Epidemiology and Risk Factors for

Cardiovascular Disease

(CVD)

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Mortality: Leading cause of mortality in developed countries and a rising tendency in developing countries (disease of civilization)

A major impact on life expectancy

Significantly contributes to morbidity and death rates in the middle aged population: potential life years lost, common cause of premature death, labor force (economic costs).

Morbidity: nearly 30% of all disability cases

Contributes to deterioration of the Quality Of Life (QOL)

1. **Coronary heart disease (CHD, ischemic heart disease, heart attack, myocardial infarction, angina pectoris)**
2. **Cerebrovascular disease (stroke, transient ischemic attack (TIA))**
3. **Hypertensive heart disease**
4. **Peripheral vascular disease**
5. **Heart failure**
6. **Rheumatic heart disease**
7. **Congenital heart disease**
8. **Cardiomyopathies**

Epidemiology & CVD

Study of the natural history of CVD

Formulation and testing of etiological hypotheses (risk factors)

Contribution to the development of cardiovascular prevention programs and the measurement of their effectiveness

1. Descriptive epidemiology:

= Describing distribution of CVD by means of certain characteristics such as : PERSON (i.e., age, gender, ethnicity) TIME and PLACE

2. Analytic epidemiology

= Analyzing relationships between CVD and risk factors (which elevate the probability of a disease at population level), risk model and multicausal developments

3. Experimental epidemiology/Interventions

= Strategies of cardiovascular prevention (primordial*, primary, secondary, tertiary; individual and community levels)

*Primordial prevention is defined as prevention of risk factors themselves: health education to children.

Levels of prevention	Phase of disease	Target
Primordial	Underlying conditions leading to causation	Total population and selected groups
Primary	Specific causal factors	Total population, selected groups and healthy individuals

Levels of prevention	Phase of disease	Target
Secondary	Early stage of disease	Patients
Tertiary	Late stage of disease (treatment, rehabilitation)	Patients

Distribution Patterns in the World

Cardiovascular diseases (CVDs) are the leading cause of death globally.

An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke.

Over three quarters of CVD deaths take place in low- and middle-income countries.

Out of the 17 million premature deaths (under the age of 70) due to non-communicable diseases in 2019, 38% were caused by CVDs.

Most cardiovascular diseases can be prevented by addressing behavioural risk factors such as tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol.
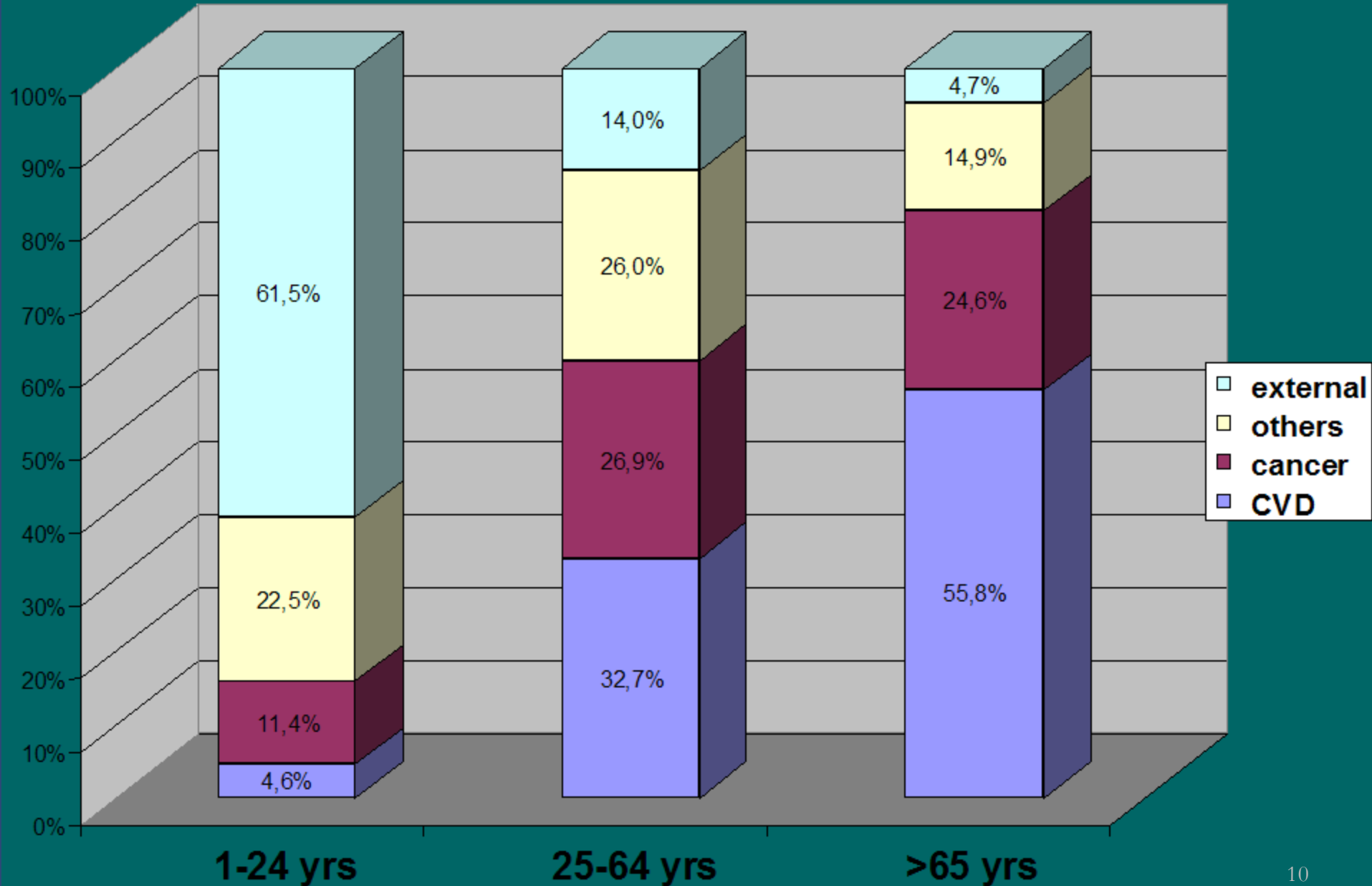
Question: What is the relative amount of CVD in death rates in different age groups?

Early lesions of blood vessel, atherosclerotic plaques: around 20 years - adult lifestyle patterns usually start in childhood and youth (smoking, dietary habits, sporting behavior, etc.)
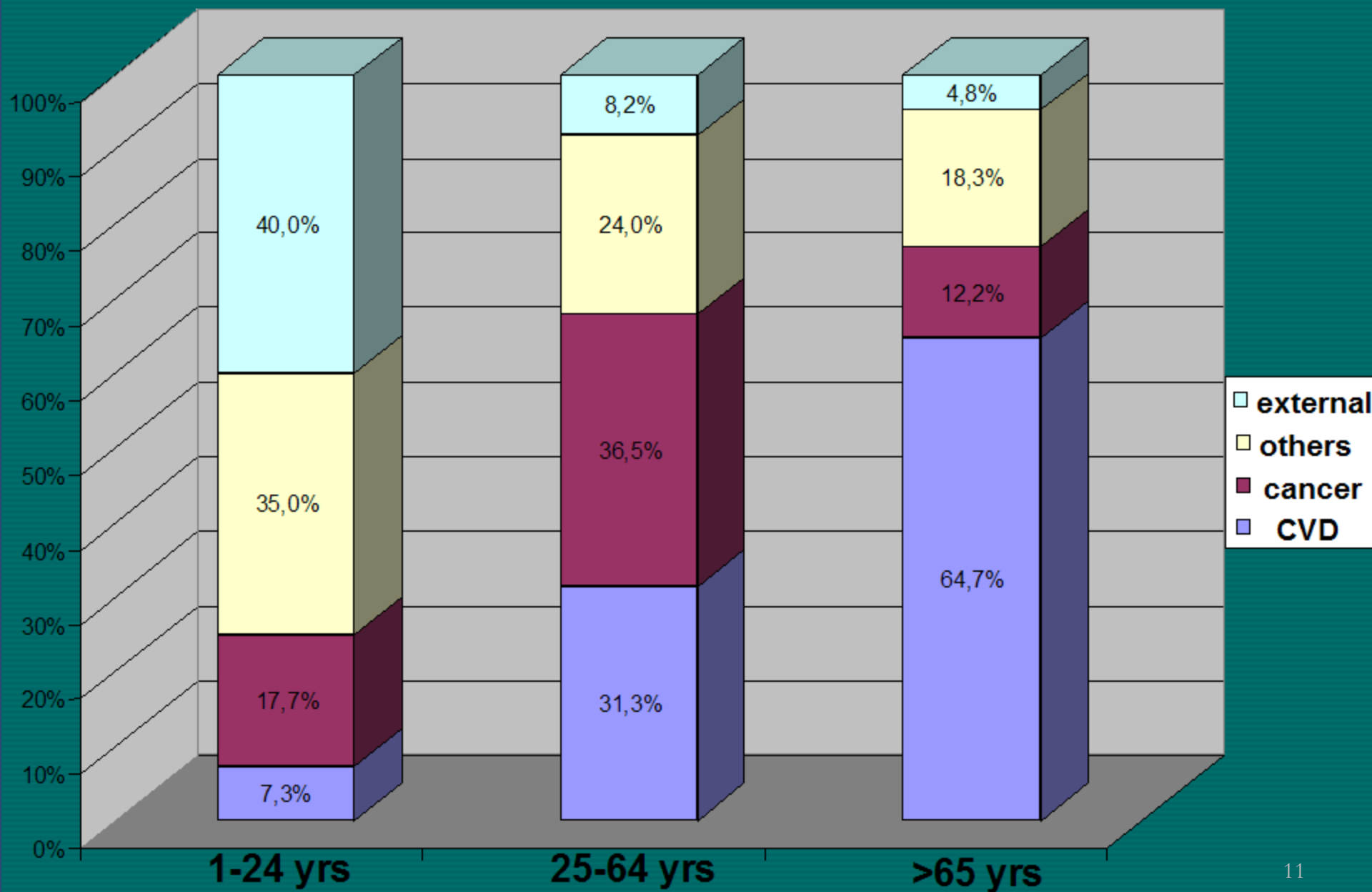
Increase in CVD morbidity and mortality: in age-group of 30-44 years

Premature death (<64 years of age, or 25-64 years)

PROPORTION OF MORTALITY IN DIFFERENT AGE-GROUPS (MEN)

	external	others	cancer	CVD
1-24 yrs	61,5%	22,5%	11,4%	4,6%
25-64 yrs	14,0%	26,0%	26,9%	32,7%
>65 yrs	4,7%	14,9%	24,6%	55,8%

PROPORTION OF MORTALITY IN DIFFERENT AGE-GROUPS (WOMEN)

Question: What is the relative amount of CVD in death rates in women and men?

Widespread idea: CVD is often thought to be a disease of Middle-aged Men.

Cardiovascular mortality (fatal cases) are more common among men.

Gender-specific risk factors (risks for women only) (oral contraceptives, hormone replacement therapy (HRT), polycystic ovary syndrome)

Question: What is the relative amount of CVD in death rates in <u>different ethnic groups?</u>

In the US: increased CVD deaths in African-American and South-Asian populations in comparison with Whites

<u>Migration:</u> Ni-Hon-San Study: Japanese living in Japan had the <u>lowest rates</u> of CHD and cholesterol levels, those living in Hawaii had <u>intermediate rates</u> for both, those living in San Francisco had the <u>highest rates</u> for both

Question: What is the relative amount of CVD in **different geographical places**?

What are the time trends? International and regional characteristics of distribution

SDR: Standardized Death Rate

Direct mode of standardization, using the age distribution of a **Hypothetical European Standard Population**

❖ **Developed countries:** **decreasing tendencies** **(e.g, USA: 30% between 1988-98, Sweden: 42%)**

1. **Improvement of lifestyle factors****, for example, a <u>decrease of smoking and a higher level of health consciousness</u> in many developed countries**

2. **Better diagnostic and therapeutic procedures** **(e.g., bypass surgeries, hypertension screening, pharmacological treatment of hypertension and hypercholesterinaemia, access to health care)**

❖ **Developing countries:** **increasing tendencies**

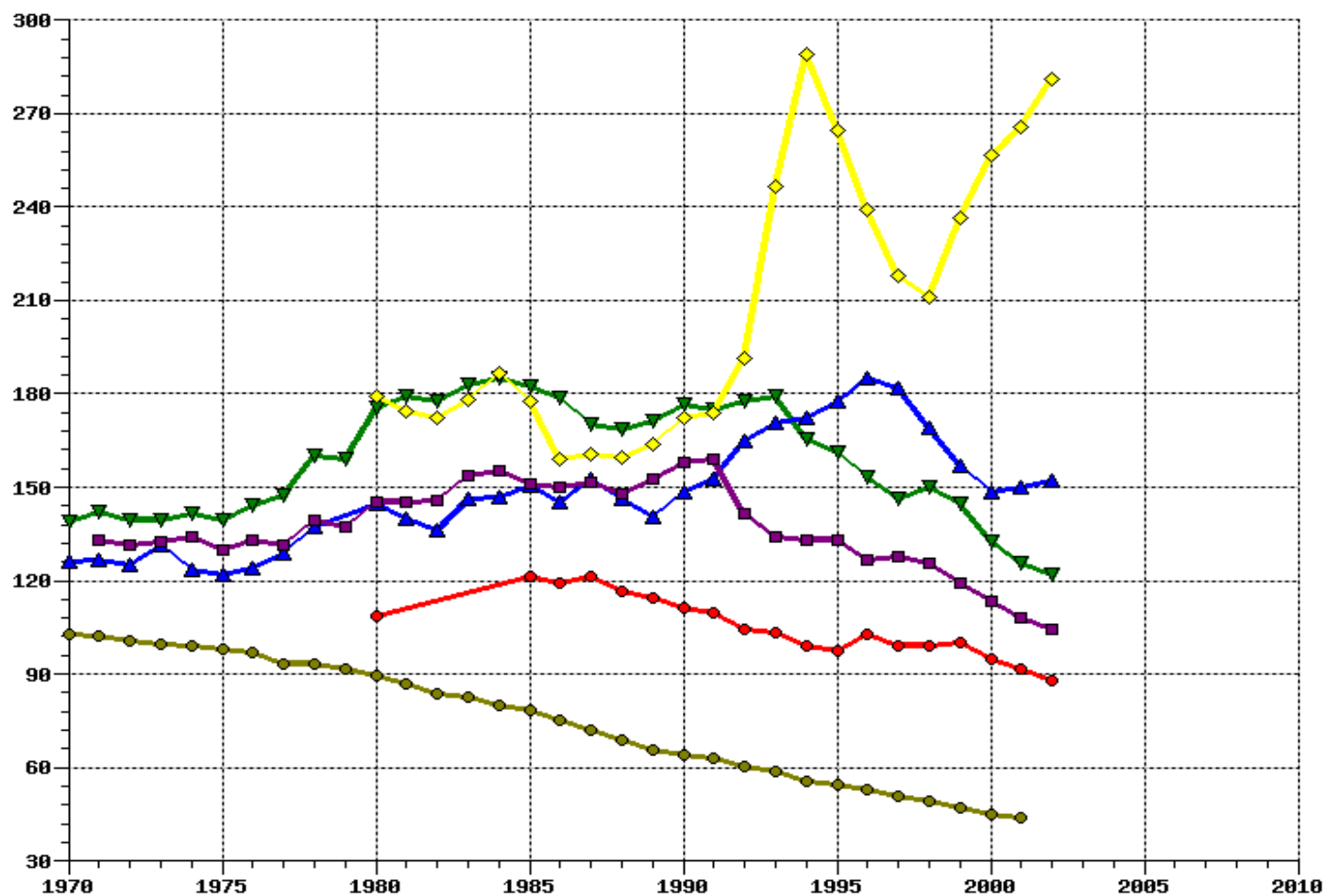✓ **increasing longevity, urbanization, and western type lifestyle**

SDR, diseases of circulatory system in Western Europe, 0-64 yrs, per 1000000
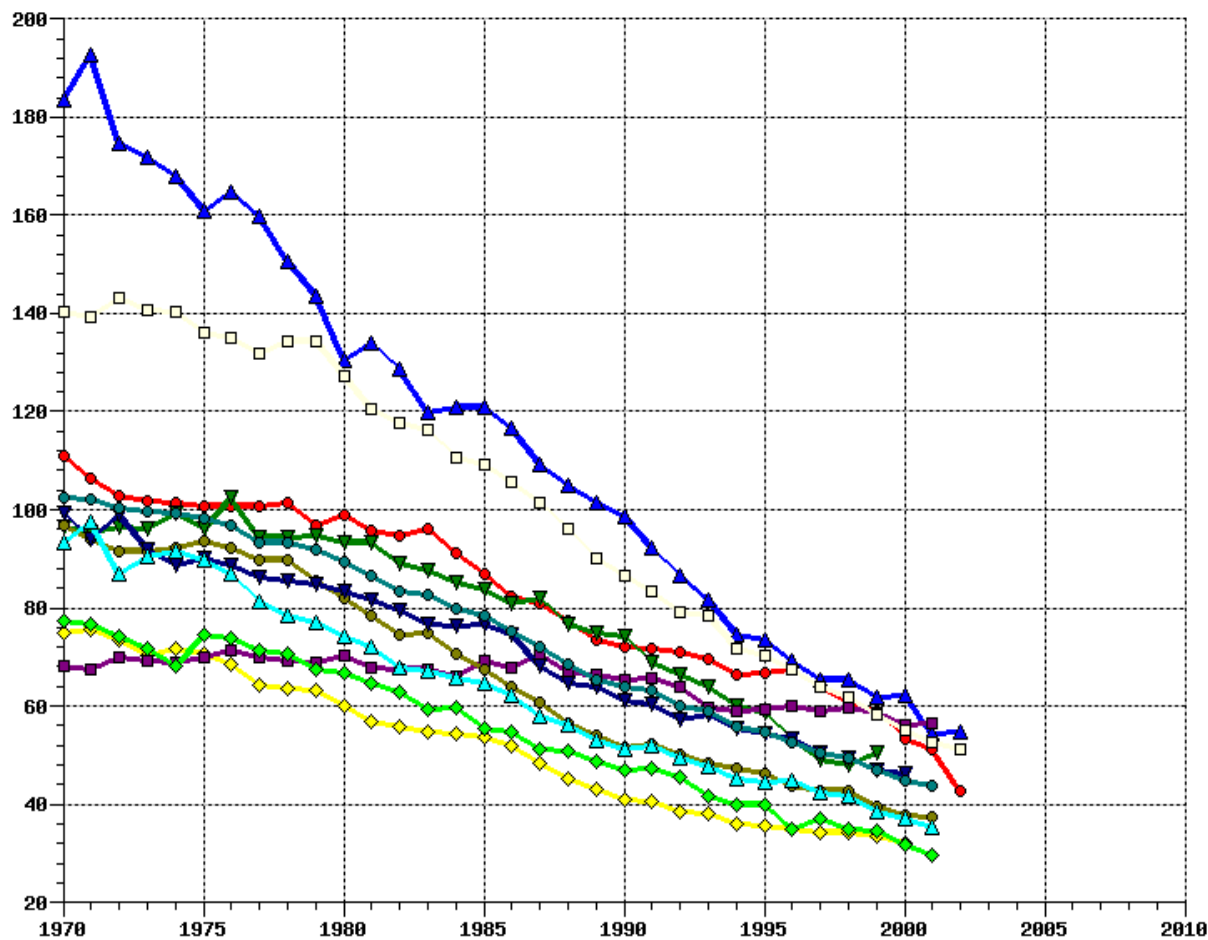
Legend:
- Austria
- Denmark
- Finland
- France
- Greece
- Italy
- Netherlands
- Spain
- Switzerland
- United Kingdom
- EU-15 average

SDR, diseases of circulatory system in Eastern Europe, 0-64 yrs, per 1000000
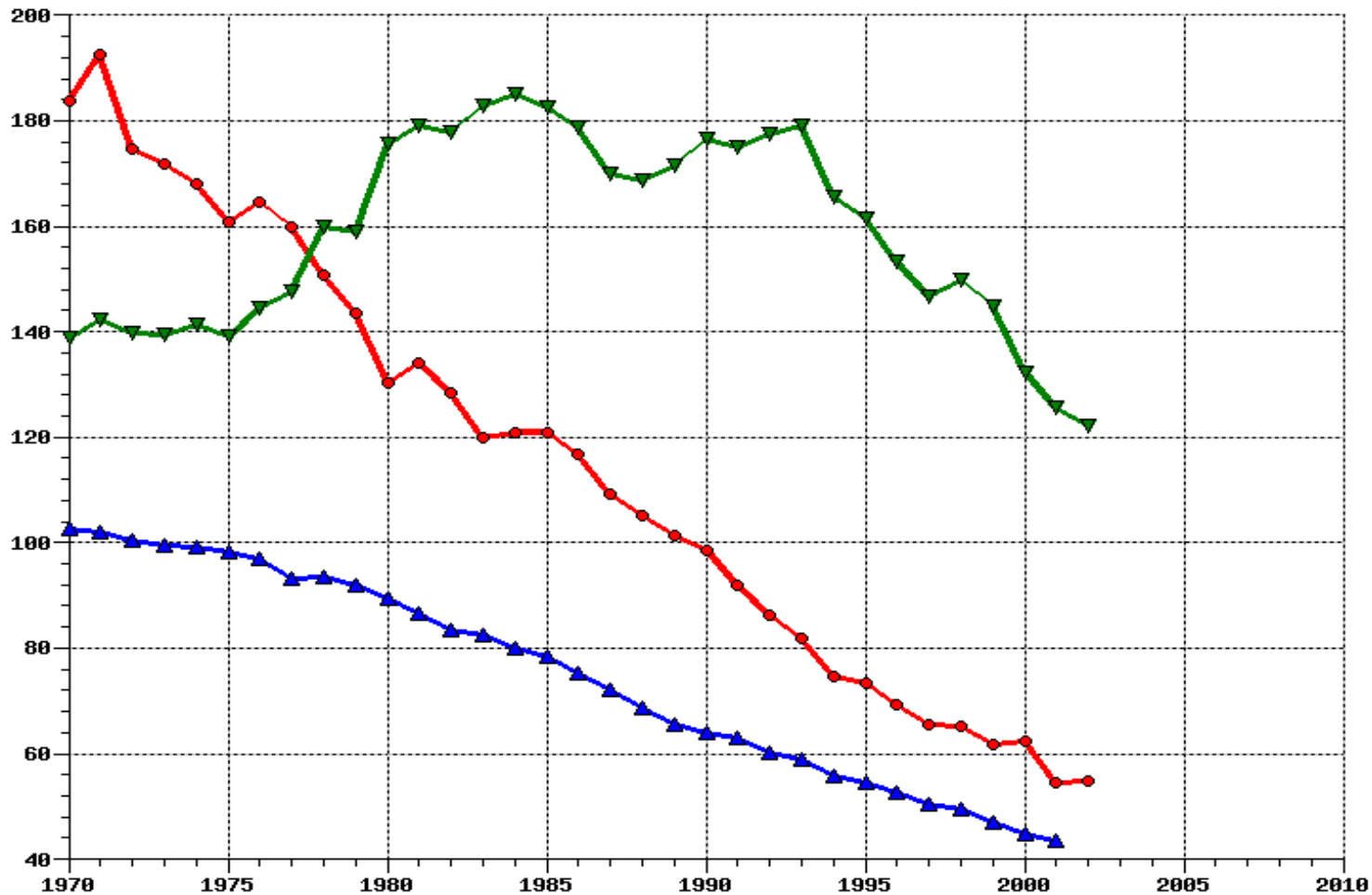

Croatia

Hungary

Romania

Russian Federation

Slovakia

SDR, diseases of circulatory system in Hungary, 0-64 yrs, per 1000000

- ✓ **Over 300 risk factors have been associated with coronary heart disease, hypertension and stroke**
- ✓ **Approx. 75% of CVD can be attributed to conventional risk factors عوامل الخطر التقليدية**
  1. Risk factors of great public health significance:
  2. High prevalence in many populations
  3. Great independent impact on CVD risk
  4. Their control and treatment result in reduced CVD risk
- ✓ Developing countries: double burden of risks (problems of undernutrition and infections + CVD risks)

Major modifiable risk factors	Other modifiable risk factors
1. High blood pressure 2. Abnormal blood lipids 3. Tobacco use 4. Physical inactivity 5. Obesity 6. Unhealthy diet 7. Diabetes mellitus	1. Low socioeconomic status 2. Mental ill health (depression) 3. Psychosocial stress 4. Heavy alcohol use 5. Use of certain medication 6. Lipoprotein(a)
Non-modifiable risk factors	**"Novel" risk factors**
1. Age 2. Heredity or family history 3. Gender 4. Ethnicity or race	1. Excess homocysteine* in blood 2. Inflammatory markers (C-reactive protein) 3. Abnormal blood coagulation (elevated blood levels of fibrinogen)

*a plasma homocysteine level less than 10 micromoles/L is associated with a lower risk of CVD.

-Systolic blood pressure >140 Hgmm and/or a diastolic blood pressure > 90 Hgmm

-Positive family history

-Dietary habits (a high intake of salt, processed food, low levels of water hardness, high tyramine content of food, alcohol use)

-Modern lifestyle (increased sympathetic activity, psychosocial stress, leading position in job)

Tyramine

Cholesterol:

structure and functioning of blood vessels, atherosclerotic plaques

Altering functions of cholesterol fractions

(LDL:⬆ risk, HDL: protection)

Estrogen: tends to raise   HDL and lower LDL, protection for women in reproductive age

	European guidelines	**US guidelines**
Total cholesterol	<5.0 mmol/l	**<240 mg/dl (6.2 mmol/l)**
LDL-cholesterol	<3.0 mmol/l	**<160 mg/dl (3.8 mmol/l)**
HDL-cholesterol	>=1.0 mmol/l (men) >=1.2 mmol/l (women)	**>=40 mg/dl (1 mmol/l)**
Triglycerides (fasting)	<1.7 mmol/l	**<200 mg/dl (2.3 mmol/l)**

- The link between **<u>Smoking</u> and CVD** (mainly CHD) was identified in 1940

- Greatest risk: initiation **< 16 years**

- **Passive smoking: additional risk**

- Women smokers: are at higher risk of CHD and CVD than male smokers

- Several mechanisms: **damages the endothelium lining, increases atherosclerotic plaques, raises LDL and lowers HDL, promotes artery spasms, raises oxigen demand of the heart muscle**

- Nicotine accelerates the heart rate (RR), and raises blood pressure

Regular Physical Activity: protective factor
Physical activity: helps reduce stress, anxiety and depression

Intensity and duration (150 minutes/week intermediate or 60 minutes/week heavy)

***Modernization, Urbanization, Mechanized Transport:**
Sedentary Lifestyle (60% of global population)

- Raises CVD risk and also the development of other risk factors (diabetes mellitus, blood coagulation, obesity, hypertention)

- **Body Mass Index (BMI)**: > 25: overweight, > 30: obesity

- A <u>modern "epidemic"</u>: **More than 60% of adults in the US are overweight or obese, in China: 70 million overweight people**

- **Elevates the risk of both CVD and diabetes mellitus**

- **Diabetes mellitus: damages both peripheral and coronary blood vessels**

-**Unhealthy diet: <u>low fruit and vegetable, low fiber content, and high saturated fat intake, refined sugar</u>**

- **Psychological factors (Type A behavior, hostility**

- **Depression** **and CVD: bidirectional link**

  depression may increase the risk of CVD and worsen recovery process

  CVD may induce depression

- Low socioeconomic status (SES):

in developing countries: less educated and lower SES groups (accumulation of risk factors)

Prevention

Primordial: Social, legal and other (often nonmedical) activities which may lead to a lowering of risk factors (e.g., socioeconomic development, smoke-free restaurants)

Primary: Controlling risk factors contributing to CVD (health education programs, anti-smoking campaign, sports programs, nutrition counselling, regular check of blood pressure and certain blood parameters, e.g., cholesterol, blood lipids, glucose)

Secondary: Screening and treatment of symptomatic patients, set up personal risk profile

Tertiary: Cardiovascular rehabilitation, prevention of recurrence of CVD (new heart attack: 5-7 times higher risk among CVD patients)