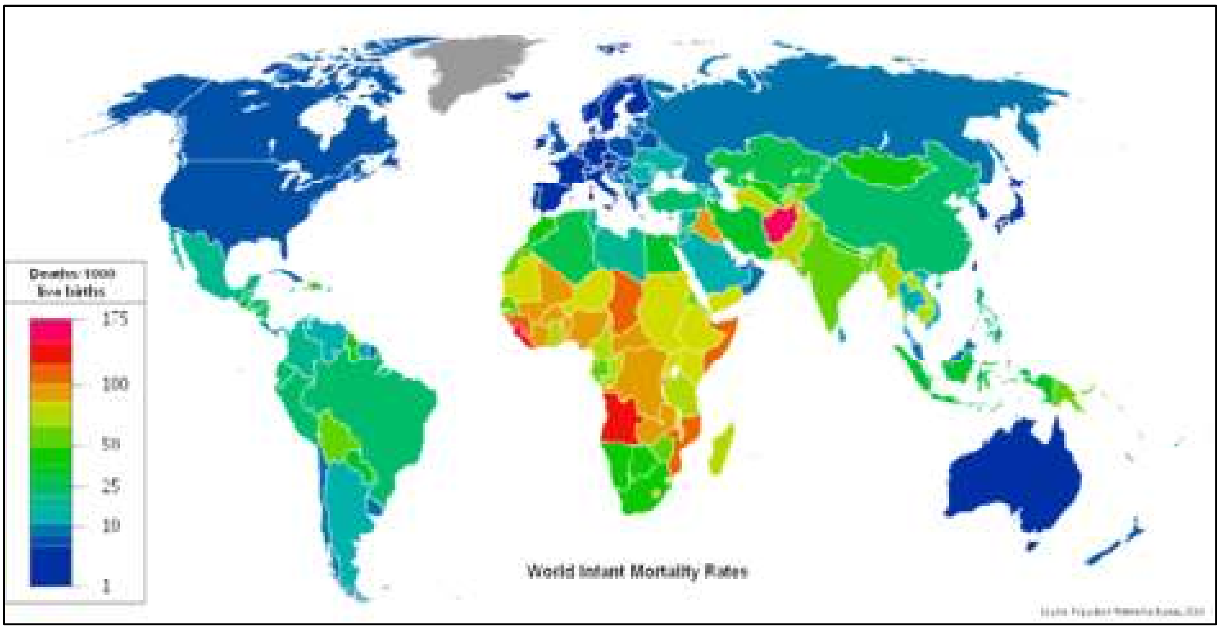
Postneonatal mortality rate:

$$Postneonatal\ Mortality\ Rate\ = \frac{\text{N of infants died in the days } 7 - 365}{\text{N of infants born in a given year}} \times 1000$$

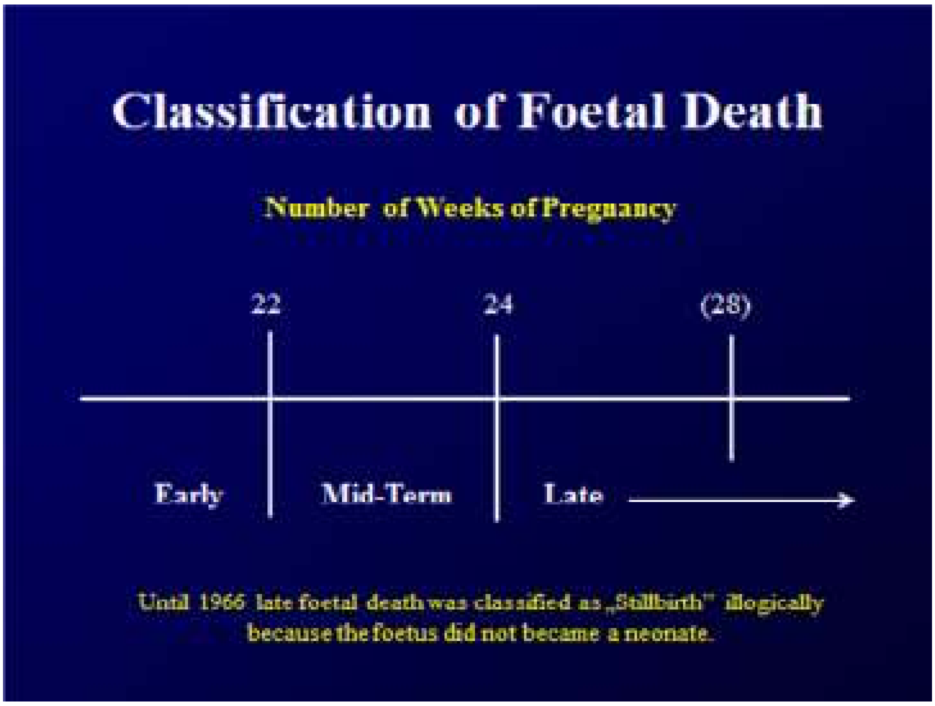
Hungary’s postnatal mortality rate was 1.6 in 2011, which means that more than 1 infant died out of 1,000 within the days 7-365 of his/her life:

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

World map of infant mortality rates in 2008



Foetal loss is defined as a total sum of 1) foetal death cases and 2) 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:

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

Foetal death related to the fertile female population:

$$Foetal\ death\ rate\ = \frac{\text{N of foetal death cases}}{\text{N of ferile female population}} \times 1000$$

Hungary's relevant data in 2011:

$$Foetal\ death\ rate\ = \frac{17{,}220}{2{,}387{,}763} \times 1000 = 7.2$$

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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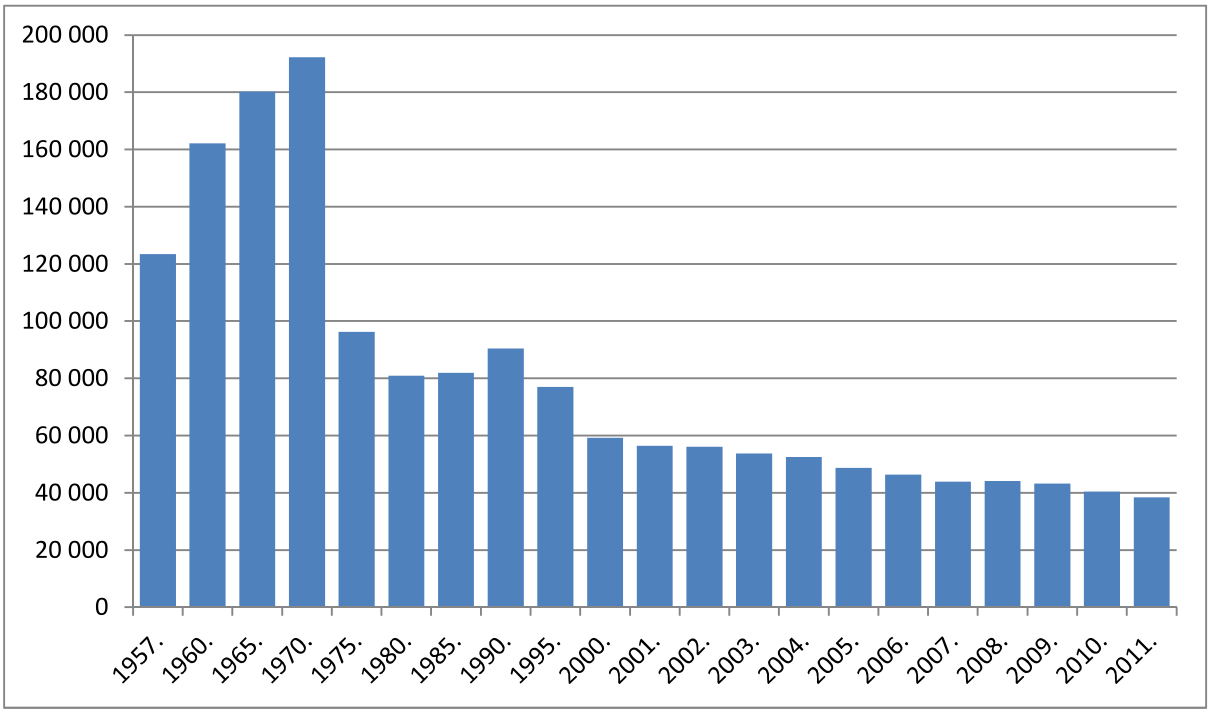
In Hungary, induced abortion is legally permitted since June 1957. The number of abortion increased extremely 1957-1970, and there is a decreasing trend since the mid1970s.



The number of abortion in a year may be related to women in fertile ages (15-49) or to live born babies.

$$Abortion\ rate\ of\ fertile\ women\ = \frac{\text{N of abortions}}{\text{N of ferile female population}} \times 1000$$

$$Abortion\ rate\ of\ liveborn\ infants\ = \frac{\text{N of abortions}}{\text{N of infants born in a given year}} \times 100$$

Hungary's relevant data in 2011:

$$Abortion\ rate\ of\ fertile\ women\ = \frac{38{,}443}{2{,}387{,}763} \times 1000 = 16.1$$

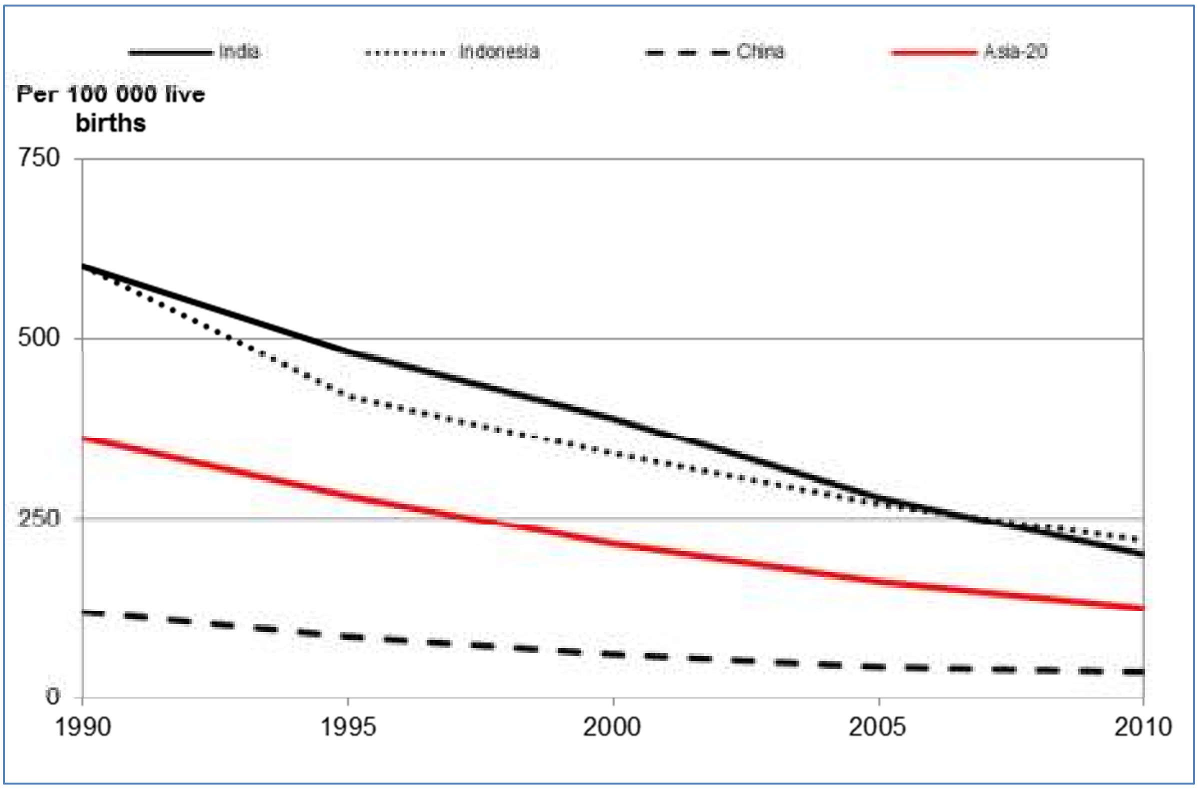
$$Abortion\ rate\ of\ liveborn\ infants\ = \frac{38{,}443}{88{,}049} \times 100 = 43.7\ \%$$

Maternal mortality is a special case of sex-related mortality. According to the WHO definition, it represents death cases of women who die during pregnancy and childbirth inclusive the first 42 days after the delivery. The number per year is relatively small (pre-eminently in the developed countries), thus maternal mortality rate is computed per 100,000 live births.

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

Maternal mortality ratio averages around 11/100,000 in the developed counries.

Estimated number of maternal death rates in India, China and Indonesia and an average of 20 Asian countries 1990-2010



4.3.3.2. Diagnosis related mortality

Causes of death are all those diseases, morbid conditions or injuries which either resulted in or contributed to death, and the circumstances of the accident or violence which produced any such injuries. Detailed data about this mortality are processed in health statistics and epidemiology. Demography is concerning only the main types of diseases, motor vehicle accidents and suicide (homicide).

People die mainly of diseases. In Hungary, total number of dead was 128,795 in 2011 and only 742 persons died of road accidents and 2,422 of suicides.

4.3.3.3. ***Life expectancy*** contrasted to its name is a mortality indicator that means the expected average number of life years when persons at a given age will die. Computing life expectancy is based on life- or actuarial-tables of a given year. These tables show the distribution of population by life years (cohorts) and the death cases in every cohort.

Assuming that the actual mortality rate would not change by time, we can say how many people die and will step up in the actual subsequent cohort down to end of their life. Summing up the years that deceased people lived in every cohort the outcome will be number of years that all the people lived in all their life. Starting the table at birth, this number divided by the number of the population results in the arithmetic mean, i.e. the years of life expectancy at birth.

The (truncated) table below shows a fictitious population of 10,000. If the infant mortality is 5.3 per 1000, it means that 53 infants die before their first birthday. Thus their contribution is 53x1=53 years to the total sum and the remaining population equals 9,947. This procedure has to be continued to the zero value of surviving people.

Life years	death rate	N. of deceased	N. of survivers	Sum of years lived
0	5,3	53	9947	53
1	0,4	4	9943	4
2	0,2	2	9941	4
3	0,1	1	9940	3
4	0,1	1	9939	4
5	0,1	1	9938	5
6	0,1	1	9937	6
7	0,1	1	9936	7
8	0,1	1	9935	8
9	0,1	1	9934	9
10	0,1	1	9933	10
11	0,1	1	9932	11
12	0,1	1	9931	12
13	0,1	1	9930	13
14	0,1	1	9929	14
15	0,3	3	9926	45
16	0,3	3	9923	48
17	0,3	3	9920	51
18	0,3	3	9917	54
19	0,3	3	9914	57
20	0,4	4	9910	80
21	0,4	4	9906	84
22	0,4	4	9902	88
23	0,4	4	9898	92
24	0,4	4	9894	96
25	0,5	5	9889	125
26	0,5	5	9884	130
27	0,5	5	9879	135
28	0,5	5	9874	140
29	0,5	5	9869	145
30	0,8	8	9861	240

It is important to stress that life expectancy is a fictitious indicator not only because of the assumption above. Every cohort had different experiences in its earlier life that might have influenced its mortality rate in a given year. In other words, we cannot say how different will be the mortality rates if compared to one another in the future.

Life expectancy at birth is the typically used indicator that shows the number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Because of the gender difference, it is calculated also separately for men and women.

The table shows 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	80.6	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	79.8	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	83.8	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)

Based on existing data, in 2011 the best total value had Spain (82.5) the worst one had Lithuania (73.8) in the EU. If separated by genders, the best value for men had Sweden (79.9) and the worst one Lithuania (68.1) for women Spain (85.4) and Bulgaria (77.8) respectively.
Hungary had an average of 75.1 with 71.2 for men and 78.7 for women.

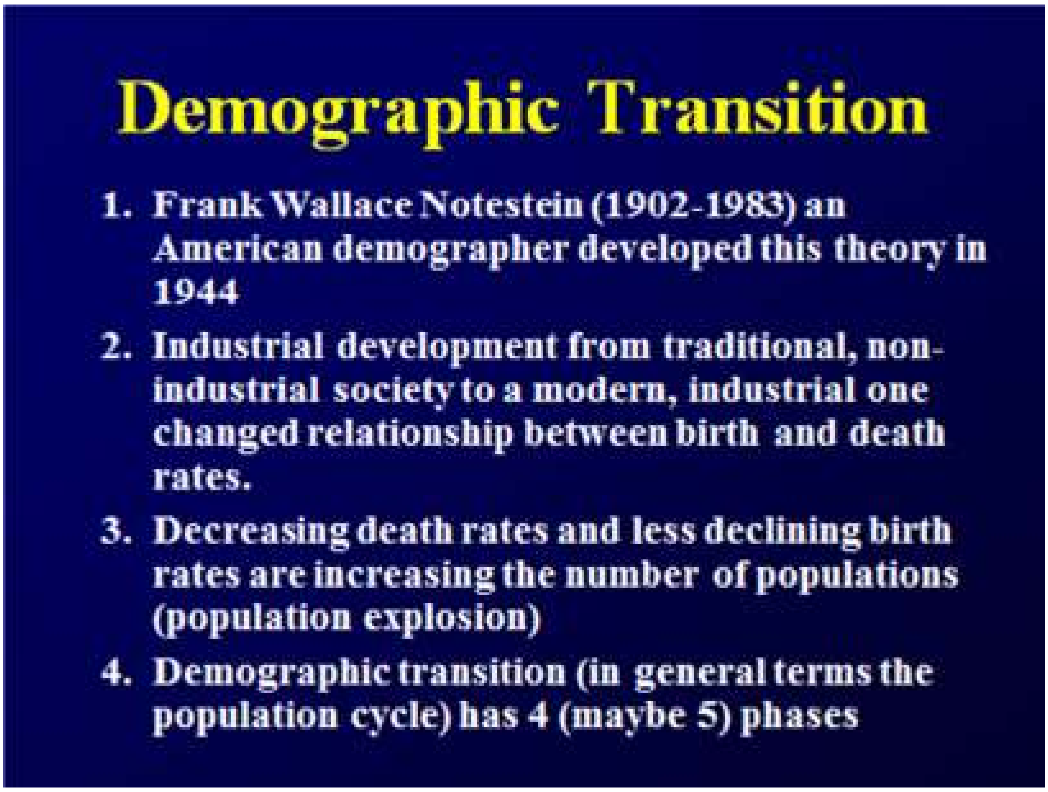
4.3.4. Demographic transition

Based on documented history of men (maximum 5,000 years) and except the last 300 years of the industrialized nations, traditional societies lived in agrarian-based economic systems. These traditional peasant economies were characterised by high death and birth rates.
The primary factor was the deaths rates fluctuating usually in response to the variations in harvests (poor diet and famine periods) and the incidence of epidemics. Additionally (from the modern point of view) there were generally primitive conditions of the sanitation and lack of preventive and curative medical and public health measures. Finally, death rates are open ended, in other words, they can result in dying out of the entire population. Birth rates in these economies were high as a functional response to high mortality. The ideals of prolific fertility have to be traced back to customs and beliefs of such societies.
Substantial changes of this high death and high birth rate model were experienced first in the last 300 years when the western type industrial revolution moved the traditional, agrarian-based economic system to a largely industrial, urbanised base. When this happened, death rates were strikingly reduced as a consequence of better and regular food supplies as well as improved sanitations (water supply, sewage systems and waste management) medical knowledge and care.

At somewhat later, birth rates also begin to fall. The decline in the birth rate follows usually after a significant time lag, as compared to the decline in death rate. This delayed response of the birth rate to economic changes comes about because death is basically a biological phenomenon, but the birth rate is a typical social response that is emerging first when changes transform the longstanding attitudes and customs prevalent in the society.
Relevant patterns of 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.
In the industrialized nations, birth rates reached very low levels already by the middle of the 1930s. This level was achieved by the widespread acceptance of contraception and developing methods of contraception "worsened" the situation since the 1950s.

4.3.4.1. Scientific model of the demographic transition

Demographers had attempted already at the beginning of the 20th century to construct a scientific model presenting the transition from high mortality and high fertility to conditions of low mortality and low fertility. However, it was Frank Wallace Notestein (1902-1983) who created the theory of demographic transition as it is accepted even today.

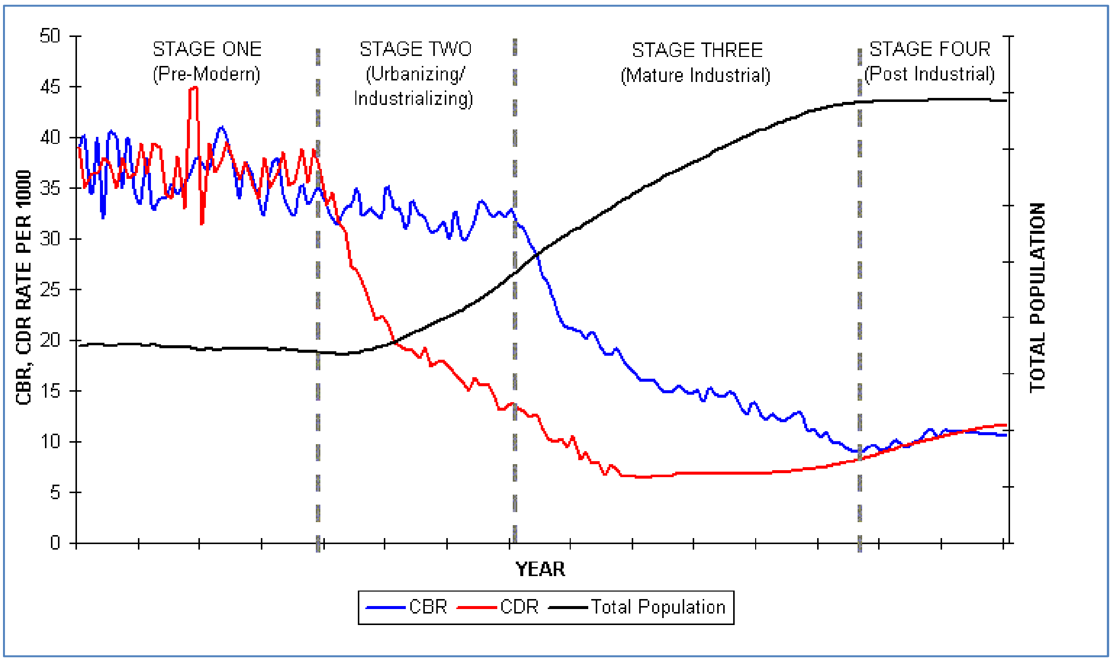


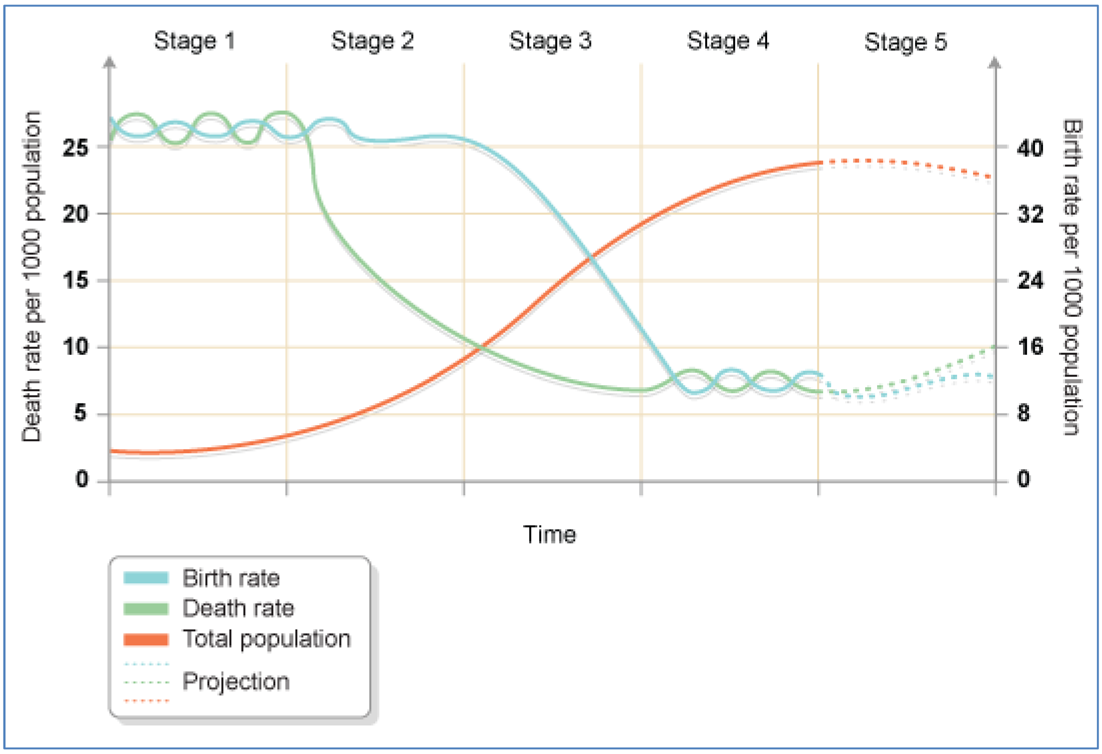
Based on Notestein's theory, the modern demography is using five stages of the demographic transition:

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.

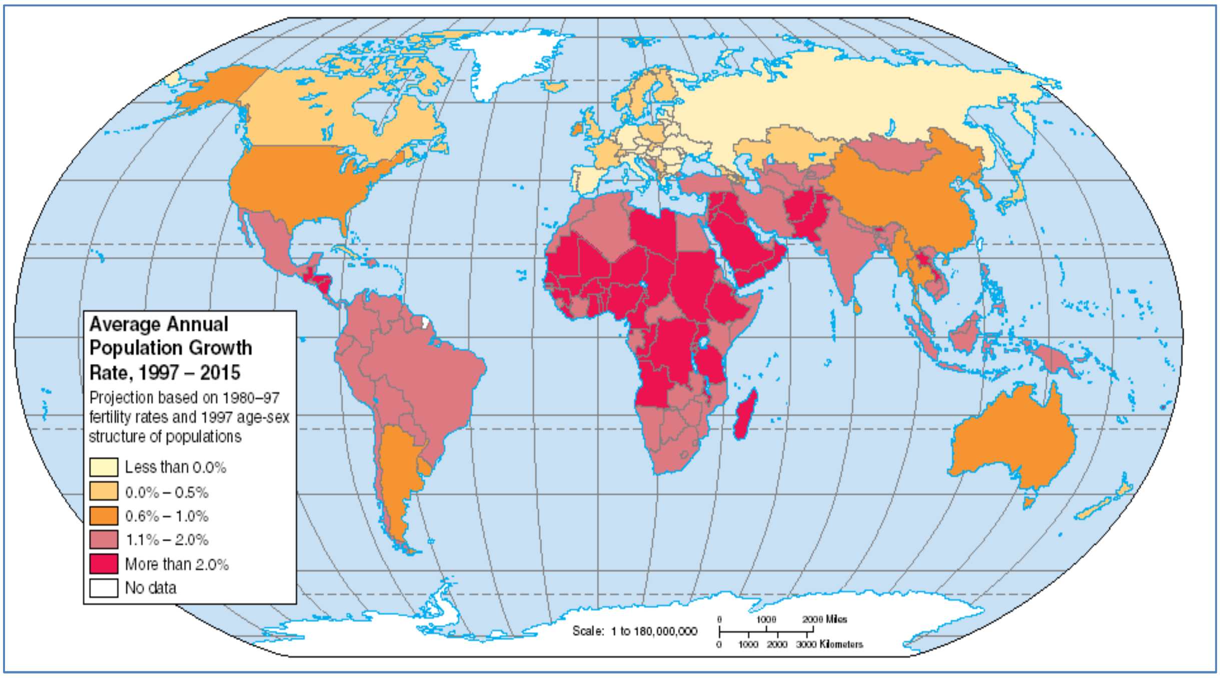
The original model had only four stages:





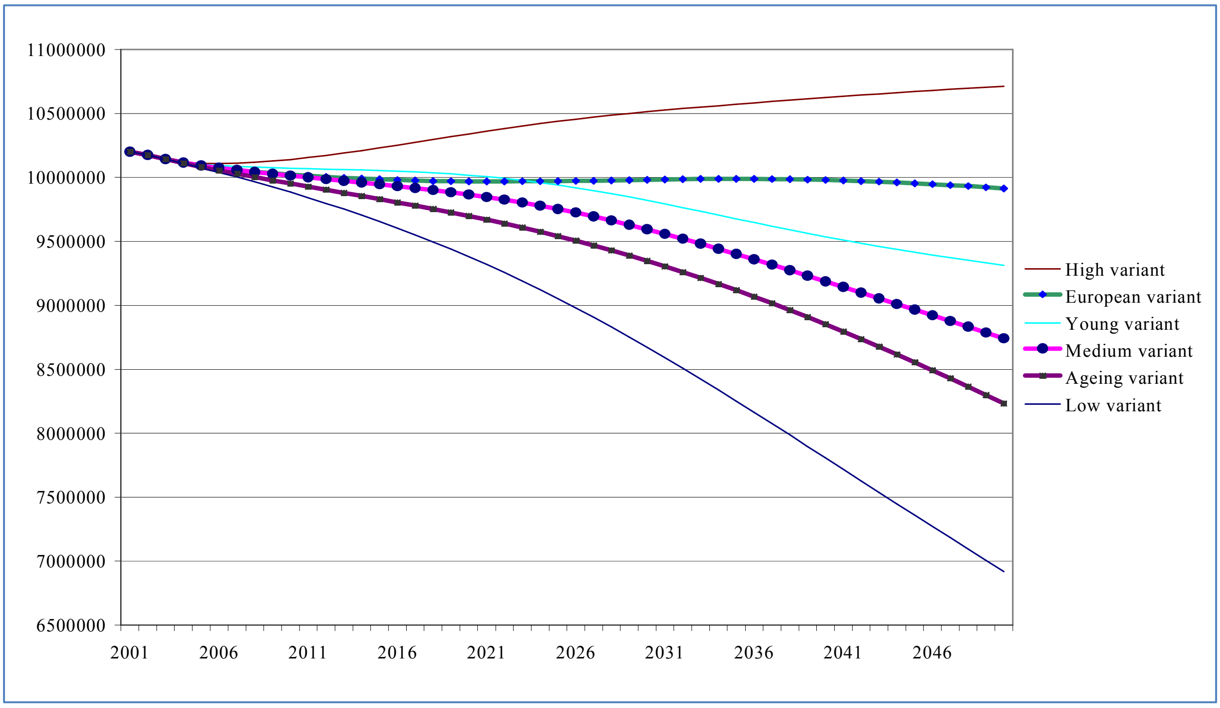
4.3.4.2. Reproductive concerns in the world and Hungary

Projected population growth of the world 1997-2015



Live birth and death rates were imbalanced during the World War I and II in Hungary but the loss of population was compensated. The first crossing over with permanent consequences followed in 1982.

Hungary's projected population by six variants 2001-2050



4.4. Migration

Men by nature were migratory creatures without constructed housing facilities except the last several ten-thousand years. Thus migration in biological terms is the "business as usual" of the human race. Building housing and settlements became widespread only by the so-called neolithic revolution about 10-12,000 years ago. Great territorial states were created first about 5,000 years ago known as riverine cultures (Egypt, Mesopotamia, India, China) in the history. However, migration was permanent also in the last five millennia.
Migration in demographic terms was considered first in Europe in the late 1600s since the emerging of modern registration (birth and death cases) of the population. 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).

Definition of migrants: according to the International Organization for Migration (IOM), there is "no universally accepted definition for migrants" as subjects of migration.
The United Nations (UN) defines migrant as an individual who has resided in a foreign country for more than one year irrespective of the causes, voluntary or involuntary, and the means, regular or irregular, used to migrate.

Definition of migration: 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) or
- involuntary (forced) migration (by factors outside of deliberation of moving persons as expulsion → refugees, or transportation → slave trade, holocaust in the WWII)

Migration to the USA in the 1800s and the early 1900s: it reached a peak of three million migrants per year in the early 1900s. In Europe Italy, Norway and Ireland were the main sources and in Asia the Guangdong region of China. It was a period of the emerging American nation (melting pot phenomenon).

The USA experienced considerable internal migration of the Afro-American population. It started after the Civil War by the abolition in the late 1800s. In the rural southern parts of the US, blacks faced poor economic opportunities and political and social prejudice, if compared to the emerging industrial cities of the Northeast, Midwest and West. There were relatively well-paid jobs thanks to the industrialization. From 1910–1970, approximately 7 million African Americans migrated in this direction. This phenomenon known as a Great Migration turned around in the 1960s with the demise of legalized segregation in the 1960s and improved economic opportunities in the South. Thus millions of blacks have returned to the South from other parts of the country since 1980 (New Great Migration)

World Wars (WW) I and II had enormous impact on migration. In and after the WWI, as a result of the collapsing Ottoman Empire, Muslims moved from the Balkan to Turkey, while Christians moved the other way. Civil War in Russia and founding of the Soviet Union caused some three million Russians, Poles, and Germans to migrate out of the country.

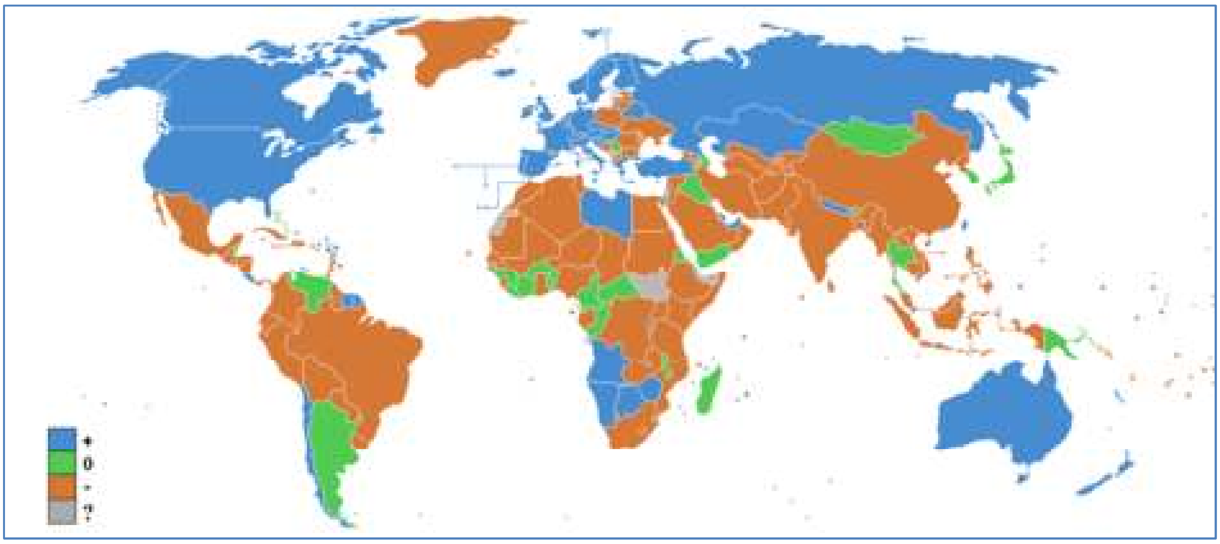
Balkan Turks on move in 1912

Jewish communities across Europe, the Mediterranean and the Middle East were formed by voluntary and involuntary migration. Four hundred thousand Jews had already moved to Palestine in the early twentieth century, and numerous Jews to America. After the WWII and the holocaust many of the several hundred thousand Jews remaining in Eastern Europe migrated to the British Mandate of Palestine part of which became the modern state of Israel in 1948.
Implementing the Potsdam Agreement (1945) started the largest ever European migration close to or over 20 million people. About 16.5 million Germans were expelled from Eastern Europe and more than 1 million Poles were expelled westward to the new border region to Germany.

Migration in the 21th century

Driving forces behind the voluntary and involuntary migration did not change in the 21th century. However, in terms of both migrations, the world became a globalized system with far reaching consequences. Interrelation of migration and globalization related to the public health concerns of globalization, as regarding the spread of infectious diseases and mental health consequences both of migrants and communities of the target countries see in chapter 3.8. “Health impact of the global migration.”

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



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

4.5. Reproductive health, maternal and child health service