

# Overview of Noncommunicable Diseases and Related Risk Factors

**Dr. Armen Torchyan**

Department of Family and Community Medicine



# Objectives

- Definition of risk factors and metabolic risk factors
- Common risk factors for NCDs
- More in-depth discussion on 4 leading NCDs, 4 behavioral/lifestyle risk factors, and 4 metabolic risk factors
  - Definition
  - Global burden
  - Health effects

# Types of NCDs

- Cardiovascular disease (e.g., Coronary heart disease, Stroke)
- Cancer
- Chronic respiratory disease
- Diabetes
- Chronic neurologic disorders (e.g., Alzheimer's, dementias)
- Arthritis/Musculoskeletal diseases
- Unintentional injuries (e.g., from traffic crashes)

# Risk Factor: Definition

- ▶ “An aspect of personal behavior or lifestyle, an environmental exposure, or a hereditary characteristic that is associated with an increase in the occurrence of a particular disease, injury, or other health condition.”

# Modifiable Risk Factor

- A behavioral risk factor that **can** be reduced or controlled by intervention, thereby reducing the probability of disease.
- WHO has prioritized the following four:
  - Physical inactivity,
  - Tobacco use,
  - Alcohol use, and
  - Unhealthy diets (increased fat and sodium, with low fruit and vegetable intake).

# Non-Modifiable Risk Factor

A risk factor that cannot be reduced or controlled by intervention; for example:

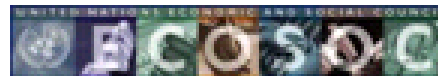
- Age,
- Gender,
- Race, and
- Family history (genetics).

# Common Risk Factors

## Noncommunicable Diseases

4 Diseases, 4 Modifiable Shared Risk Factors

	Tobacco Use	Unhealthy diets	Physical Inactivity	Harmful Use of Alcohol
Cardio-vascular				
Diabetes				
Cancer				
Chronic Respiratory				

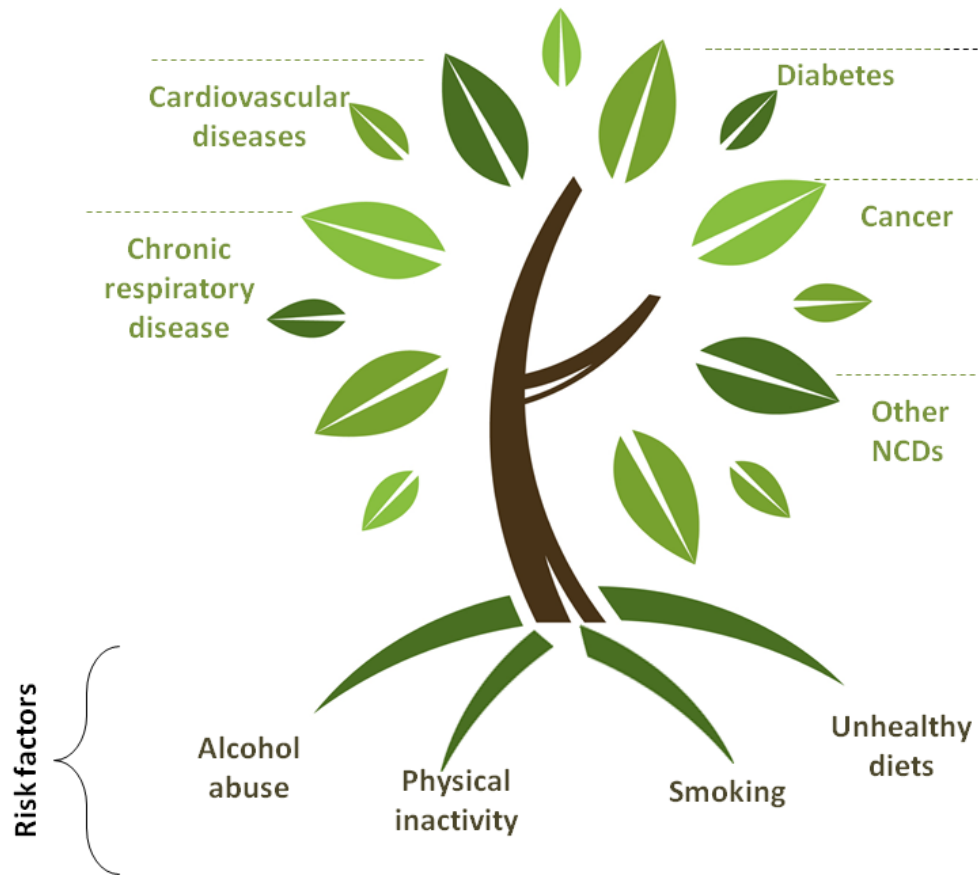


# Metabolic Risk Factors

- “Metabolic” refers to the biochemical processes involved in the body's normal functioning
- Behaviors (modifiable risk factors) can lead to metabolic/physiologic changes.
- WHO has prioritized the following four metabolic risk factors:
  - Raised blood pressure
  - Raised total cholesterol
  - Elevated glucose
  - Overweight and obesity



# FOUR LEADING NCDs



# WHO Website

Global Health Observatory (GHO): <http://www.who.int/gho/en/>

- Provides data and analyses on global health priorities
- Noncommunicable diseases
  - Mortality/morbidity
  - Risk Factors
- Country statistics: health data and statistics for countries

Media centre fact sheets:

<http://www.who.int/mediacentre/factsheets/en/>

- Key facts
- Symptoms
- Risk factors

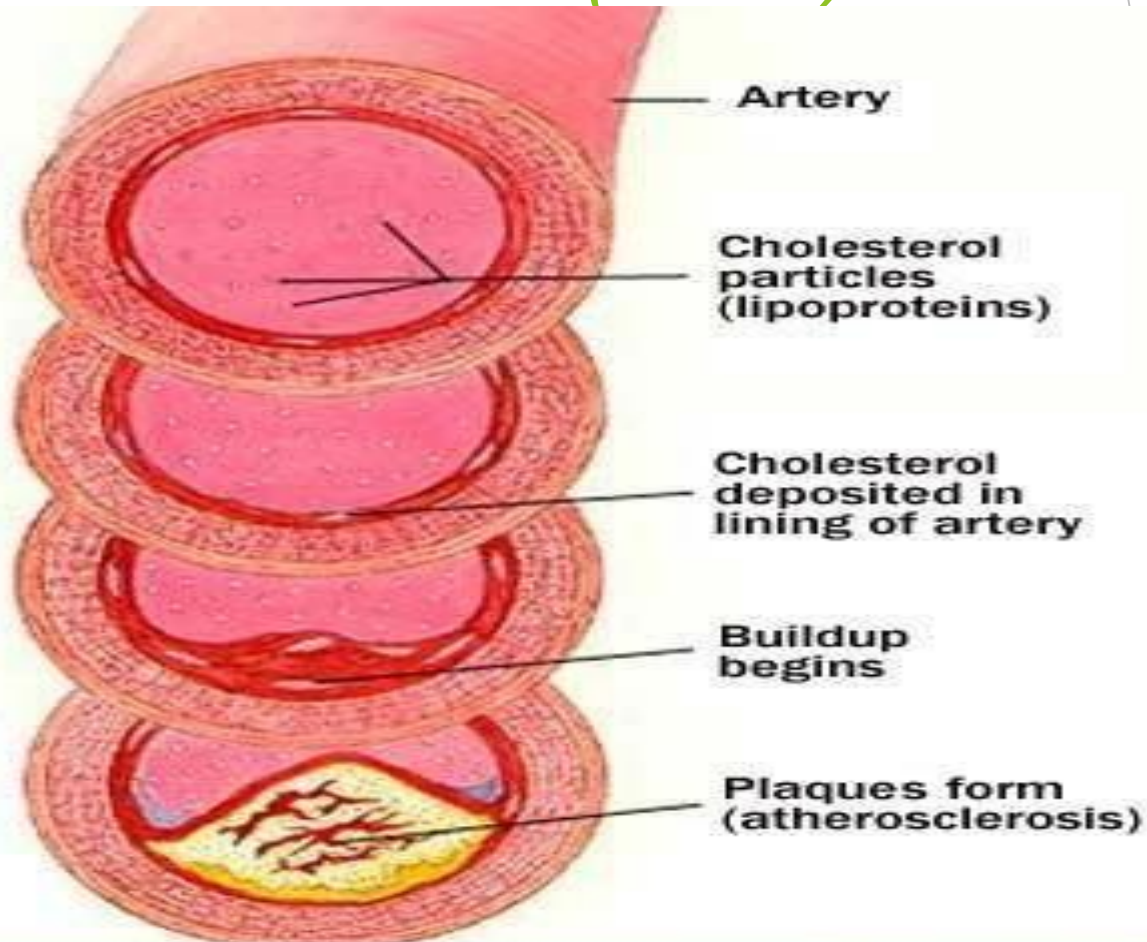
- Burden of disease

# Cardiovascular Disease: Definition

- Cardiovascular disease (CVD) is a group of disorders of the heart and blood vessels, and may include:

<b>Coronary heart disease</b>	Disease of the blood vessels supplying the heart muscle
<b>Cerebrovascular disease</b> (Stroke)	Disease of the blood vessels supplying the brain
<b>Peripheral arterial disease</b>	Disease of blood vessels supplying the arms and legs
<b>Congenital heart disease</b>	Malformations of heart structure existing at birth

# Cardiovascular Disease: Definition (*cont.*)



# Global Burden of Cardiovascular Disease

- CVDs are the #1 cause of death globally.
- An estimated 17.3 million people died from CVDs in 2008. (30% of all global deaths)
  - 7.3 million were due to coronary heart disease
  - 6.2 million were due to stroke
- Over 80% CVD deaths occur in low- and middle- income countries.
- By 2030, almost 25 million people will die from CVDs.

# Cardiovascular Disease: Risk Factors

<p><b><i>Major modifiable risk factors</i></b></p> <ul style="list-style-type: none"><li>- High blood pressure</li><li>- Abnormal blood lipids</li><li>- Tobacco use</li><li>- Physical inactivity</li><li>- Obesity</li><li>- Unhealthy diet (salt)</li><li>- Diabetes</li></ul>	<p><b><i>Other modifiable risk factors</i></b></p> <ul style="list-style-type: none"><li>- Low socioeconomic status</li><li>- Mental ill health (depression)</li><li>- Psychosocial stress</li><li>- Heavy alcohol use</li><li>- Use of certain medication</li><li>- Lipoprotein(a)</li></ul>
<p><b><i>Non-modifiable risk factors</i></b></p> <ul style="list-style-type: none"><li>- Age</li><li>- Heredity or family history</li><li>- Gender</li><li>- Ethnicity or race</li></ul>	<p><b><i>“Novel” risk factors</i></b></p> <ul style="list-style-type: none"><li>- Excess homocysteine in blood</li><li>- Inflammatory markers (C-reactive protein)</li><li>- Abnormal blood coagulation (elevated blood levels of fibrinogen)</li></ul>

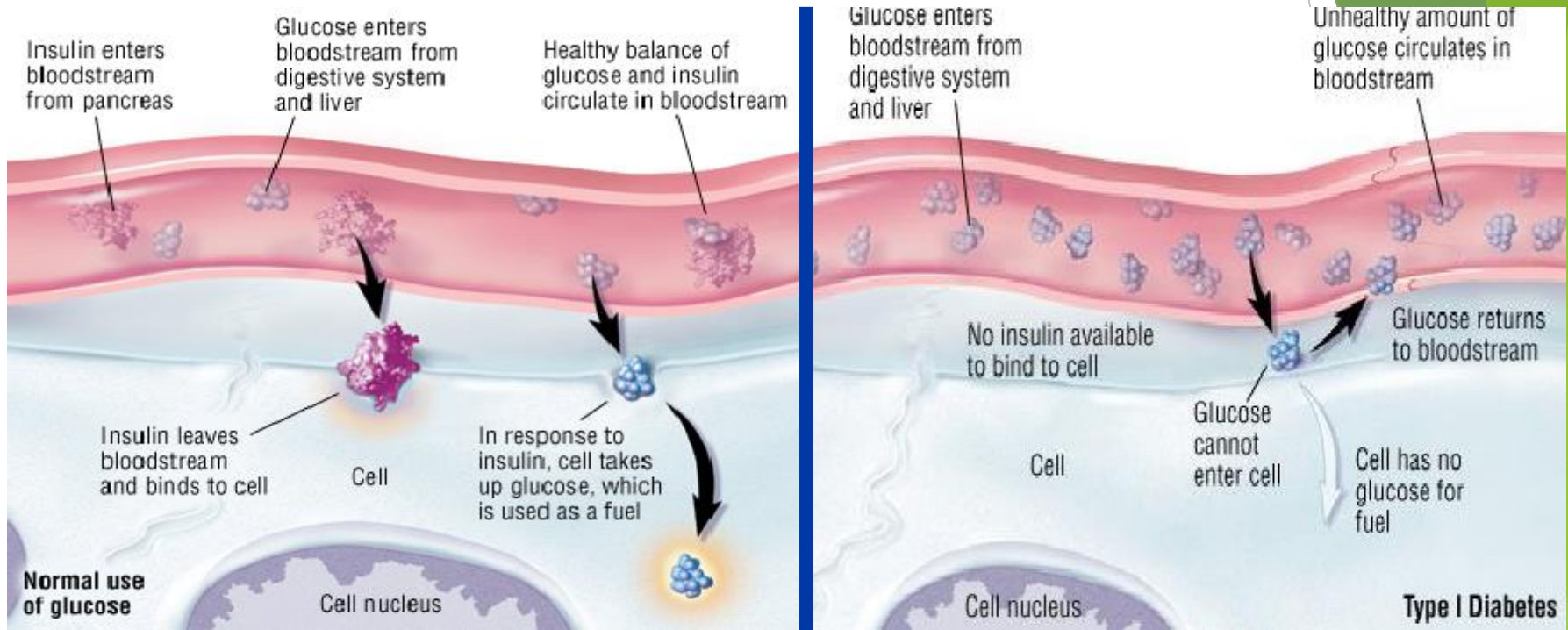
# Diabetes: Definition

- Diabetes is a disorder of metabolism—the way the body uses digested food for growth and energy.
- There are 4 types: Type 1, Type 2, Gestational, and Pre-Diabetes (Impaired Glucose Tolerance).
- Type 2 is caused by modifiable risk factors and is the most common worldwide.
  - >90% of all adult diabetes cases are Type 2

1. <http://www.who.int/mediacentre/factsheets/fs312/en/>

2. National Institute of Diabetes and Digestive and Kidney Diseases, 2012

# Diabetes: Definition





# Diabetes: Burden of Disease

- 347 million people worldwide have diabetes.
- In 2004, an estimated 3.4 million people died from consequences of high blood sugar.
- More than 80% of diabetes deaths occur in low- and middle-income countries.
- WHO projects that diabetes deaths will increase by two thirds between 2008 and 2030.
- Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use can prevent or delay the onset of type 2 diabetes.

1. <http://www.who.int/mediacentre/factsheets/en/>

2. <http://www.NCD.org/factsheets>

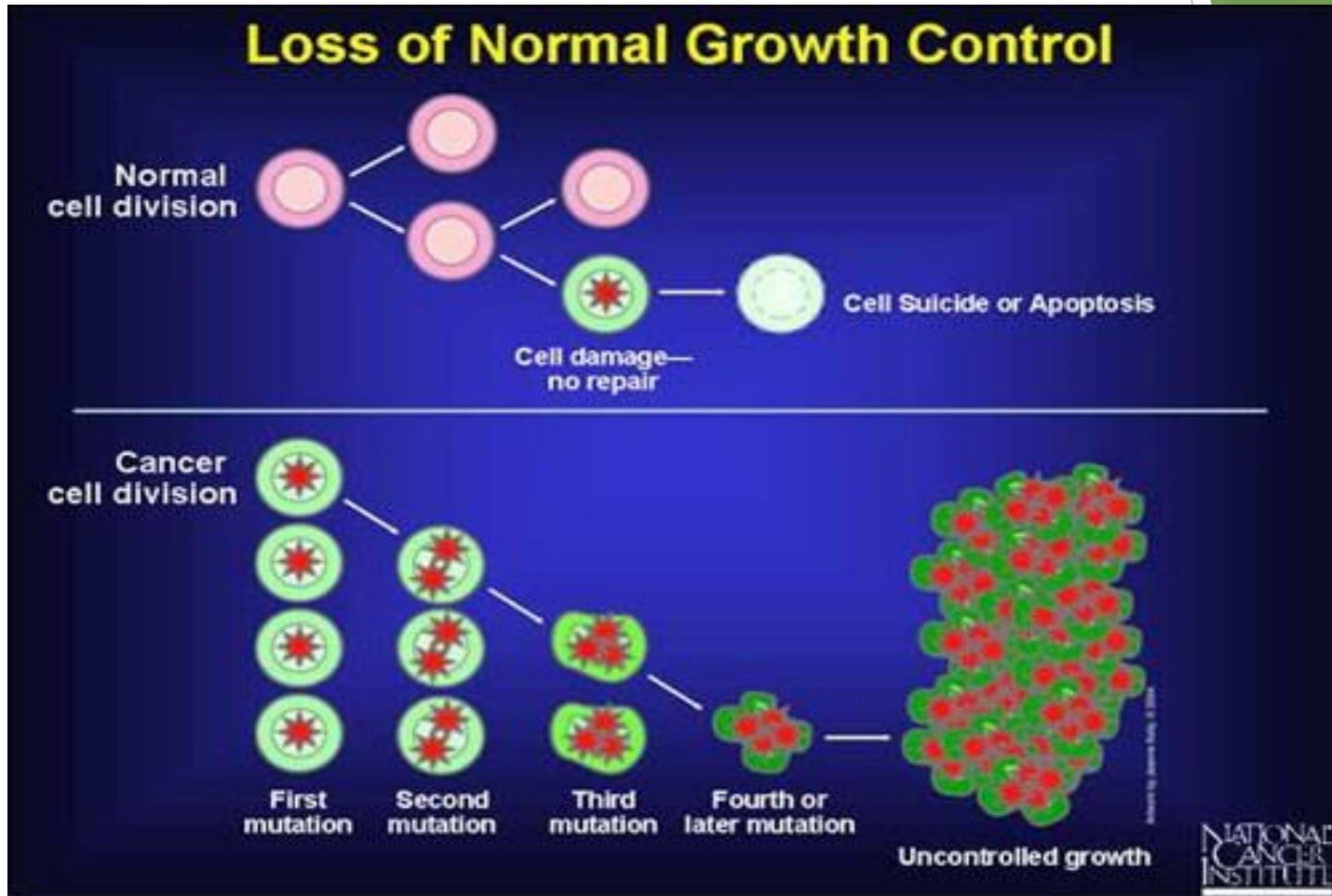
# Diabetes: Risk Factors

<p><b><i>Major modifiable Risk Factors</i></b></p> <ul style="list-style-type: none"><li>- Unhealthy diets</li><li>- Physical Inactivity</li><li>- Obesity or Overweight</li><li>- High Blood Pressure</li><li>- High Cholesterol</li></ul>	<p><b><i>Other Modifiable Risk Factors</i></b></p> <ul style="list-style-type: none"><li>- Low socioeconomic status</li><li>- Heavy alcohol use</li><li>- Psychological stress</li><li>- High consumption of sugar-sweetened beverages</li><li>- Low consumption of fiber</li></ul>
<p><b><i>Non-modifiable Risk Factors</i></b></p> <ul style="list-style-type: none"><li>- Increased age</li><li>- Family history/genetics</li><li>- Race</li><li>- Distribution of fat</li></ul>	<p><b><i>Other Risk Factors</i></b></p> <ul style="list-style-type: none"><li>- Low birth weight</li><li>- Presence of autoantibodies</li></ul>

# Cancer: Definition

- Generic term for a large group of diseases that can affect any part of the body.
- “Rapid creation of abnormal cells that grow beyond their usual boundaries, and which can then invade adjoining parts of the body and spread to other organs.” (WHO, 2012)
- Benign tumors
- Malignant tumors

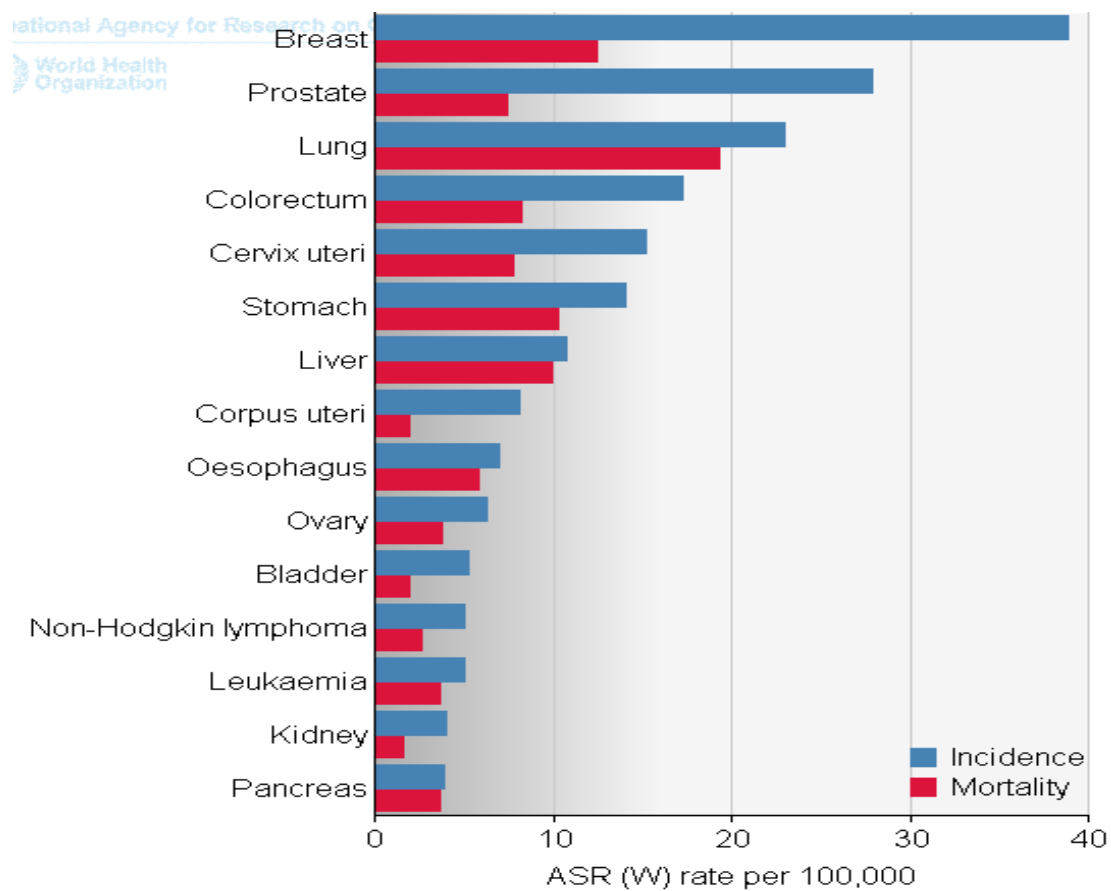
# Cancer: Definition (*cont.*)



# Global Burden of Cancer

- 7.6 million people died from cancer in 2008.
- 70% of all cancer deaths occur in low- and middle-income countries.
- Deaths from cancer are estimated to reach 13.1 million by 2030.
- About 30% of cancers are attributable to behavior risk factors.

## Estimated age-standardised incidence and mortality rates: total population



# Cervical Cancer: Definition

Cancer of the female reproductive system:

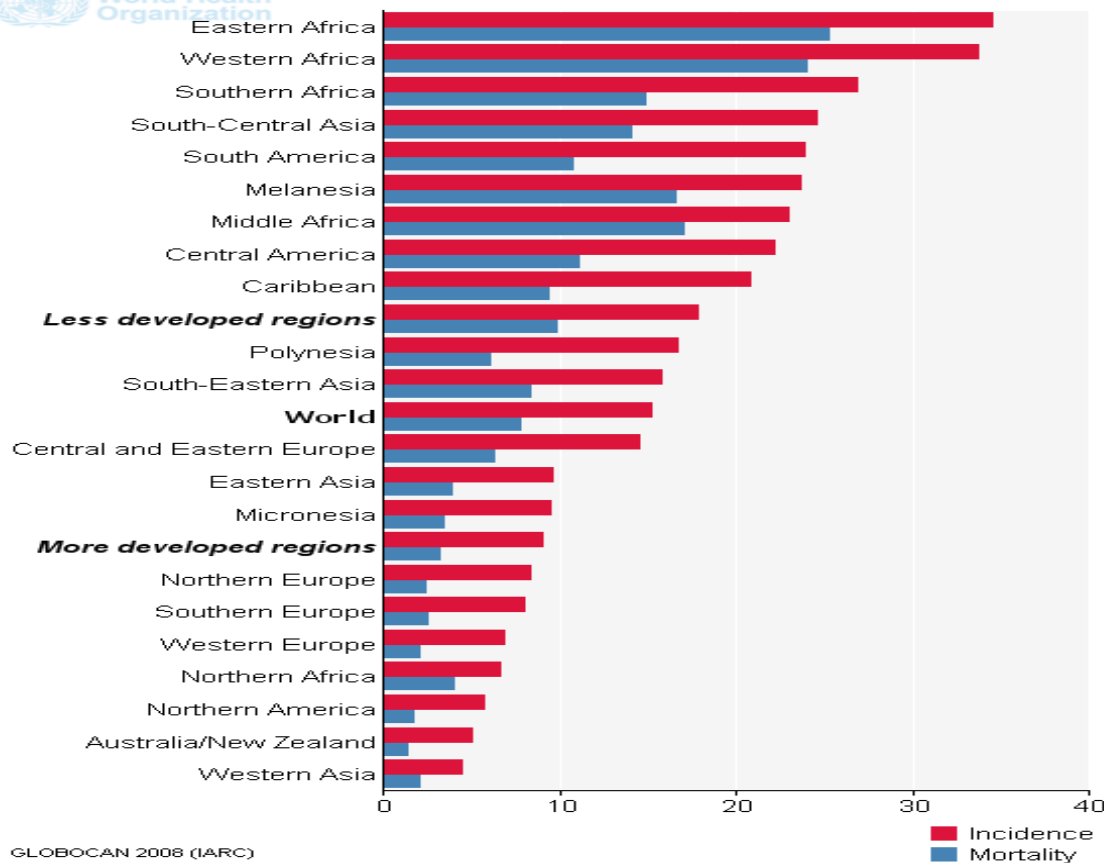
- Two cell types present (*squamous and glandular*)
- Tend to occur where the two cell types meet
- 99% of cases linked to genital infection with human papillomavirus (HPV)



# Cervical Cancer

Estimated age-standardised rates (World) per

International Agency for Research on Cancer



GLOBOCAN 2008 (IARC)

■ Incidence  
■ Mortality



# Cervical Cancer: Risk Factors

- Human papilloma virus infection (HPV)
- Smoking
- Immune Deficiencies
- Poverty
- No access to PAP screening
- Family history of cervical cancer

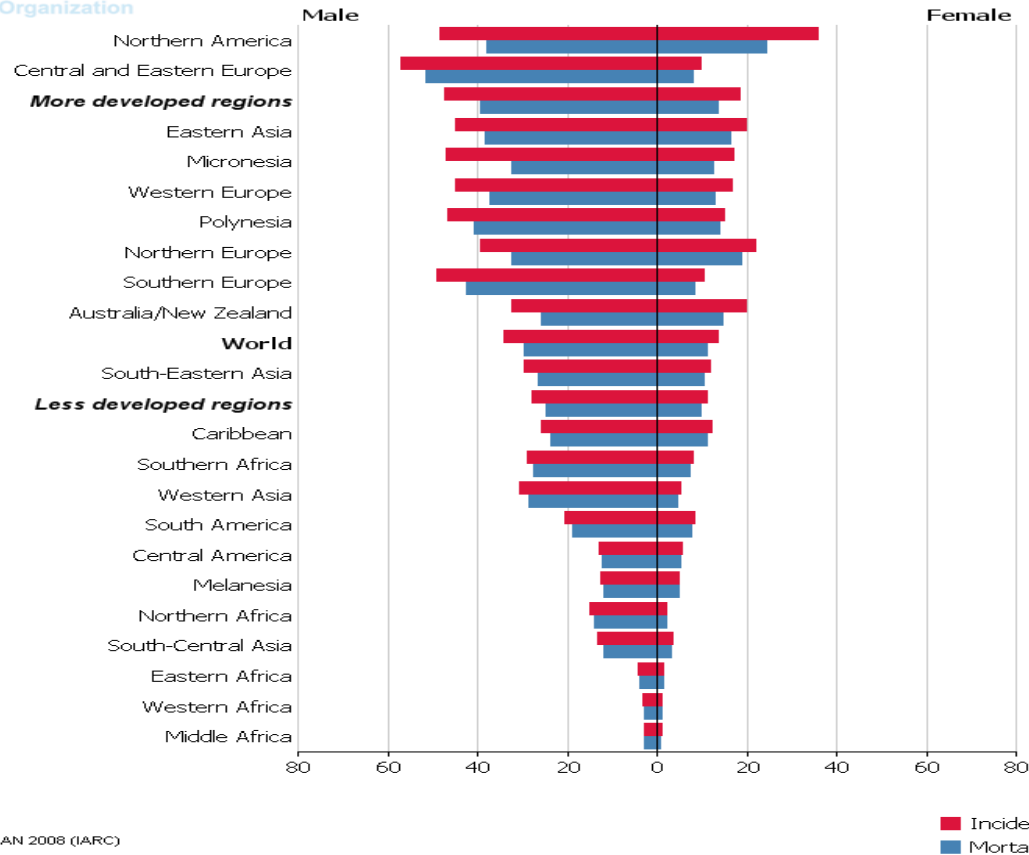
# Lung Cancer: Definition

- Cancer that forms in tissues of the lung, usually in the cells lining air passages
- Leading cause of cancer death globally, 1.37 million deaths in 2008
- Affects more men than women
- Two main types:
  - Small cell lung cancer
  - Non-small cell lung cancer

# Lung Cancer

## Incidence and Mortality in 2008: Both Sexes

International Agency for Research on Cancer



GLOBOCAN 2008 (IARC)

Source: <http://globocan.iarc.fr/>

# Lung Cancer: Risk Factors

- Smoking cigarettes, pipes, or cigars - now or in the past
- Being exposed to second-hand smoke
- Being treated with radiation therapy to the breast or chest
- Being exposed to asbestos, radon, chromium, nickel, arsenic, soot, or tar
- Living where there is air pollution

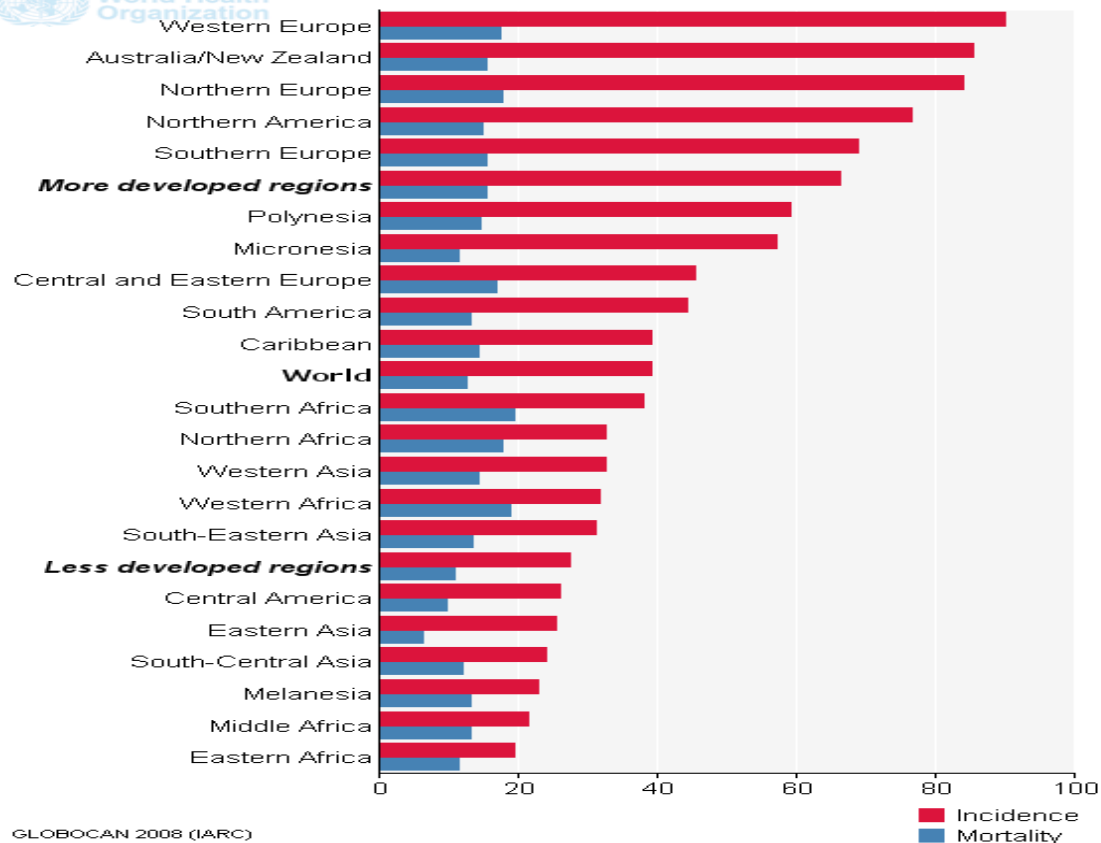
# Breast Cancer: Definition

- Cancer that forms in the tissues of the breast, usually in the ducts or in the lobules
- Occurs commonly in women, rarely occurs in men
- 1 of 8 women will be diagnosed with breast cancer in her lifetime.

# Breast Cancer

## Incidence and Mortality in 2008: Both Sexes

International Agency for Research on Cancer



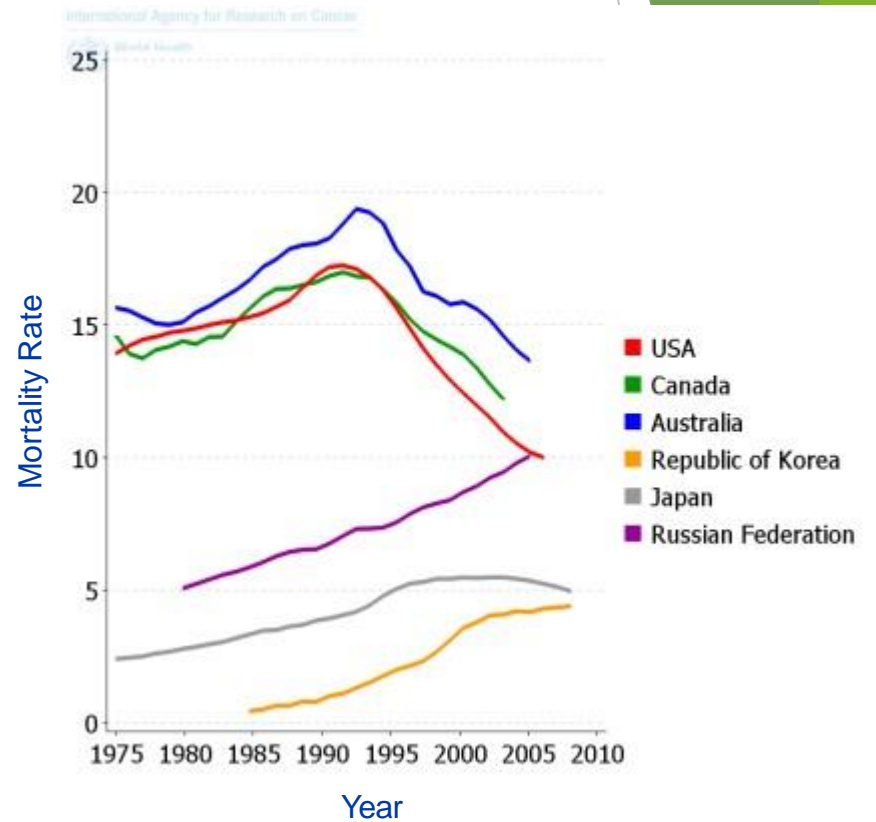
GLOBOCAN 2008 (IARC)

# Breast Cancer: Risk Factors

- Hormone therapies
- Weight and physical activity
- Race
- Genetics or family history
  - BRCA1 and BRCA2 genes
- **Age** is the most reliable risk factor!
  - Risk increases with age

# Prostate Cancer

- 2<sup>nd</sup> most common cancer among men
- The cancer develops inside of the prostate gland.
- Risk factors: age, race, obesity, weight gain

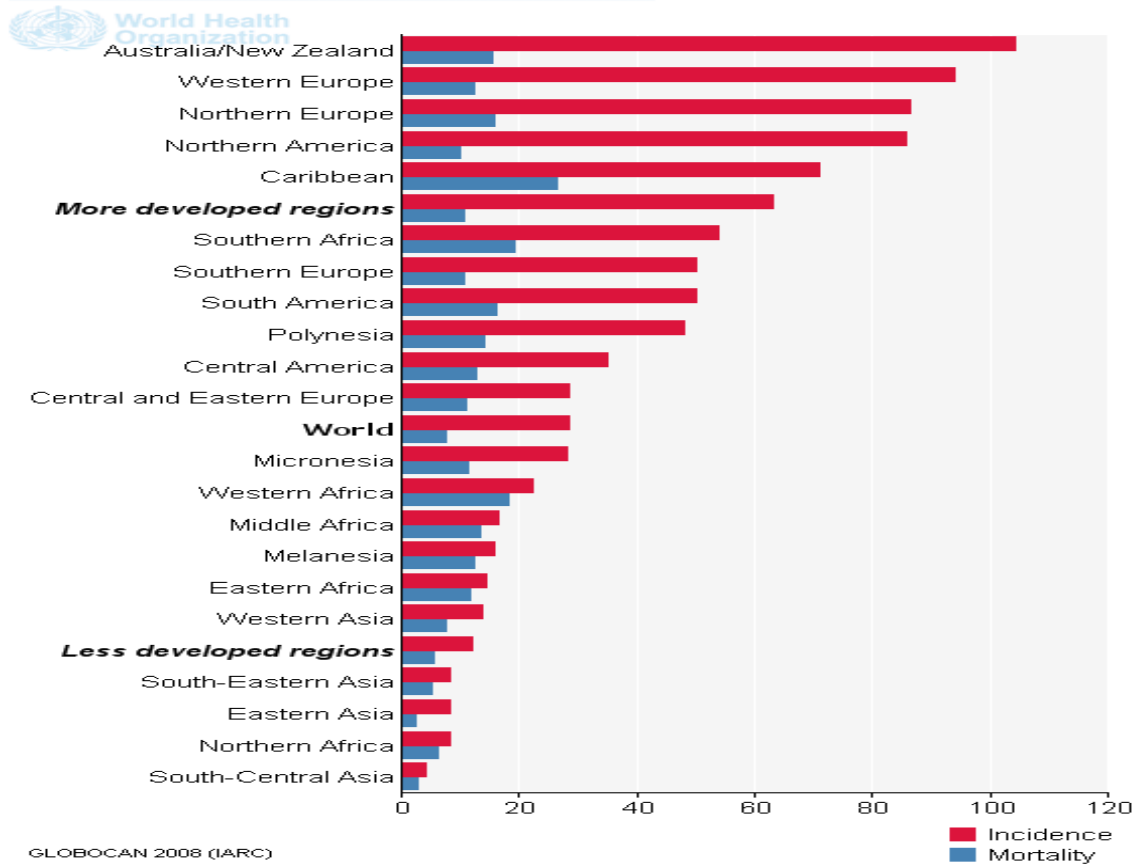




# Prostate Cancer

## Incidence and Mortality in 2008: Total

International Agency for Research on Cancer



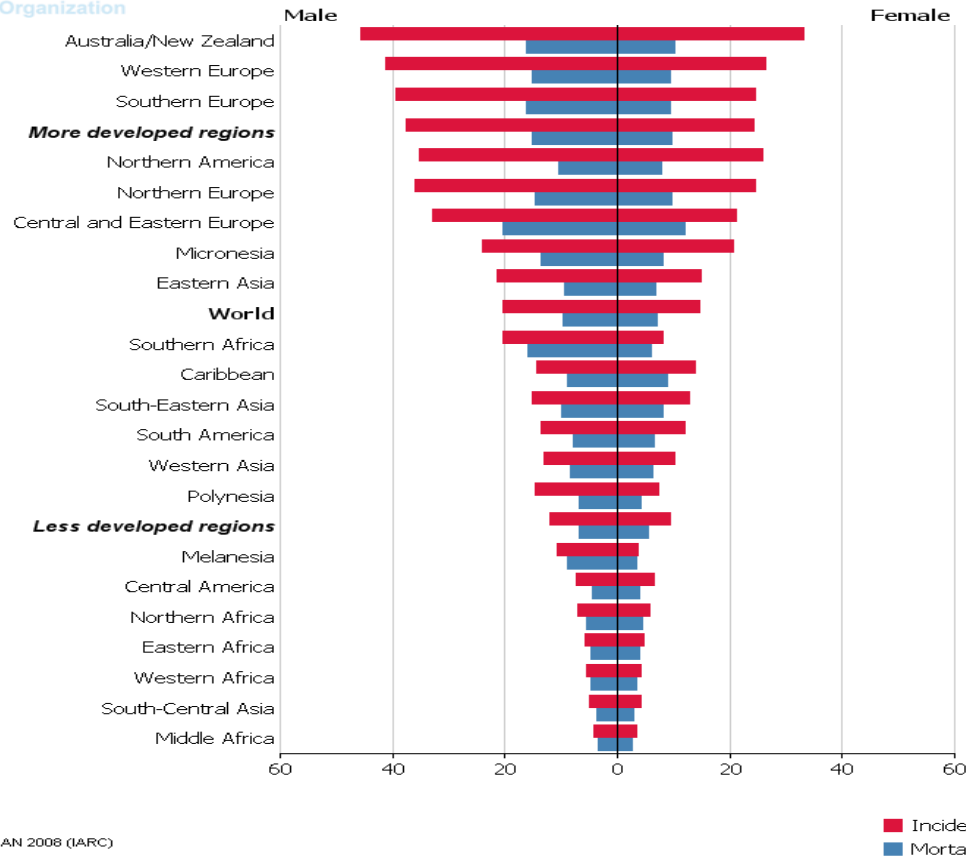
# Colorectal Cancer

- 3<sup>rd</sup> most common type of cancer
- Forms in the lower part of the digestive system (large intestine)
- Risk Factors include:
  - Aging
  - Black race
  - Unhealthy diet and low exercise
  - Diabetes
  - Family history of colorectal cancer

# Colorectal Cancer

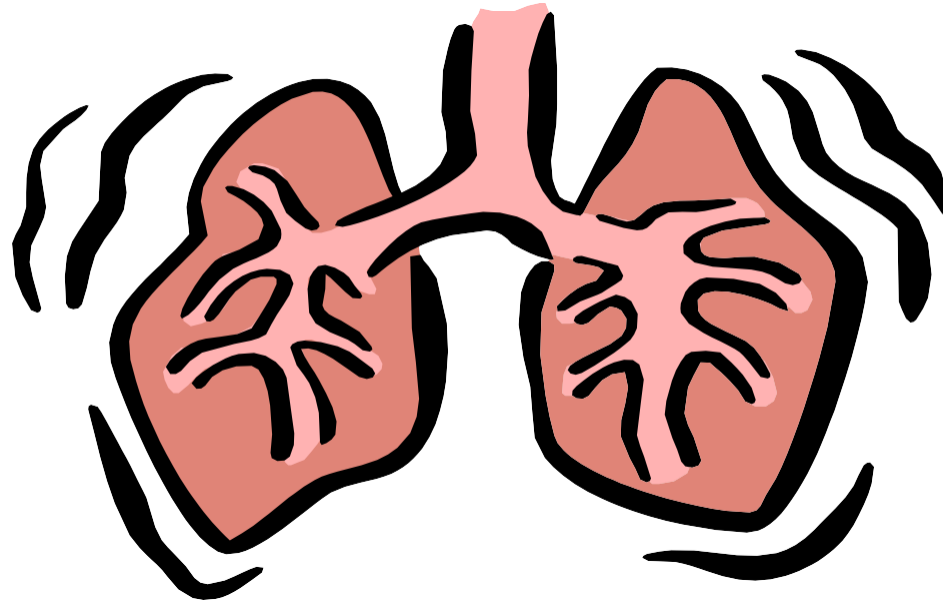
## Incidence and Mortality in 2008: Both Sexes

International Agency for Research on Cancer



GLOBOCAN 2008 (IARC)

Overview of NCDs and Risk Factors  
<http://globocan.iarc.fr/>



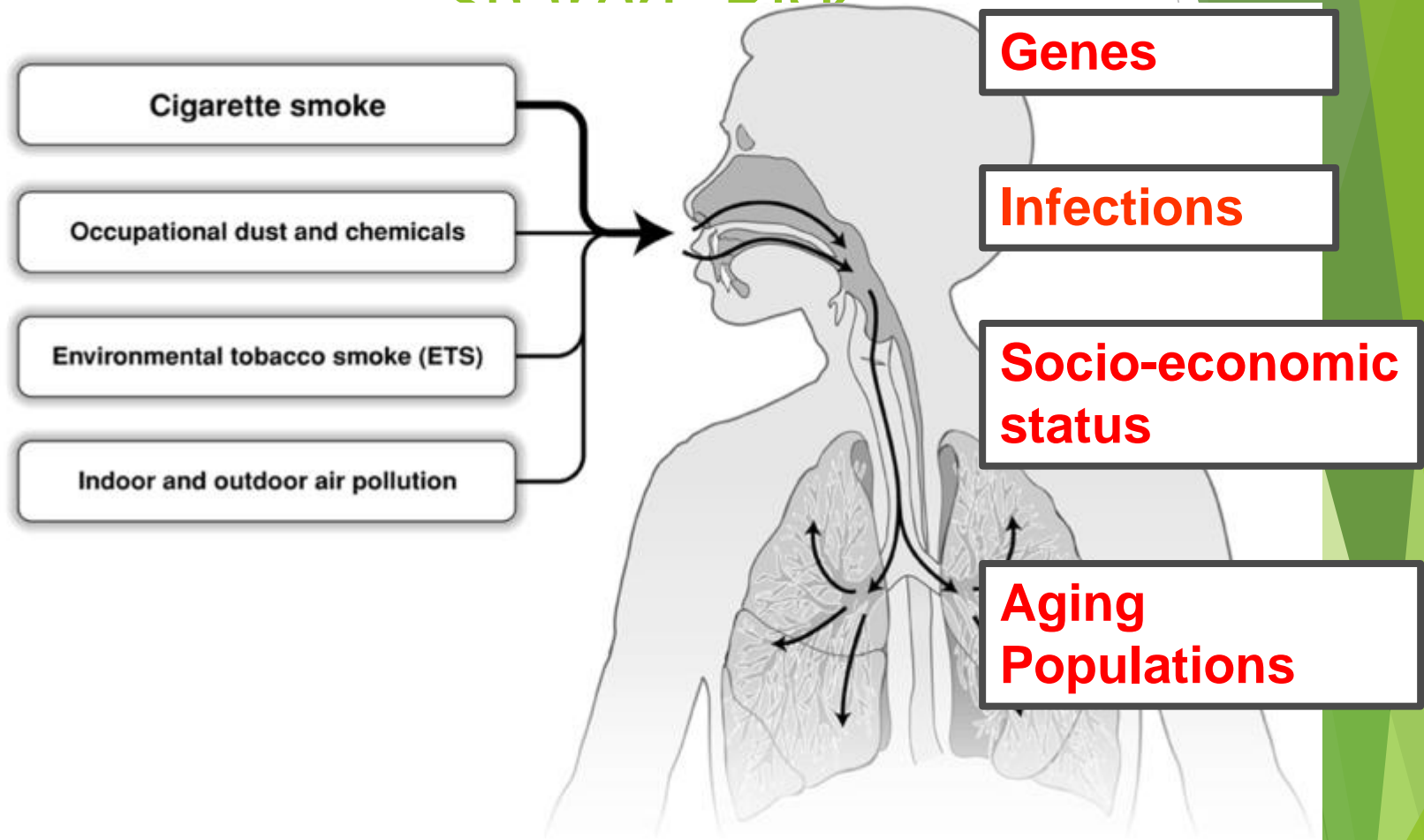
# CHRONIC RESPIRATORY DISEASES

Overview of NCD's and Risk Factors

# Global Burden of Chronic Respiratory Disease

- A leading cause of death
- High under-diagnoses rates
- 90% of deaths occur in low-income countries

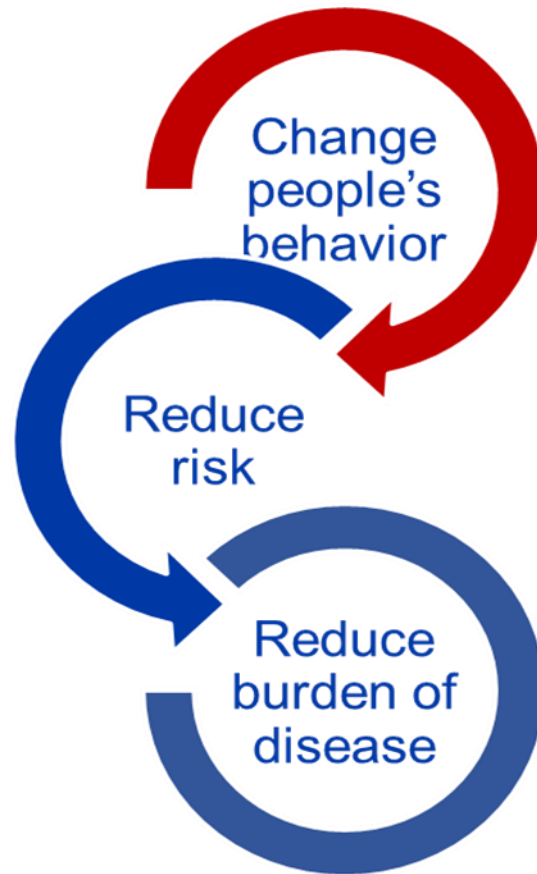
# Chronic Respiratory Diseases: Shared Risk



# Why Risk Factors?

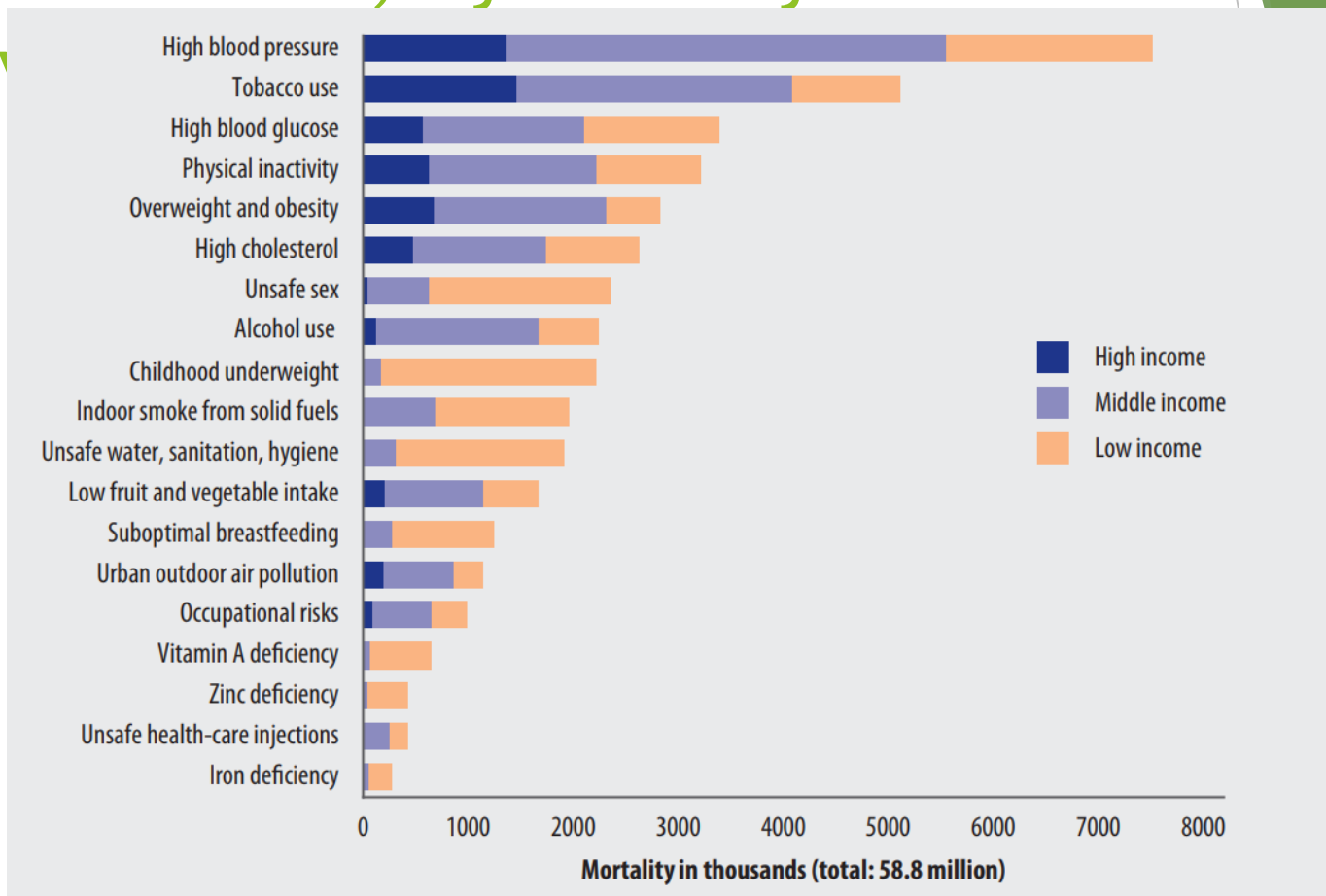
- Surveillance for non-communicable disease can be difficult because of:
  - Lag time between exposure and health condition,
  - More than one exposure for a health condition, and
  - Exposure linked to more than one health condition.
- Interventions that target risk factors are needed to prevent disease.

# Risk Factor Surveillance





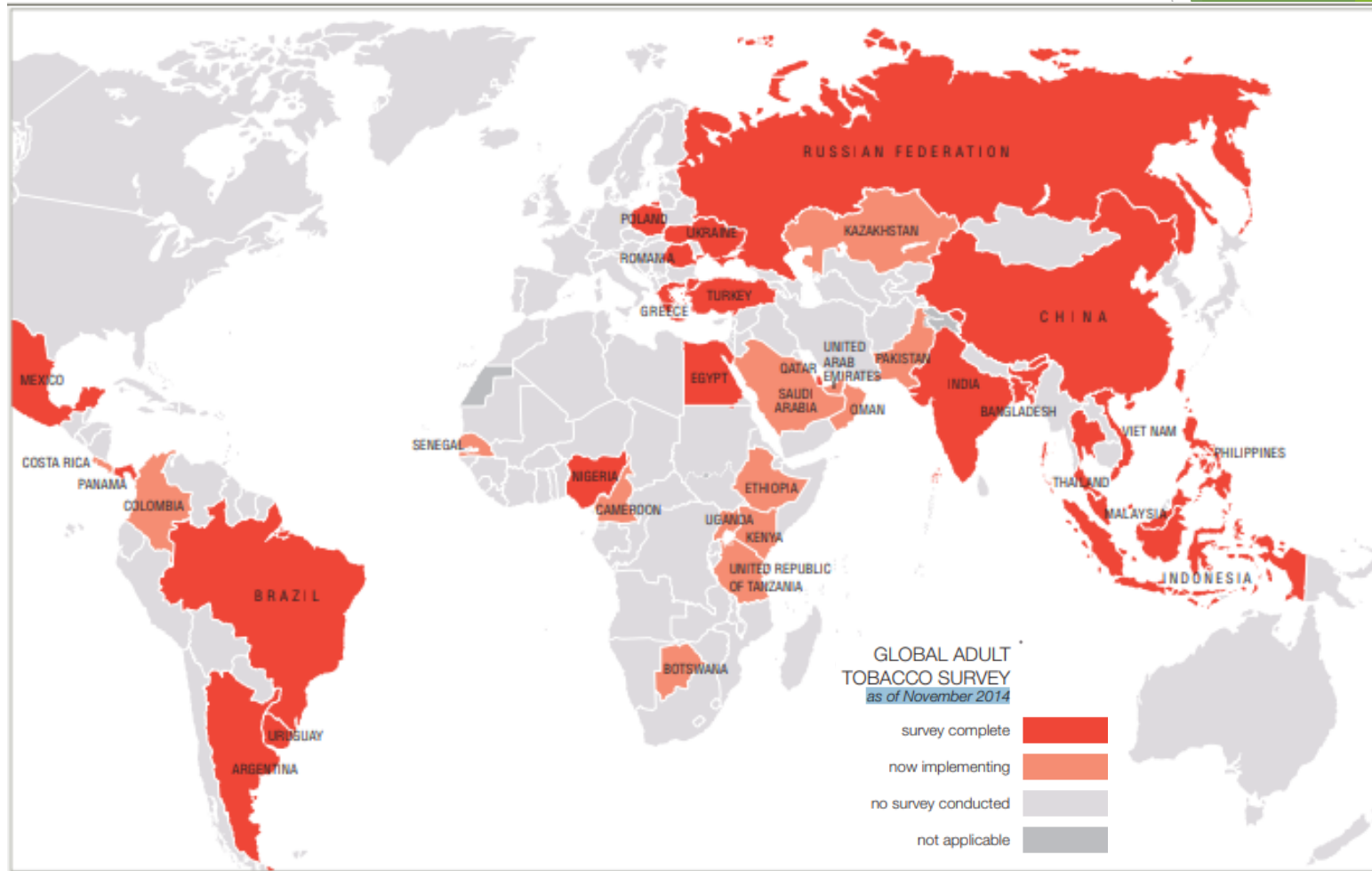
# Deaths attributed to 19 leading risk factors, by country income level



# Tobacco Use

- Tobacco kills up to half of its users.
- Tobacco kills nearly 6 million people each year.
- Annual death toll could rise to more than 8 million by 2030.
- Nearly 80% of the world's 1 billion smokers live in low- and middle-income countries.

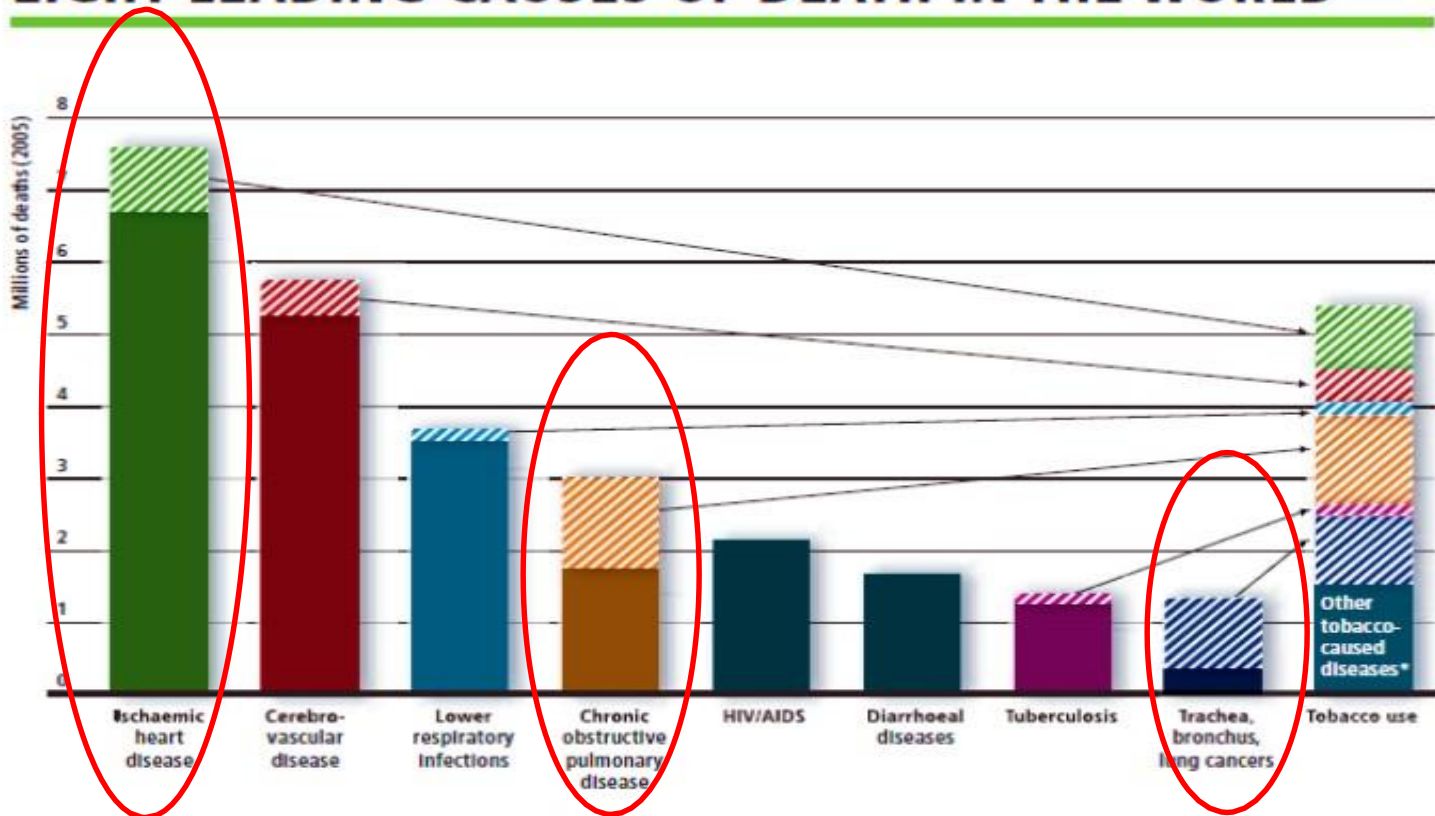
# Global Adult Tobacco Survey



Overview of NCD's and Risk Factors  
[http://www.cdc.gov/tobacco/global/gtss/tobacco\\_atlas/index.htm](http://www.cdc.gov/tobacco/global/gtss/tobacco_atlas/index.htm)

# Tobacco Use: Health Effects

## TOBACCO USE IS A RISK FACTOR FOR SIX OF THE EIGHT LEADING CAUSES OF DEATH IN THE WORLD



Mathers CD, Loncar D. *Projections of global mortality and burden of disease from 2002 to 2030*. PLoS Medicine, 2006, 3(11): e142

Overview of Global Risk Factors

# Tobacco Use: Health Effects

## *(cont.)*

Among smokers:

- Cancer
  - Coronary heart disease
  - Diseases of the lungs
  - Peripheral vascular disease
  - Stroke
  - Fetal complications and stillbirth
- Second-hand smoke causes:
    - Heart disease, including heart attack
    - Lung cancer





# DIET

Overview of NCD's and Risk Factors

# Global Changes in Diet

- Most countries have increased overall daily consumption of:
  - Daily calories,
  - Fat and meats, and
  - Energy dense and nutrient-poor foods such as:
    - Starches
    - Refined sugars
    - Trans-fats

# Unhealthy Diet: Health Effects

- Coronary heart disease
- Stroke
- Cancer
- Type 2 diabetes
- Hypertension
- Diseases of the liver and gallbladder
- Obesity







# PHYSICAL INACTIVITY

# Global Changes in Physical Activity

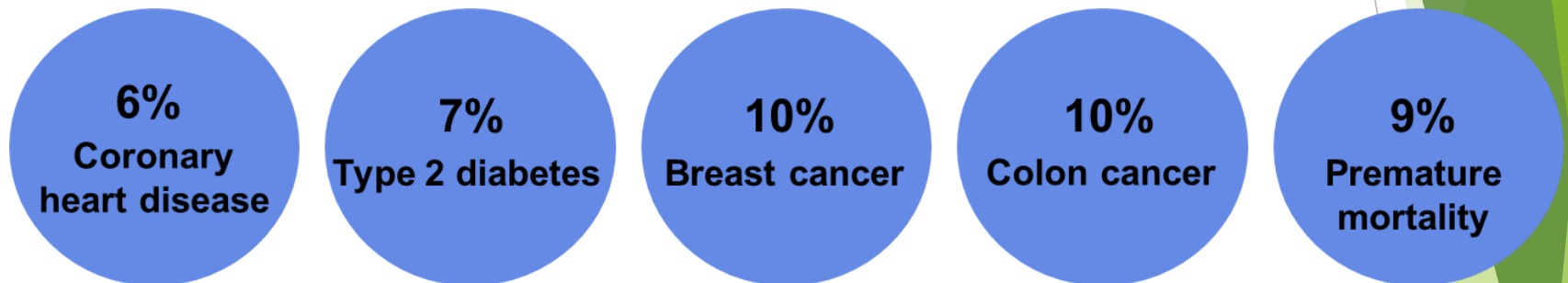
- 31% of the world's population does not get enough physical activity.
- Many social and economic changes contribute to this trend:
  - Aging populations,
  - Transportation, and
  - Communication technology.

1. <http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html>

2. <http://www.sciencedirect.com/science/article/pii/S0140673612608988>

# Global Changes in Physical Activity *(cont.)*

**~ 6-10% of major NCDs worldwide is attributable to physical inactivity**



Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT; Lancet Physical Activity Series Working Group. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet*. 2012 Jul 21;380(9838):219-29

# Physical Activity: Health Effects

## ▶ Reduces:

- ← High blood pressure
- ← Adverse lipid profile
- ← Arthritis pain
- ← Psychiatric issues



## ▶ Reduces risk of:

- ← Type 2 diabetes
- ← Certain cancers
- ← Heart attacks
- ← Stroke
- ← Falls
- ← Early death



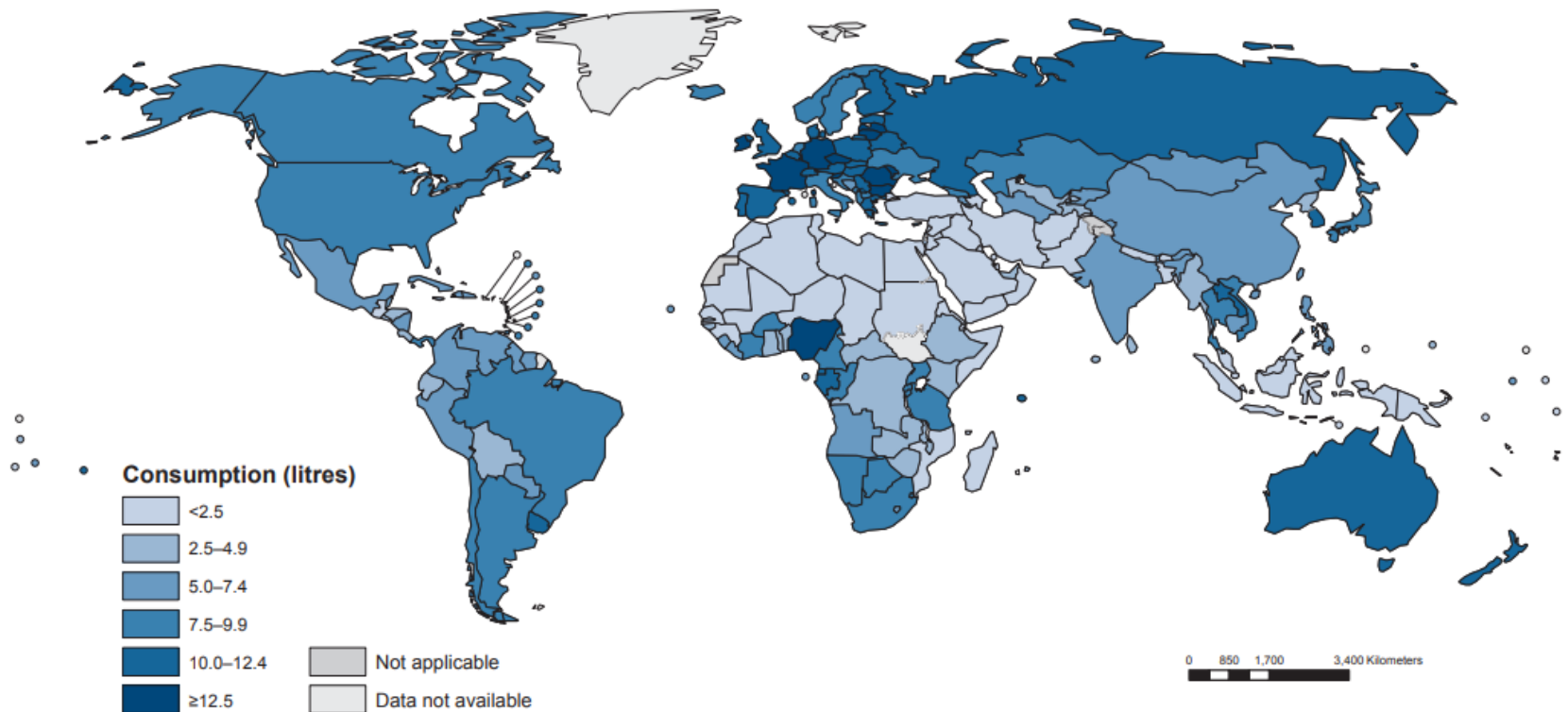
# ALCOHOL USE

# Global Alcohol Consumption

- 11.5% of all global drinkers are episodic, heavy users.
  - 2.5 million people die from alcohol consumption per year
- The majority of adults consume at low-risk levels.
- Estimated worldwide consumption of alcohol has remained relatively stable.

# Global Alcohol Consumption

**Figure 3.3** Total alcohol per capita consumption (APC) (15+ years; in litres of pure alcohol), 2016



# Use of Alcohol: Definitions

## Excessive drinking, per day

- Heavy drinking – on average



>



>



- Binge drinking – single occasion



IV



IV





# Alcohol Use: Effects

## Immediate effects:

- Diminished brain function
- Loss of body heat
- Fetal damage
- Risk for unintentional injuries
- Risk for violence
- Coma and death

## Long-term effects:

- Liver diseases
- Cancers
- Hypertension
- Gastrointestinal disorders
- Neurological issues
- Psychiatric issues

# Metabolic Risk Factors

What are the four **metabolic** risk factors?

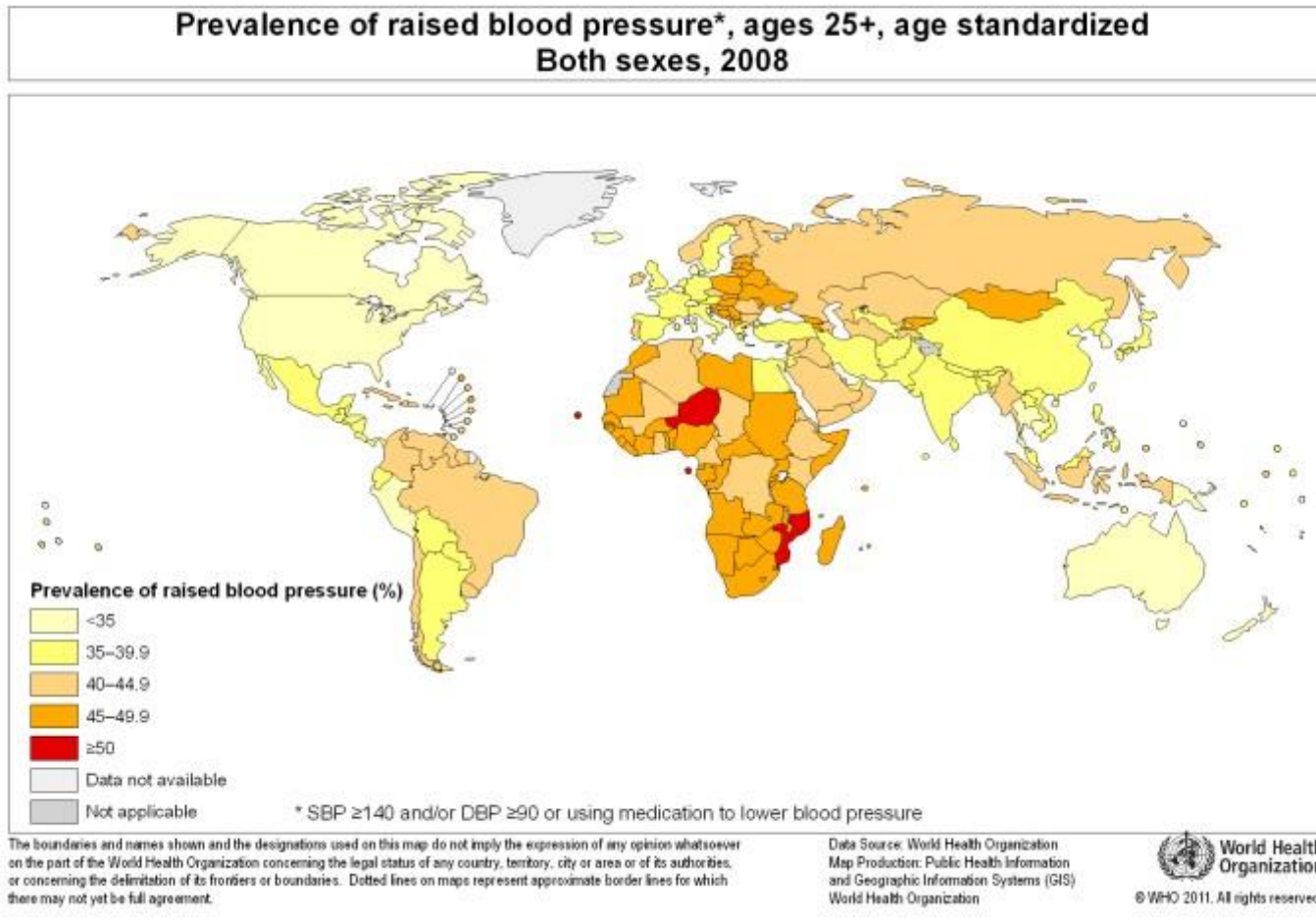
1. Raised Blood Pressure (Hypertension)
2. Raised Cholesterol
3. Raised Blood Glucose
4. Overweight and Obesity

# Raised Blood Pressure

- Hypertension
- (Systolic)/(Diastolic) in mm of Hg (mercury)
- Systolic = amount of force your arteries use when the heart pumps
- Diastolic = amount of force your arteries use when the heart relaxes

Measurement	Normal	Pre-Hypertensive	Hypertensive
<b><i>Systolic</i></b> mmHg	<120	120-139	140+
<b><i>Diastolic</i></b> mmHg	<80	80-89	90+

# High Blood Pressure



1. US Department of Health & Human Services, National Heart, Lung, and Blood

2. [http://gamapserver.who.int/gho/interactive\\_charts/ncd/risk\\_factors/blood\\_pressure\\_prevalence/atlas.html](http://gamapserver.who.int/gho/interactive_charts/ncd/risk_factors/blood_pressure_prevalence/atlas.html)

# Raised Blood Pressure: Health Effects

- ← Leading risk factor for stroke
- ← Major risk factor for coronary heart disease
- ← In some age groups, the risk of CVD doubles for each increment of 20/10 mmHg of blood pressure
- ← Other complications of raised blood pressure:
  - Heart failure
  - Peripheral vascular disease
  - Renal impairment
  - Retinal hemorrhage
  - Visual impairment

# Hypertension and Excessive Sodium Intake

- Sodium, through hypertension, is a major cause of cardiovascular disease deaths and disability.
- About 10% of cardiovascular disease is caused by excess sodium intake.
- 8.5 million deaths could be prevented over 10 years if sodium intake were reduced by 15%.

# Sources of Sodium

- People are unaware of how much dietary sodium they are eating.
- In the U.S. 75% of sodium consumed comes from processed and restaurant foods.
- In China and Japan, 75% of sodium consumed comes from cooking with high sodium products.

# Recommendations and Actual Intakes WHO/PAHO

- **Recommendations**
  - A population salt intake of less than 5 grams or approximately 2,000 milligrams of sodium, per person per day is recommended to reach national targets or in their absence. This level was recommended for the prevention of cardiovascular diseases.
- **Actual Intake**
  - Latest global estimates show that average sodium intake varies from 2,000 to 7,200 milligrams of sodium per person per day.



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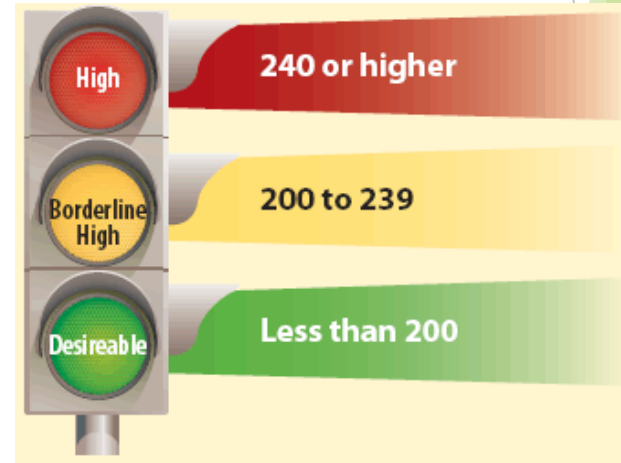
# Raised Total Cholesterol

**HDL:** High density lipoproteins; often called “good cholesterol”

**LDL:** Low density lipoproteins; often called “bad cholesterol”

**VLDL:** Very low density lipoproteins; has highest amount of triglycerides

**Triglycerides:** Type of fat found in your blood (stored in fat cells)



# Global Burden of Raised Total Cholesterol

- In 2008, global prevalence of raised total cholesterol among adults ( $\geq 5.0$  mmol/l) was 39% (37% for males and 40% for females).
- Estimated to cause 2.6 million deaths.
- What is the prevalence of raised total cholesterol in your country?
  - Search the WHO Global Health Observatory website:  
[http://www.who.int/gho/ncd/risk\\_factors/en/index.html](http://www.who.int/gho/ncd/risk_factors/en/index.html)

# Raised Total Cholesterol: Health Effects

- Increases risks of heart disease and stroke
  - Globally, 1/3 of ischaemic heart disease is attributable to high cholesterol
  - A 10% reduction in serum cholesterol in men aged 40 has been reported to result in a 50% reduction in heart disease within 5 years
  - A 10% reduction in serum cholesterol in men aged 70 years can result in an average 20% reduction in heart disease occurrence in the next 5 years

# Elevated Glucose

- Sugar produces fuel and energy for our cells
- Insulin helps control the amount of glucose in our bodies

# Global Burden of Elevated Glucose

- In 2004, it was estimated that elevated glucose resulted in 3.4 million deaths (5.8% of all deaths).
- Globally, approximately 9% of adults aged 25 and over had elevated blood glucose in 2008.

# Elevated Glucose: Health Effects

- Elevated glucose levels can lead to type 2 diabetes.
  - Diabetes: leading cause of renal failure
  - Lower limb amputations are at least 10 times more common in people with diabetes than in non-diabetic people
- Raised glucose is a major cause of heart disease and renal disease.

# Overweight and Obesity

- Overweight and obesity are defined as "abnormal or excessive fat accumulation that presents a risk to health." (1)
- BMI - the Body Mass Index
  - BMI = (weight in kg)/(height in meters, squared)*
  - Between 25 and 29.9 indicates overweight
  - 30 or higher indicates obesity
- Skinfold Thickness Test
- Waist-to-Hip Circumference Ratio
  - Men > 102 cm are considered high risk
  - Women > 88 cm are considered high risk