Cardiovascular Epidemiology, Prevention & Control

435 Lecture Notes by Haifa almohsen

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Session objectives

By the end of the session students should be able to understand the:

- Public health significance of CVD
- Descriptive CVD Epidemiology
- Analytical CVD Epidemiology
- CVD Prevention and control (interventional epidemiology)

Introduction

- Cardiovascular diseases are leading causes of morbidity and mortality burdens worldwide, more in developed nations, but developing nations are catching up very quickly
- Someone has a heart attack every two minutes (British Heart Foundation)

Public Health Significance

- 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)
- Nearly 30% of all disability cases
- A major impact on life expectancy
- Contributes to deterioration of the quality of life
- Leading cause of mortality in developed countries and a rising tendency in developing countries (disease of civilization)

Types of Cardiovascular Diseases

- Congenital heart disease
- Rheumatic heart disease (streptococcal infection)
- Hypertensive heart disease
- Coronary heart disease (ischemic heart disease [IHD], heart attack, myocardial infarction, angina pectoris)
- Cerebrovascular disease (stroke, transient ischemic attack [TIA])
- Peripheral vascular disease
- Heart failure
- Cardiomyopathies

Disciplines of CVD Epidemiology

- **Descriptive epidemiology:**
  - Describing distribution of cardiovascular disease by PERSON (i.e., age, gender, ethnicity) TIME and PLACE
- **Analytic epidemiology**
  - Analyzing relationships between CVD and risk factors (which increase the probability of disease occurrence at population level), risk models, multicausal developments
- **Experimental epidemiology/Interventions**
  - Strategies of CVD prevention (primordial, primary, secondary, tertiary; individual vs community levels)

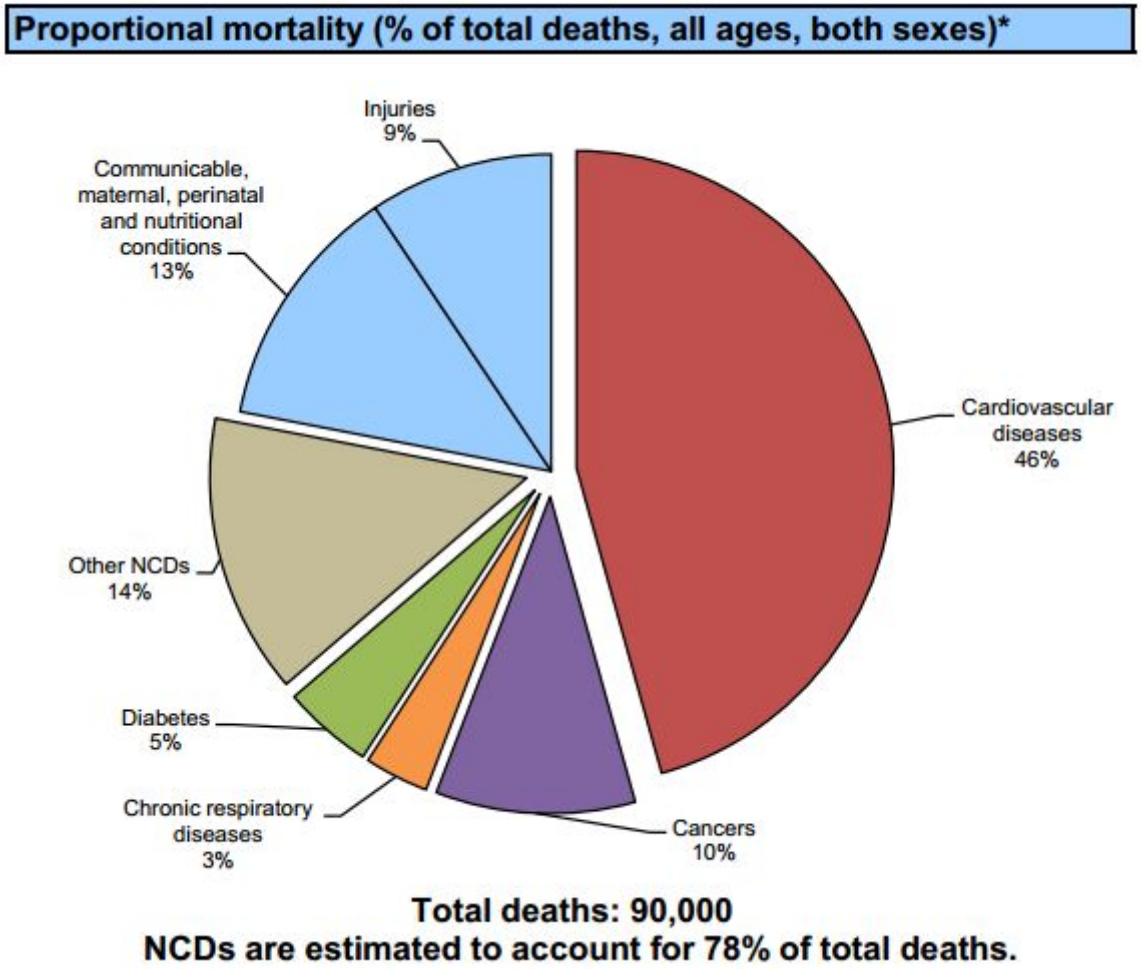
Descriptive **CVD Epidemiology**

Descriptive Epidemiology

I. Distribution Patterns in the World

- CVD deaths account for one third of all deaths (50% attributed to coronary deaths)
- Developed countries: decreasing tendencies (e.g, USA, Sweden), attributed to: improvement of lifestyle factors, decrease of tobacco use, higher level of health consciousness, better diagnostic and therapeutic procedures
- Developing countries: increasing tendencies due to increasing longevity, urbanization, western type lifestyle

World Health Organization – Noncommunicable Diseases (NCD) Saudi Arabia profile

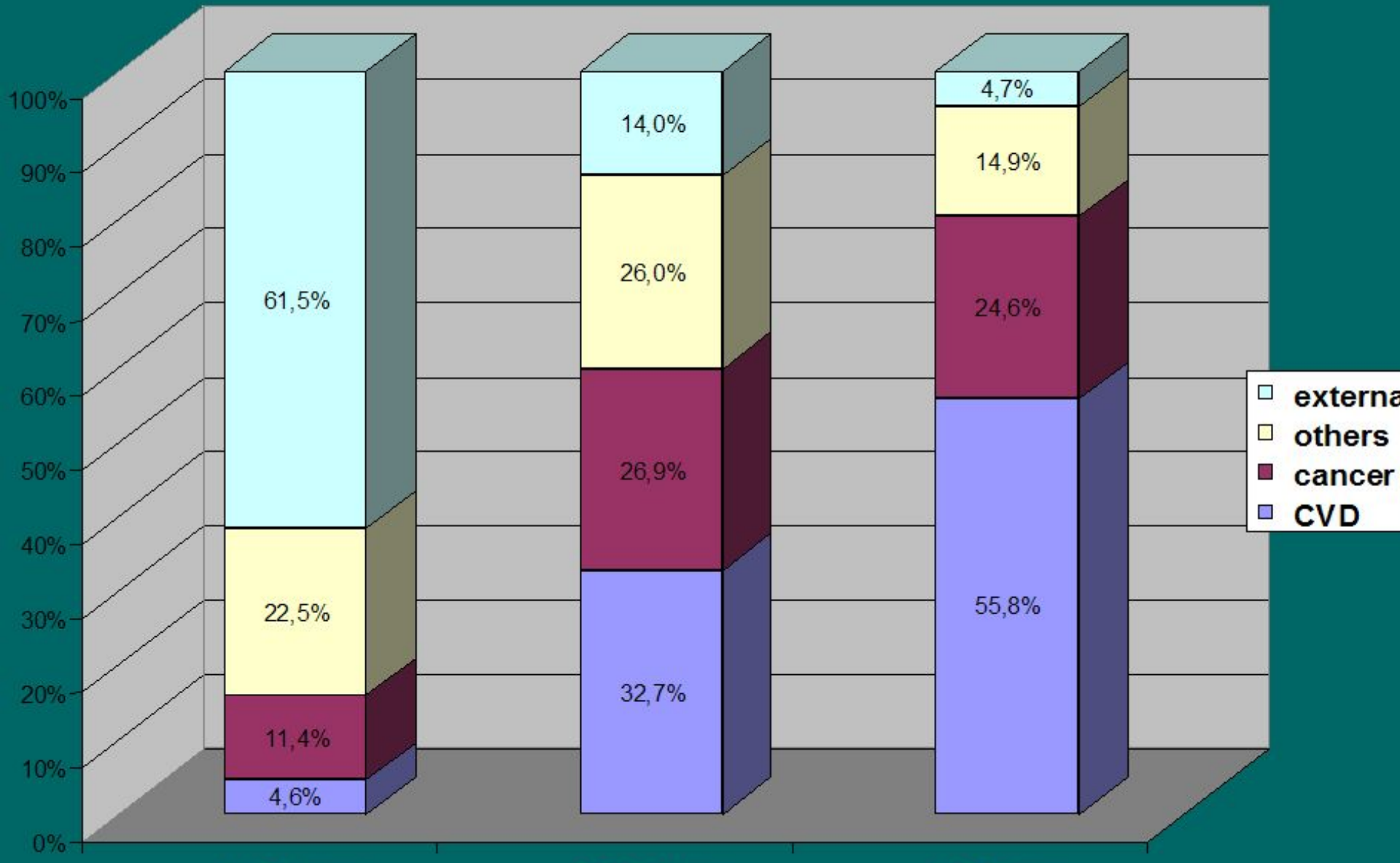


Source: http://www.who.int/nmh/countries/sau_en.pdf?ua=1

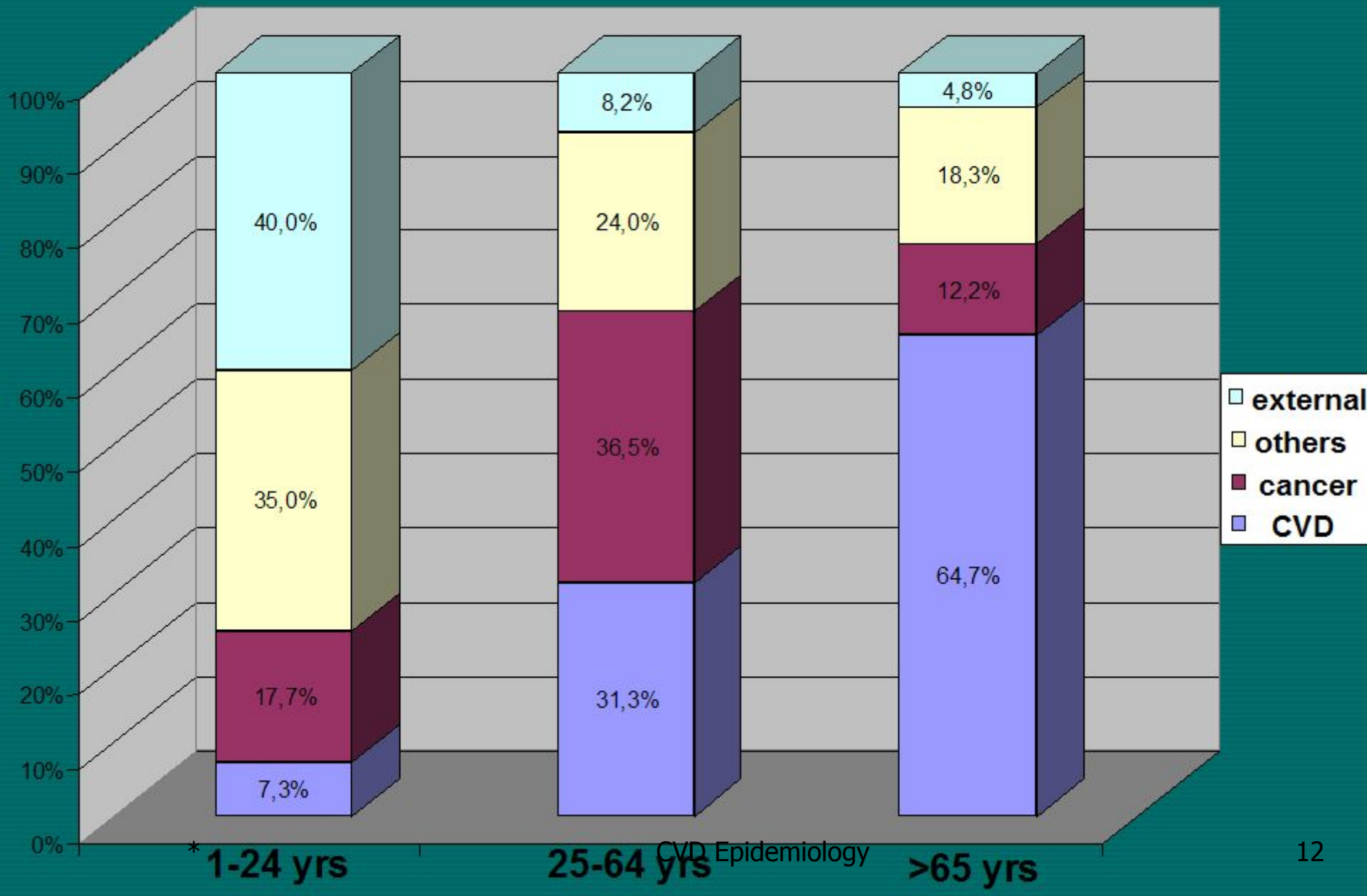
Descriptive Epidemiology
II. AGE

- Early lesions of blood vessel, atherosclerotic plaques: around 20 years - adult lifestyle patterns usually start in childhood and youth (tobacco use, 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): in the elderly population more difficult to interpret death rate due to multiple ill health causes

PROPORTION OF MORTALITY IN DIFFERENT AGE-GROUPS (MEN)



PROPORTION OF MORTALITY IN DIFFERENT AGE-GROUPS (WOMEN)



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Descriptive Epidemiology

III. SEX

- Widespread idea: CVD is often thought to be a disease of middle-aged men.
- Cardiovascular mortality (fatal cases) are more common among men. However, CVD affect nearly as many women as men, but at an older age
- Women: special case (WHO reports)
  - Higher risk in women than men (tobacco use, high triglyceride levels)
  - Higher prevalence of certain risk factors in women (diabetes mellitus, depression)
  - Gender-specific risk factors (risks for women only: use of oral contraceptives, hormone replacement therapy, polycystic ovary syndrome, etc)

Descriptive Epidemiology
IV. ETHNICITY

- In the US: increased CVD deaths among African-American and South-Asian populations in comparison with Whites
- Increased stroke risk in African-American, some Hispanic American, Chinese, and Japanese populations
- Migration: Japanese living in Japan had the lowest rates of CHD and cholesterol levels, those living in Hawaii had intermediate rates for both, those living in San Francisco had the highest rates for both (migrant studies)

Analytical **CVD Epidemiology**

Analytic Epidemiology
I. Role of Risk Factors

- Over 300 risk factors have been associated with coronary heart disease, hypertension and stroke
- About 75% of CVD can be attributed to conventional risk factors
- Risk factors of great public health significance:
  - High prevalence in many populations
  - Great independent impact on CVD risk
  - Their control and treatment result in reduced CVD risk
- Developing countries: double burden of risks (problems of undernutrition and infections in addition to CVD risks)

Analytic Epidemiology
II. Classification of Risk Factors

Major modifiable risk factors
- High blood pressure
- Abnormal blood lipids
- Tobacco use
- Physical inactivity
- Obesity
- Unhealthy diet
- Diabetes mellitus

Non-modifiable risk factors
- Age
- Heredity or family history
- Gender
- Ethnicity or race

Other modifiable risk factors
- Low socioeconomic status
- Mental ill health (depression)
- Psychosocial stress
- Heavy alcohol use
- Use of certain medication
- Lipoprotein(a)

"Novel" risk factors
- Excess homocysteine in blood
- Inflammatory markers (C-reactive protein)
- Abnormal blood coagulation (elevated blood levels of fibrinogen)

Analytic Epidemiology
III. Hypertension

- Systolic blood pressure >140 Hgmm and/or a diastolic blood pressure > 90 Hgmm
- Free of clinical symptoms for many years (screening)
- In most countries, up to 30 percent of adults suffer from hypertension
- Positive family history
- Dietary habits (a high intake of salt, processed food, low levels of water hardness, high thyramine content of food, alcohol use)
- Modern lifestyle (increased sympathetic activity, psychosocial and occupational stressors)

Analytic Epidemiology

IV.Rheumatic Fever and Rheumatic Heart Disease

- Development: Rheumatic fever usually follows an untreated beta-haemolytic streptococcal (GABS) throat infection in children
- As a consequence, some heart valves (e.g. mitral, tricuspid) may be permanently damaged, which may progress to heart failure
- Today mostly affects children in developing countries, linked to poverty, inadequacy of health care access
- Occurrence: 12 million people are currently estimated to suffer from rheumatic fever and RHD, of whom two-thirds are children (5-15 years)

Analytic Epidemiology
V. Abnormal Blood Lipids

- Serum cholesterol: structure and functioning of blood vessels, atherosclerotic plaques
- Altering functions of cholesterol fractions (LDL: risk, HDL: protection)
- Estrogen: tends to raise HDL-cholesterol and lower LDL-cholesterol, which provides protection for women during their reproductive age (15-49 years)
- Partially genetic determination of metabolism, partially dependent of nutrition (eggs, meats, dairy products)

Current Recommended Lipid Levels

	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)

Analytic Epidemiology
VI. Tobacco Use

- The link between smoking and CVD (mainly CHD) was identified in 1940
- Greatest risk: initiation during adolescence (< 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 oxygen demand of cardiac muscles
- Nicotine accelerates the heart rate and raises blood pressure

Analytic Epidemiology
VII. Physical Inactivity

- Regular physical activity: protective factor
- Physical activity: helps reduce stress, anxiety and depression
- Intensity and duration (150 minutes/week or 60 minutes/week)
- Modernization, urbanization, mechanized transport: sedentary lifestyle (60% of global population)
- Raises CVD risk and also the development of other risk factors (glucose metabolism, diabetes mellitus, blood coagulation, obesity, high blood pressure, worsening lipid profile)

Analytic Epidemiology
VIII. Unhealthy Diet, Obesity, Diabetes

- Unhealthy diet: low fruits, vegetables, fiber content; high saturated fat intake, refined sugar
- Body Mass Index (BMI): > 25: overweight;
  > 30: obesity
- A modern ”epidemic”: more than 60% of adults in the US are overweight or obese, in China: 70 million overweight people
- Increases the risk of both CVD and diabetes mellitus
- Diabetes mellitus: damages both peripheral and coronary blood vessels (micro-angiopathies)

Analytic Epidemiology
IX. Psycho-social factors

- 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 developed countries: less educated and lower SES groups (accumulation of risk factors)
  - In developing countries: more educated and higher SES groups (western lifestyle)

CVD Prevention
(Interventional **CVD Epidemiology)**

Levels of CVD Prevention -I

- **Primordial:** social, legal and other (often nonmedical) activities which may lead to lowering of risk factors (e.g. socioeconomic development, smoke-free public places)
- **Primary:** controlling risk factors contributing to CVD (health education programs, tobacco prevention campaigns, sports programs, nutrition counselling, regular check-up of blood pressure / certain blood parameters, e.g. blood lipids including cholesterol, glucose, etc)

Levels of CVD Prevention - II

- **Secondary:** early detection by screening / setting up personal risk profile; proper management of symptomatic patients
- **Tertiary:** CVD rehabilitation (e.g. for stroke, paralysis patients); prevention of CVD recurrence (CVD patients have a 5-7 times higher risk of a new heart attack)

Risk Factor Concepts in Primary Prevention

- Non-modifiable risk factors (e.g. age, sex, race, and family history of CVD) identify high-risk populations
- Behavioral (modifiable) risk factors (e.g. sedentary lifestyle, unhealthy diet, tobacco or alcohol use, physical inactivity)
- Physiological risk factors (e.g. hypertension, obesity, lipid problems, and diabetes) may be a consequence of behavioral risk factors

Cardiovascular Prevention - III

- **The population-wide approach:** targeting the whole population: includes tobacco prevention programs, salt and refined sugar restriction, promoting high fiber – low fat diets, etc.
- **The individual approach:** detecting those at greatest risk: includes targeting lifestyle guidelines, e.g. tobacco cessation programs

Cardiovascular Prevention - IV

Examples of community-wide CVD prevention programs:

- Framingham Heart Study & Risk Scoring (1948-), USA
- North-Karelia Project (1972-), Finland
- Stanford Projects (1972-75, 1980-86), USA
- Multiple Risk factor Intervention Trial (1972-79), USA
- Minnesota Cardiovascular Health Program (1980-88), USA

The awareness about CPR in the general population.

Can the public identify the symptoms of a heart attack .

What entities certify the lay person in CPR in KSA?

As CPR saves lives, a public health issue is to raise awareness of its importance and to provide opportunity to learn the skill

Any policy on providing AED in public places. I read somewhere a while ago they were planning to distribute AEDs in hajj stops. I don't' have a follow up on that.

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Thank you for your kind attention