Diabetes mellitus

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Learning Objectives

- At the end of the presentation the students should be able to ;
  - Understand Global prevalence of diabetes
  - Understand the Epidemiology of diabetes in KSA
  - List the risk factors of diabetes
  - List complications of diabetes
  - Discuss preventive measures within the framework of NCDs
  - Know preventive programs in KSA towards DM

Diabetes Mellitus

Definition

A metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both.

Main types of diabetes

- **Type 1** (5-10%) – due to autoimmune b-cell destruction, usually leading to absolute insulin deficiency. Usually affects younger age group (not always)

- **Type 2** (90 - 95%) – due to a progressive loss of β-cell insulin secretion frequently on the background of insulin resistance. Usually older age group (not always).

- **Gestational diabetes** - diabetes diagnosed in the second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation

- **Specific types of diabetes due to other causes** - e.g., neonatal, maturity-onset diabetes of the young, diseases of the exocrine pancreas, drug- or chemical-induced diabetes.

- **Impaired glucose tolerance (IGT) and impaired fasting glycaemia (IFG)** - intermediate conditions in the transition between normal blood glucose levels and diabetes (especially type 2).

Symptoms

- Increase frequency of Urine (pee)
  - Specially nocturnal
- Increase thirst
- Weight loss
- Increase appetite
- Blurred vision
- Tingling hands and feet
- Easy fatigability
- Dry skin
- Slow healing wounds

CDC, 2018

Diabetes	
Fasting plasma glucose 2-h plasma glucose* HbA1c	≥ 7.0 mmol/L (126 mg/dl) or ≥ 11.1 mmol/L (200 mg/dl) or ≥ 6.5%
Impaired glucose tolerance (IGT)	
Fasting plasma glucose 2-h plasma glucose*	<7.0 mmol/L (126 mg/dl) and ≥ 7.8 and <11.1 mmol/L (140 mg/dl and 200 mg/dl)
Impaired fasting glucose (IFG)	
Fasting plasma glucose 2-h plasma glucose*	6.1 to 6.9 mmol/L (110 mg/dl to 125 mg/dl) and (if measured) <7.8 mmol/L (140 mg/dl)
Gestational diabetes (GDM)	
One or more of the following: Fasting plasma glucose 1-h plasma glucose** 2-h plasma glucose	 5.1–6.9 mmol/L (92–125 mgl/dl) ≥ 10.0 mmol/L (180 mg/dl) 8.5–11.0 mmol/L (153–199 mg/dl)

Venous plasma glucose 2 hours after ingestion of 75 g oral glucose load

** Venous plasma glucose 1 hour after ingestion of 75 g oral glucose load

Key facts

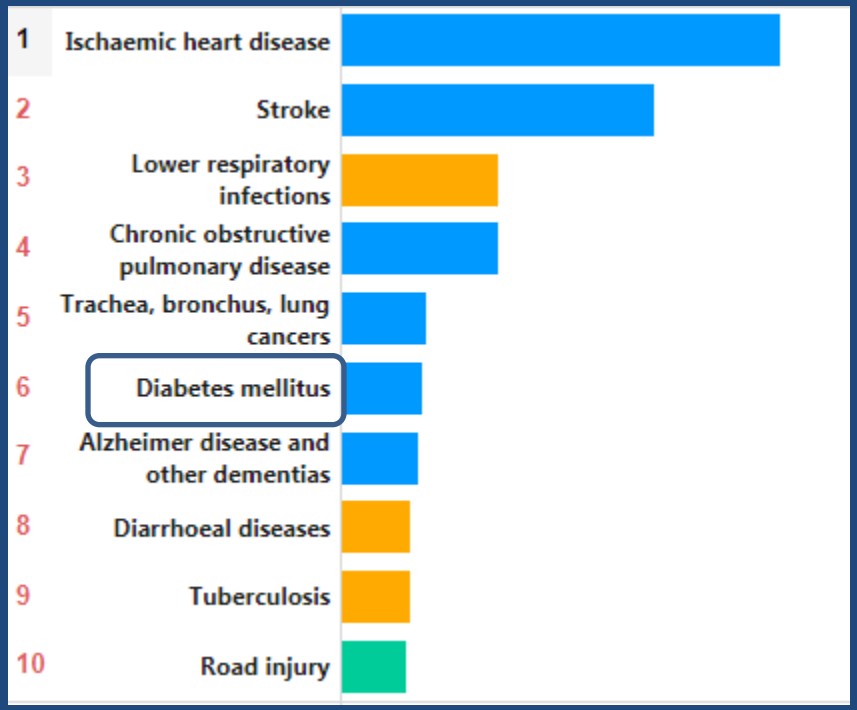
- The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014.
- The global prevalence of diabetes* among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014.
- Diabetes prevalence has been rising more rapidly in middle- and low-income countries.
- Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation.
- In 2015, an estimated 1.6 million deaths were directly caused by diabetes. Another 2.2 million deaths were attributable to high blood glucose in 2012**.
- Almost half of all deaths attributable to high blood glucose occur before the age of 70 years. WHO projects that diabetes will be the seventh leading cause of death in 2030.
- Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use are ways to prevent or delay the onset of type 2 diabetes.
- Diabetes can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications.

* Defined as FBG ≥ 7 mmol/L, or on medication for raised blood glucose, or with a history of diagnosis of diabetes.

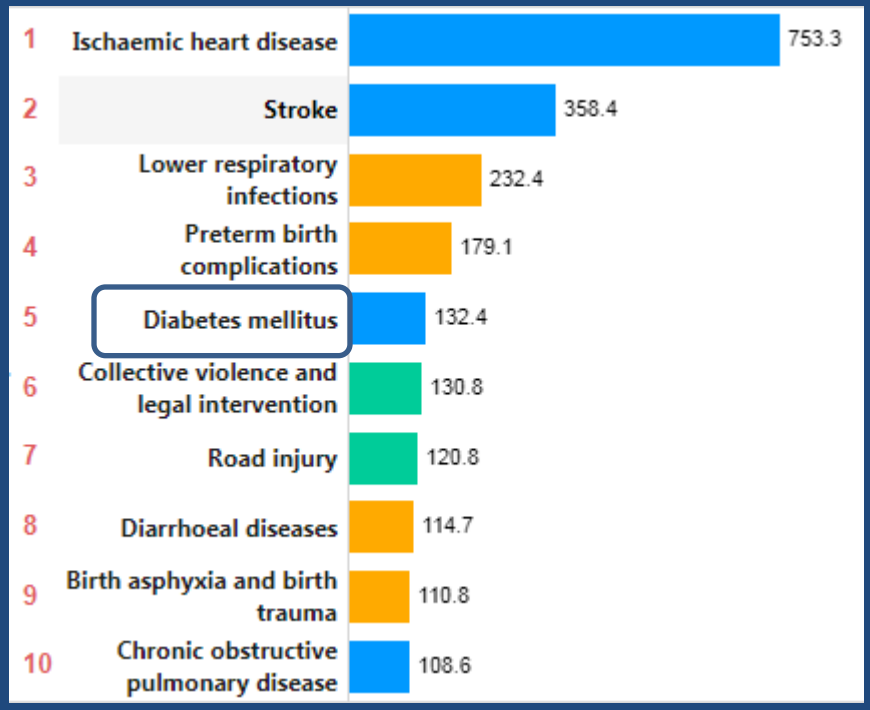
** High blood glucose is defined as a distribution of FBG in a population that is higher than the theoretical distribution that would minimize risks to health (derived from epidemiological studies). High blood glucose is a statistical concept, not a clinical or diagnostic category

Top 10 causes of death

World, 2015



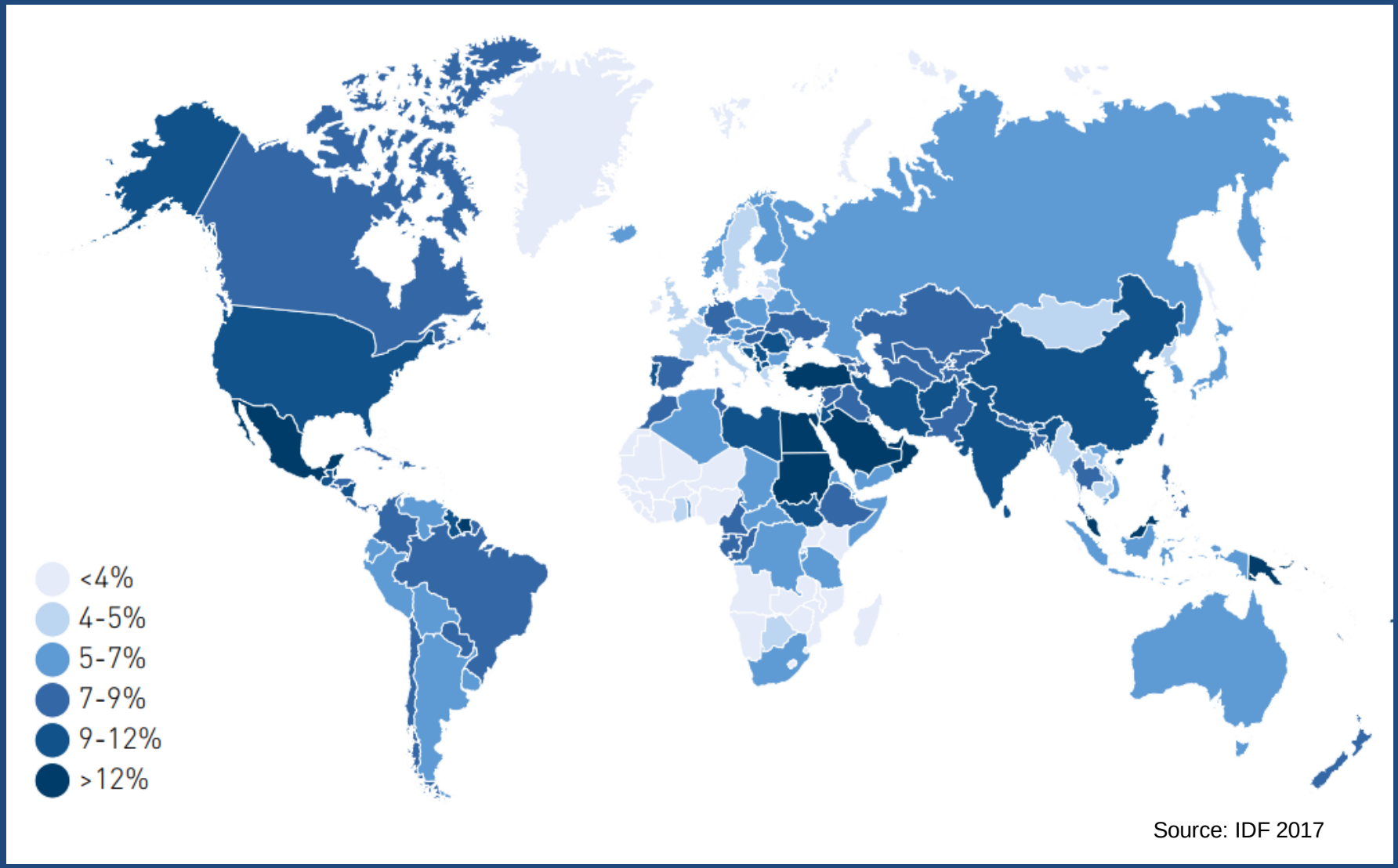
EMRO, 2015



Crude death rates (per 100,000)

Global Health Observatory (GHO) data

Estimated age-adjusted prevalence of diabetes in adults (20-79 years), 2017



Source: IDF 2017

Estimated prevalence and number of people with diabetes (adults 18+ years)

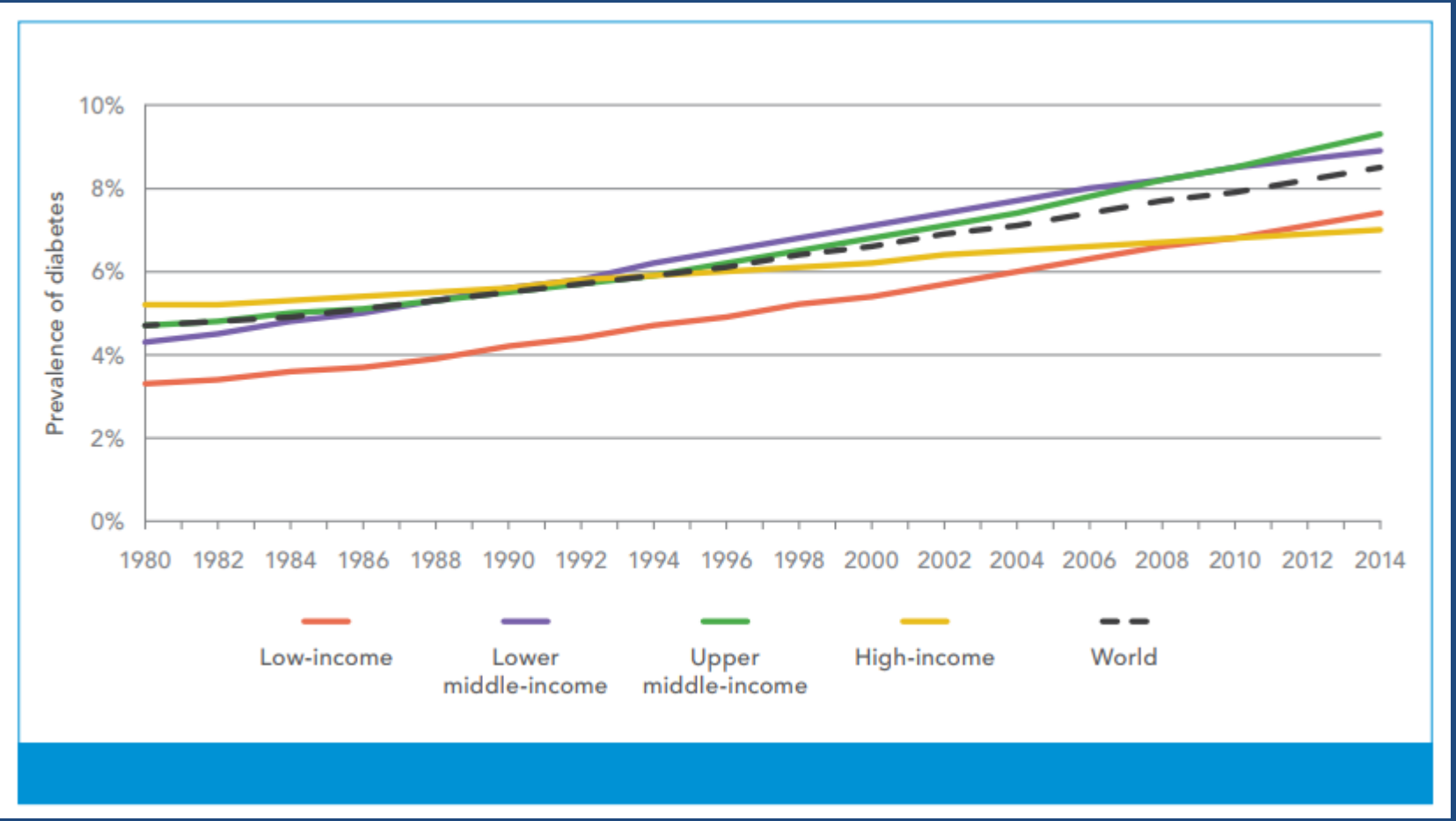
WHO Region	Prevalence (%)		Number (millions)	
	1980	2014	1980	2014
African Region	3.1%	7.1%	4	25
Region of the Americas	5%	8.3%	18	62
Eastern Mediterranean Region	5.9%	13.7%	6	43
European Region	5.3%	7.3%	33	64
South-East Asia Region	4.1%	8.6%	17	96
Western Pacific Region	4.4%	8.4%	29	131
Total[a]	**4.7%**	**8.5%**	**108**	**422**

a. Totals include non-Member States.

Source: (4).

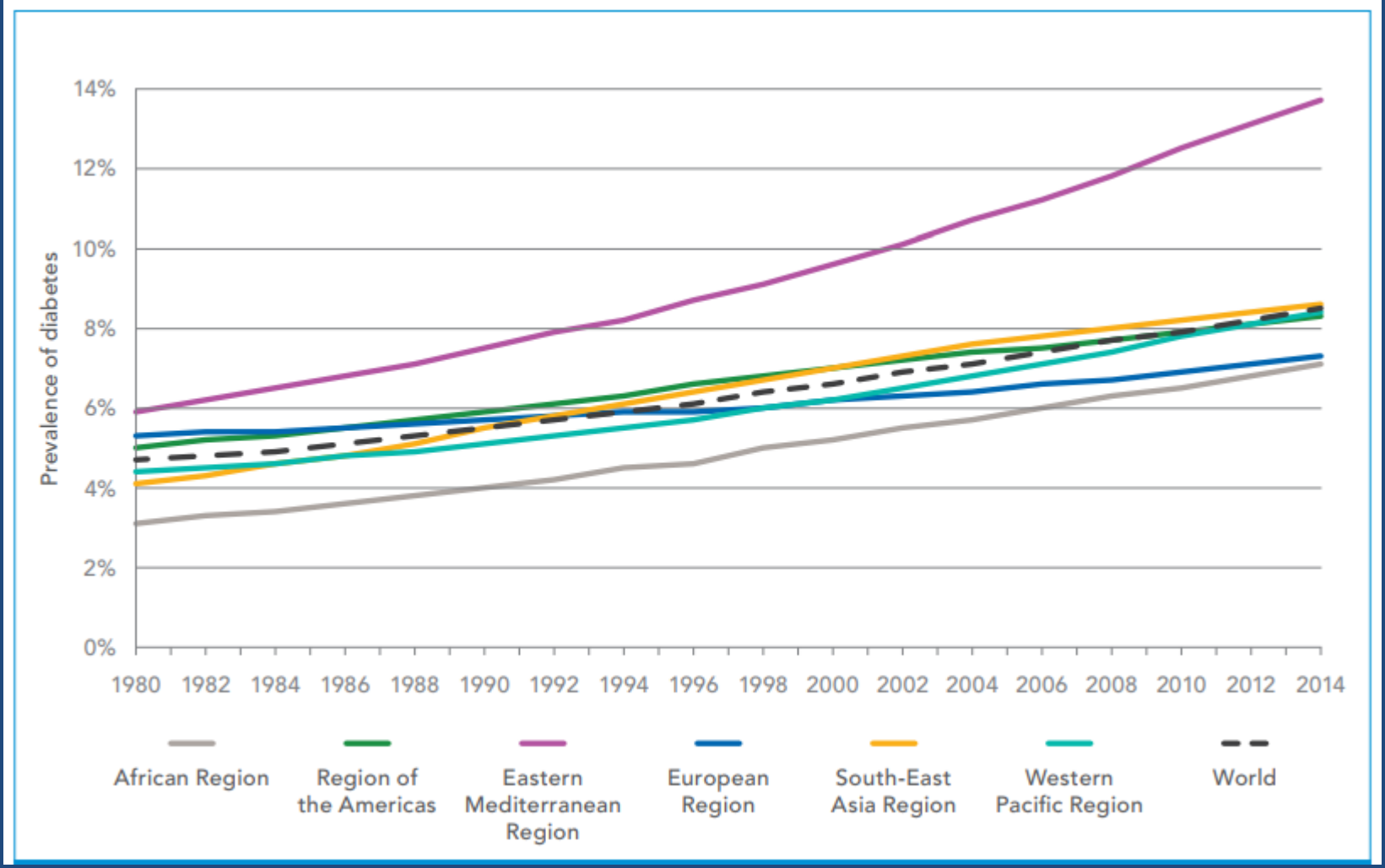
Source, WHO 2016

Trends in prevalence of diabetes, 1980–2014, by country income group



Source, WHO 2016

Trends in prevalence of diabetes, 1980–2014, by WHO region



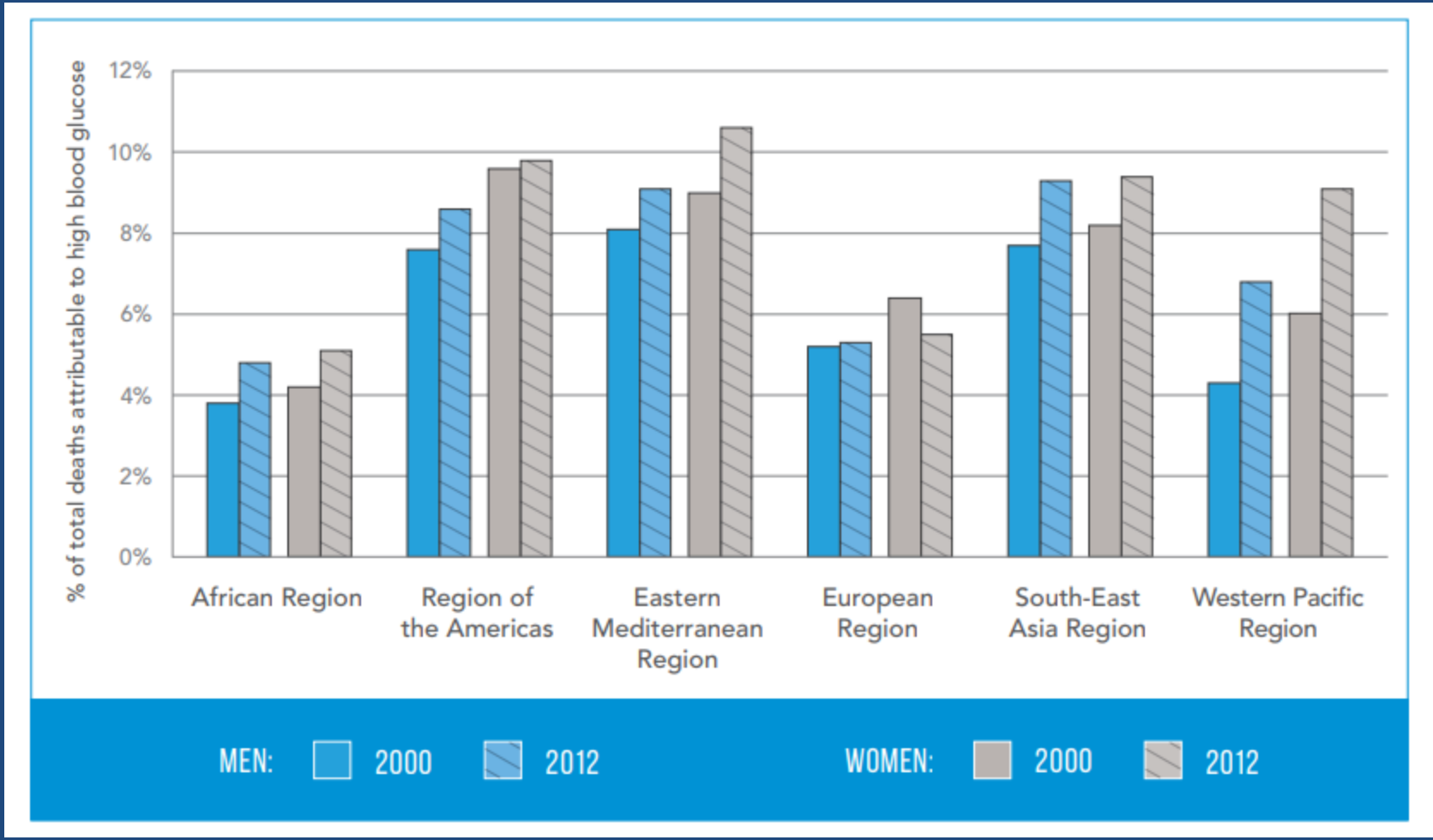
Source, WHO 2016

High blood glucose age-standardized mortality rates per 100000 by WHO region, age 20+, 2012

	Both sexes	Female	Male
African Region	111.3	110.9	111.1
Region of the Americas	72.6	63.9	82.8
Eastern Mediterranean Region	139.6	140.2	138.3
European Region	55.7	46.5	64.5
South-East Asia Region	115.3	101.8	129.1
Western Pacific Region	67	65.8	67.8

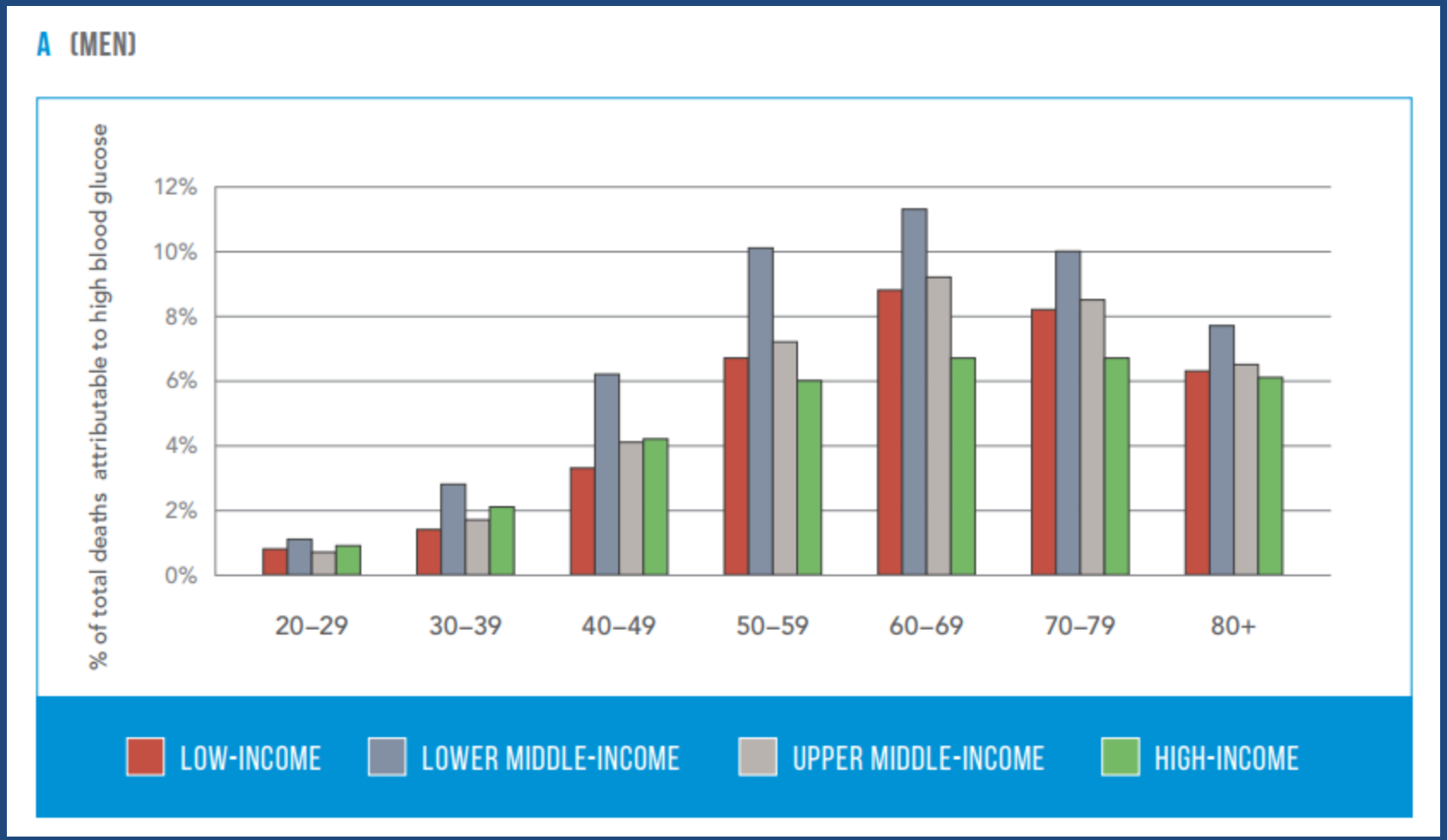
Source, WHO 2016

Percentage of all deaths attributable to high blood glucose for adults aged 20–69 years, by WHO region and sex, 2000 and 2012



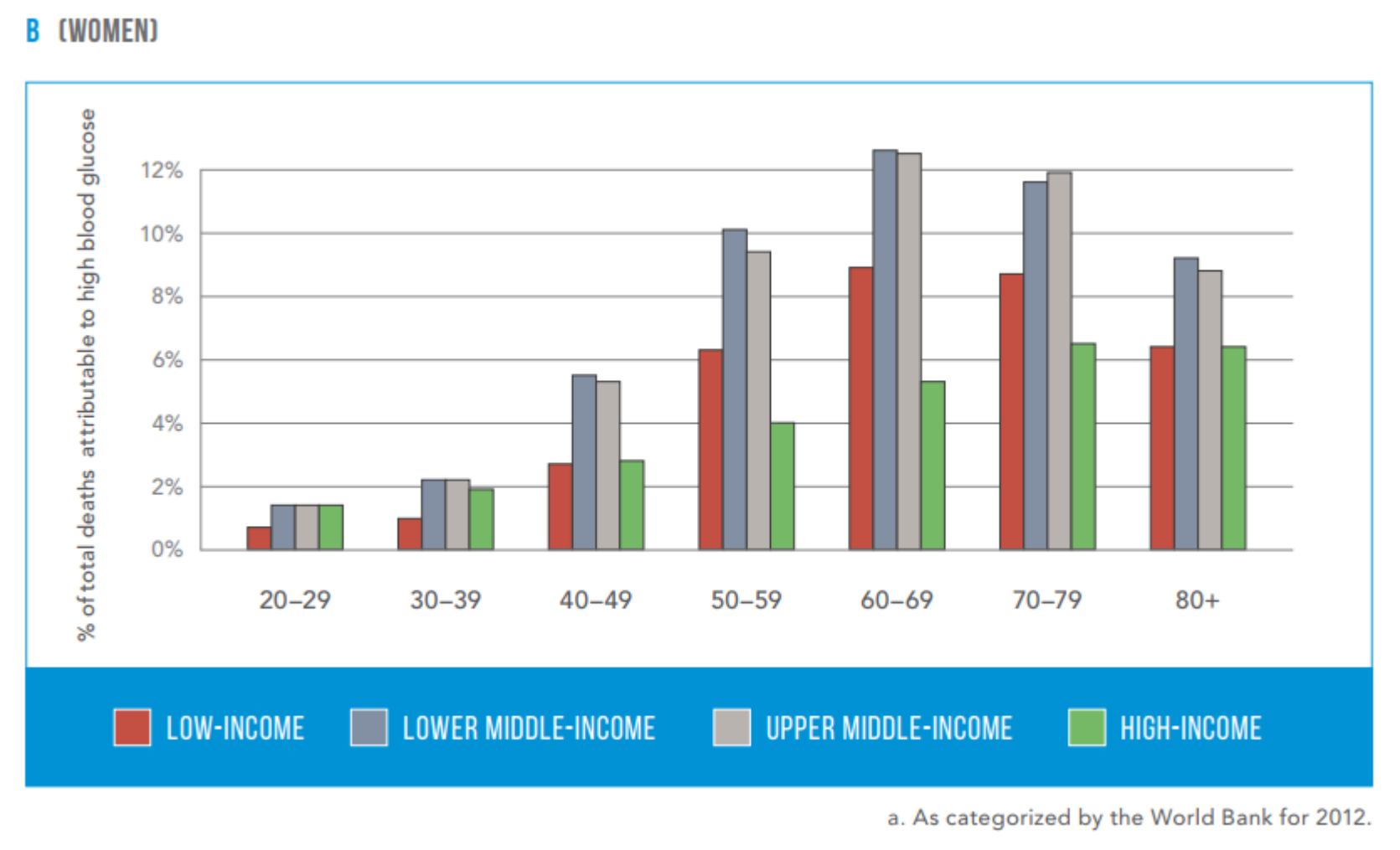
Source, WHO 2016

Percentage of all-cause deaths globally attributed to high blood glucose in men, 2012



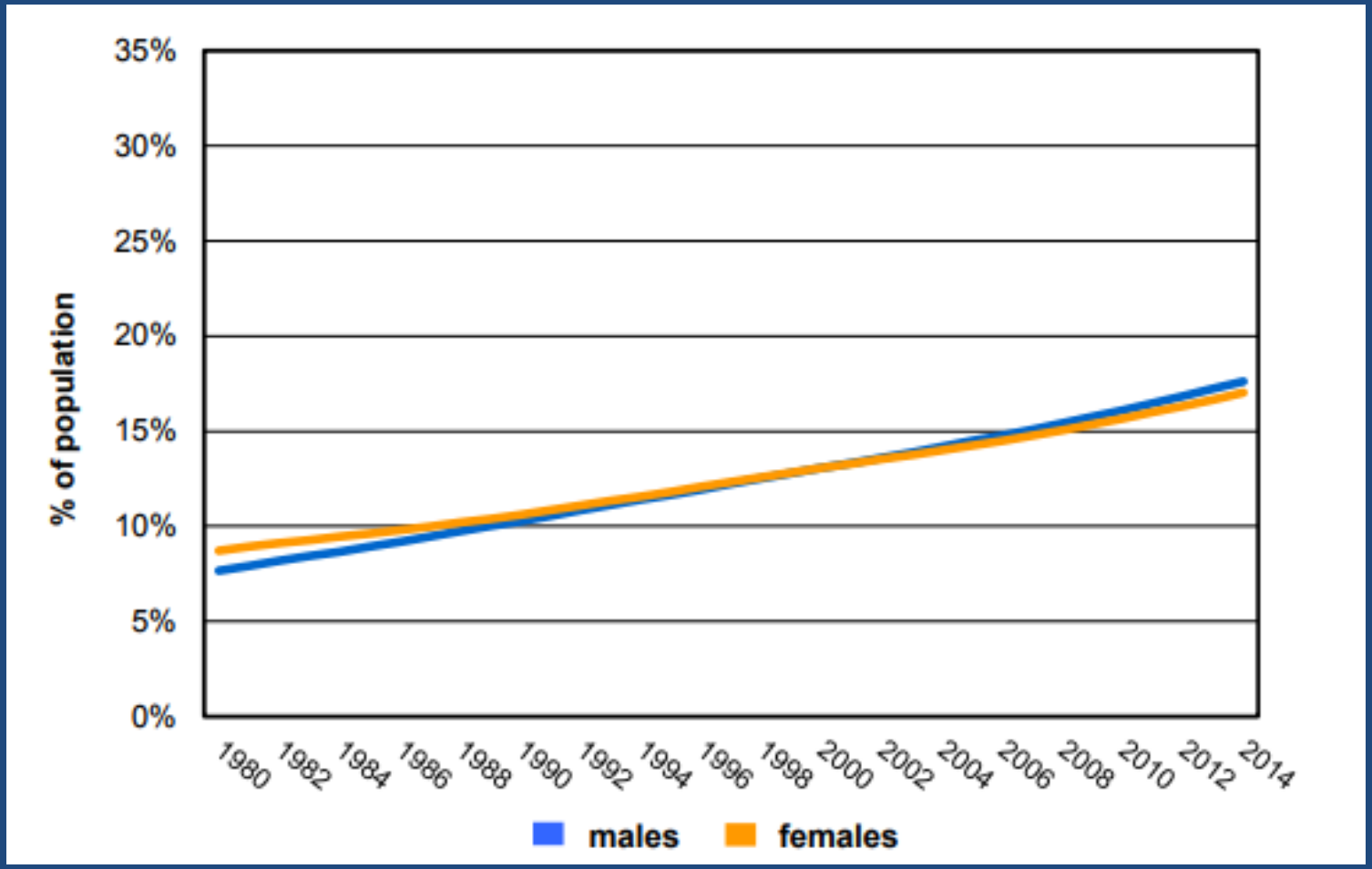
Source, WHO 2016

Percentage of all-cause deaths globally attributed to high blood glucose in women, 2012



Source, WHO 2016

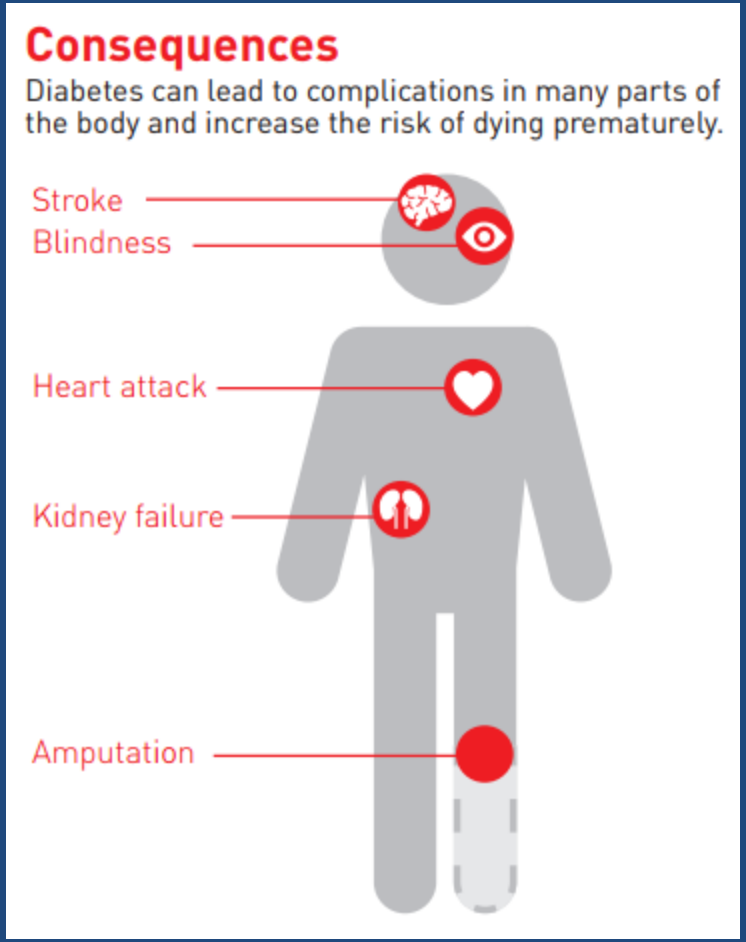
Trends in age-standardized prevalence of diabetes in Saudi Arabia



WHO Diabetes country profiles, 2016.

Common diabetes complications

- Loss of vision
- End-stage renal disease
- Cardiovascular events
- Lower extremity amputations

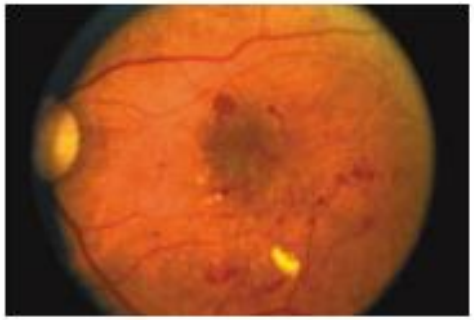


Source, WHO 2016

Loss of vision

- Diabetic retinopathy caused 1.9% of moderate or severe visual impairment globally and 2.6% of blindness in 2010.
- Studies suggest that prevalence of any retinopathy in persons with diabetes is 35% while proliferative (vision-threatening) retinopathy is 7%.
- However, retinopathy rates are higher among: people with type 1 diabetes; people with longer duration of diabetes; Caucasian populations; and possibly among people of lower socioeconomic status

A normal retina.



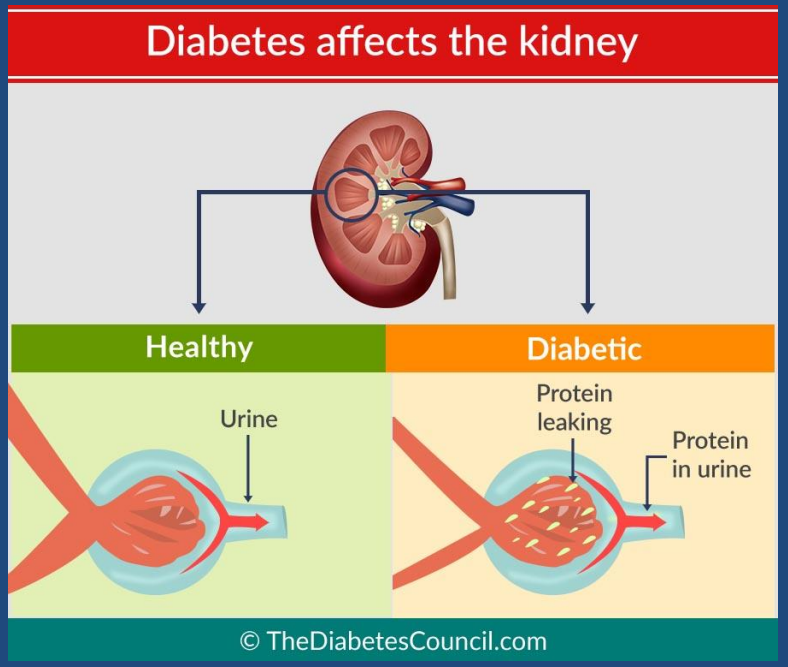
A retina showing signs of diabetic retinopathy.

Source, WHO 2016

Source, AAO 2018

End-stage renal disease

- Pooled data from 54 countries show that at least 80% of cases of end-stage renal disease (ESRD) are caused by diabetes, hypertension or a combination of the two.
- The proportion of ESRD attributable to diabetes alone ranges from 12–55%.
- The incidence of ESRD is up to 10 times as high in adults with diabetes as those without.



Cardiovascular events

- Adults with diabetes historically have 2-3 times higher rate of cardiovascular disease (CVD) than adults without diabetes.
- The risk of cardiovascular disease increases continuously with rising fasting plasma glucose levels, even before reaching levels sufficient for a diabetes diagnosis.
- Almost 7 in 10 people with diabetes over age 65 will die of some type of heart disease. About 1 in 6 will die of stroke.

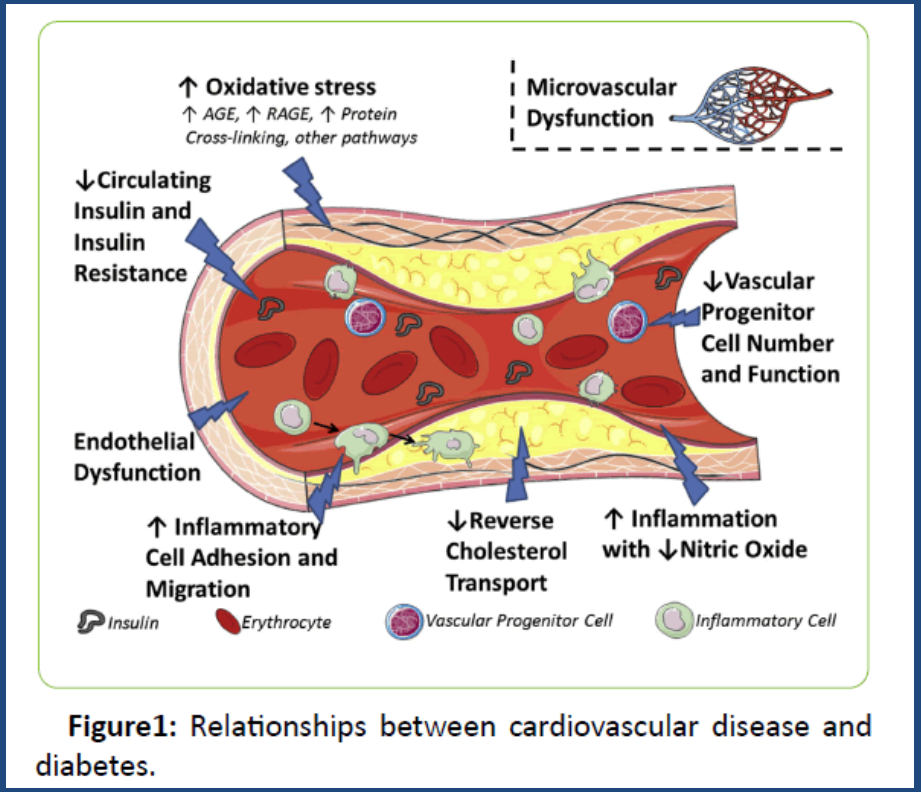
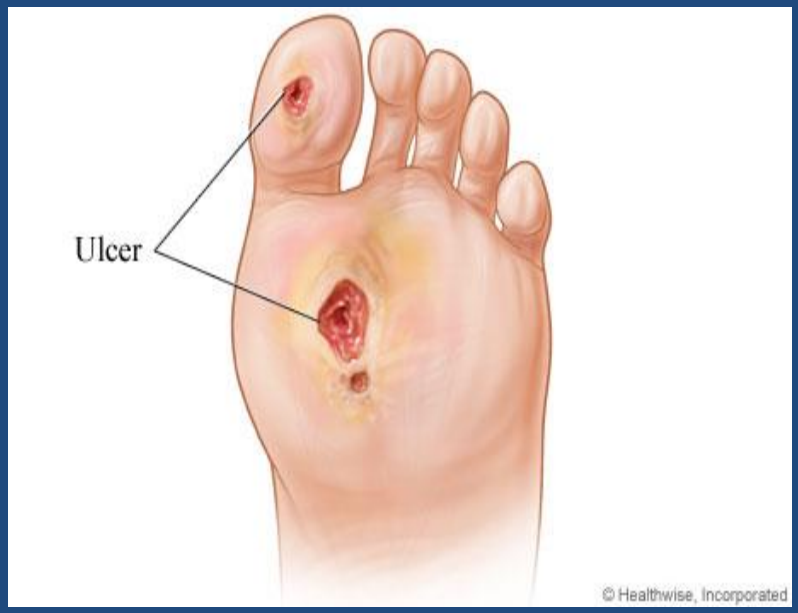


Figure1: Relationships between cardiovascular disease and diabetes.

Source, iMedpub

Lower extremity amputations

- Diabetes appears to dramatically increase the risk of lower extremity amputation because of infected, non-healing foot ulcers.
- Rates of amputation in populations with diagnosed diabetes are typically 10 to 20 times those of nondiabetic populations.
- Encouragingly several studies show a 40% to 60% reduction in rates of amputations among adults with diabetes during the past 10–15 years in western countries.



Risk factors

Genetic factors

- May play a part in development of all types; autoimmune disease and viral infections may be risk factors in Type I DM.

- Twin studies

Family history

- Compared with individuals without a family history of type 2 diabetes, individuals with a family history in any first degree relative have a two to three-fold increased risk of developing diabetes.
- The risk of type 2 diabetes is higher (five- to six fold) in those with both a maternal and paternal history of type 2 diabetes .
- The risk is likely mediated through genetic, anthropometric (body mass index, waist circumference), and lifestyle (diet, physical activity, smoking) factors.

Obesity

- Contributes to the resistance to endogenous insulin.
  - RR risk of DM in females (ref. BMI < 22)
    - 22-23 3.0
    - 24-25 5.0
    - > 31 40.0

    (Colditz & al, Ann Int Med, 1995, 122; 481-6)

- The risk of impaired glucose tolerance (IGT) or type 2 diabetes rises with increasing body weight.
- The Nurses' Health Study demonstrated an approximately 100-fold increased risk of incident diabetes over 14 years in nurses whose baseline body mass index was >35 kg/m2 compared with those with BMI <22 .
- The risk of diabetes associated with body weight appears to be modified by age.
- Obesity acts at least in part by inducing resistance to insulin-mediated peripheral glucose uptake, which is an important component of type 2 diabetes

Fat distribution

- The distribution of excess adipose tissue is another important determinant of the risk of insulin resistance and type 2 diabetes.
- The incidence of type 2 diabetes are highest in those subjects with central or abdominal obesity, as measured by waist circumference or waist-to-hip circumference ratio.
- Intra-abdominal (visceral) fat rather than subcutaneous or retroperitoneal fat appears to be of primary importance.

Physical inactivity.

- Prolonged TV watching is associated with a significantly increased risk of type 2 diabetes. Men who watched TV more than 40 h per week had a nearly threefold increase in the risk of type 2 diabetes compared with those who spent less than 1 h per week watching TV.

Diet

- A number of dietary factors have been linked to an increased risk of type 1 diabetes, such as low vitamin D consumption; early exposure to cow's milk or cow's milk formula; or exposure to cereals before 4 months of age. However, none of these factors has been shown to cause type 1 diabetes.
- Consumption of red meat, processed meat, and sugar sweetened beverages is associated with an increased risk of diabetes
- Fruits, vegetables, nuts, whole grains, and olive oil is associated with a reduced risk.
- It is important to recognize that most studies have used food frequency questionnaires to capture dietary patterns and that none of the food stuffs examined can be considered in isolation. For example, higher meat intake always means more saturated fat intake, relatively lower fruit and vegetable intake, and frequently, higher BMI (body mass index).

Smoking

Several large prospective studies have raised the possibility that cigarette smoking increases the risk of type 2 diabetes. In a meta-analysis of 25 prospective cohort studies, current smokers had an increased risk of developing type 2 diabetes compared with nonsmokers (pooled adjusted RR 1.4, 95% CI 1.3-1.6).

A definitive causal association has not been established, a relationship between cigarette smoking and diabetes mellitus is biologically possible based upon a number of observations:

Smoking increases the blood glucose concentration after an oral glucose challenge.

Smoking may impair insulin sensitivity.

Cigarette smoking has been linked to increased abdominal fat distribution and greater waist-to-hip ratio that may have an impact upon glucose tolerance.

Infections

- A range of relatively rare infections and illnesses can damage the pancreas and cause type 1 diabetes.

Pregnancy

Pregnancy causes weight gain and increases levels of estrogen and placental hormones, which antagonize insulin.

Medications

- Drugs that are known to antagonize the effects of insulin:
- Thiazide diuretics,
- Adrenal corticosteroids,
- Oral contraceptives.

Physiologic or emotional stress

- Causes prolonged elevation of stress hormone levels (cortisol, epinephrine, glucagon and growth hormone), which raises blood glucose levels, placing increased demands on the pancreas.

Prevention

Prevention

- Type 2 diabetes is largely preventable.
- **Multisectoral, population-based approaches** are needed to reduce the prevalence of modifiable diabetes risk factors – such as overweight, obesity, physical inactivity and unhealthy diet – in the general population.
- A combination of **fiscal policies, legislation, changes to the environment and raising awareness of health risks** works best for promoting healthier diets and physical activity.
- Diabetes can be delayed or prevented in people who are overweight and have impaired glucose tolerance (IGT). Diet and physical activity interventions are more effective than medication.

Prevention – type 2 diabetes

- Not modifiable factors
  - Genetics
  - Ethnicity
  - Age
- Modifiable factors
  - being overweight or obese
  - unhealthy diet
  - insufficient physical activity
  - smoking

HEALTHY DIET AND PHYSICAL ACTIVITY

- **Saturated fatty acid intake** - less than 10% of total energy intake (and for high risk groups, less than 7%);
- **Dietary fibre** - minimum daily intake of 20 g through regular consumption of wholegrain cereals, legumes, fruits and vegetables.
- **Free sugars** - less than 10% of total energy intake
- **Further reduction** to 5% could have additional health benefits
- **Children and youth aged 5–17** - at least 60 minutes of moderate- to vigorous-intensity physical activity daily.
- **Adults aged 18–64** - at least 150 minutes of moderate-intensity aerobic physical activity (for example brisk walking, jogging, gardening) spread throughout the week, or at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity.
- **Older adults** - the same amount of physical activity, but should also include balance and muscle strengthening activity tailored to their ability and circumstances.

Prevention – type 2 diabetes

- Population-based prevention
  - A life-course approach to preventing diabetes
  - Improving early childhood nutrition
  - Supportive environments for physical activity
  - Settings-based interventions
  - Fiscal, legislative and regulatory measures for healthy diet
  - Education, social marketing and mobilization
- Preventing diabetes in people at high risk
  - Intensive behavioral interventions for people with IGT
  - Pharmacological interventions for people with IGT

A life-course approach

- Taking a life-course perspective is essential for type 2 diabetes prevention.
- Early in life, when eating and physical activity habits are formed and when the long-term regulation of energy balance may be programmed, there is a critical window for intervention to mitigate the risk of obesity and type 2 diabetes later in life.
- Recognize the increasing risk that comes with advancing age, and the need to identify the unique needs for risk reduction in older adults.

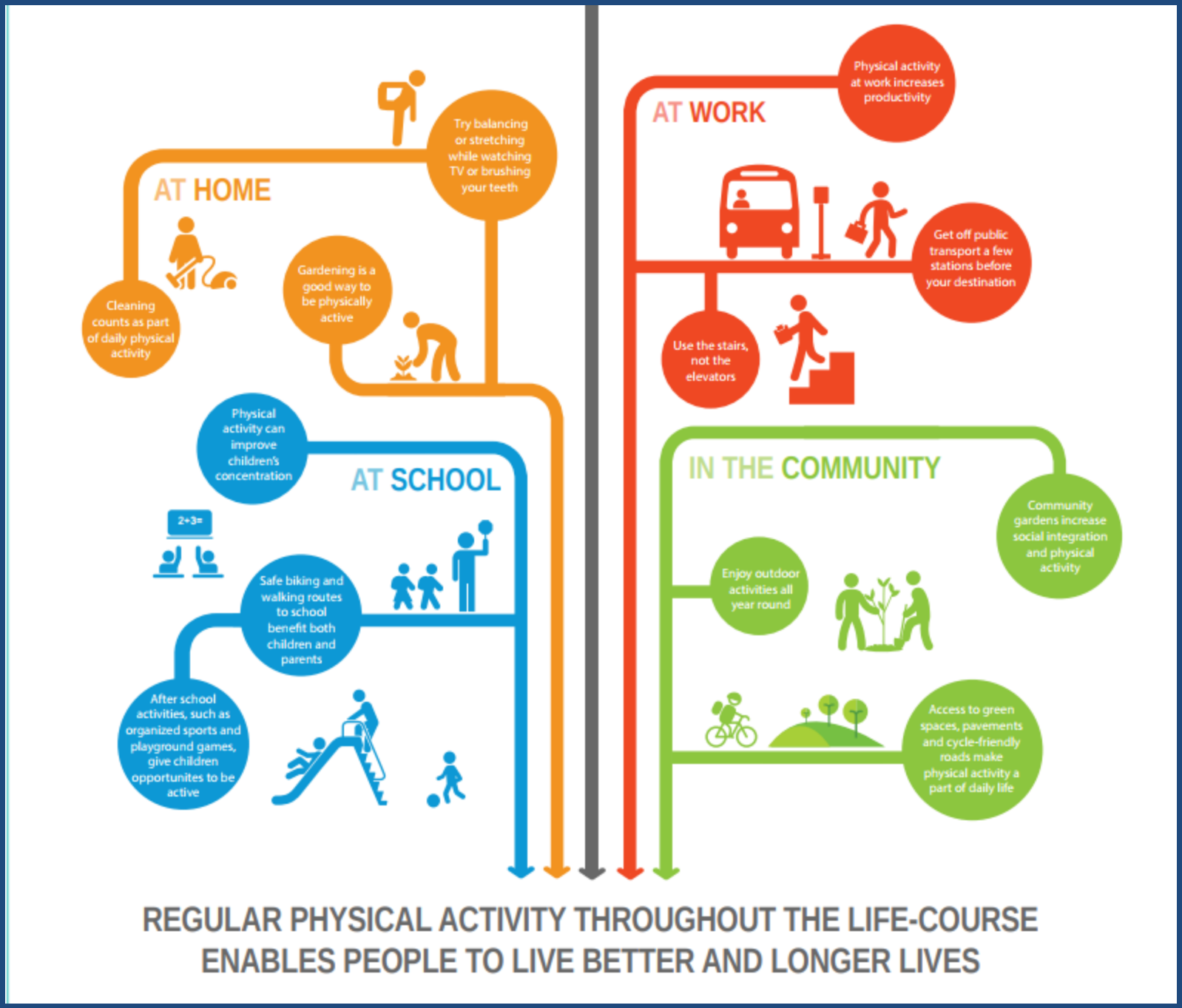
Improving early childhood nutrition

Strategies to improve early childhood nutrition aimed at improving maternal health and nutritional status and infant and young childfeeding practices, focusing on the first 1000 days from a woman's pregnancy to her child's second birthday.

- promoting the nutritional well-being of pregnant women;
- promotion of breastfeeding, including the implementation of the Code of Marketing of Breast Milk Substitutes
- exclusive breastfeeding up to 6 months of age
- breastfeeding until babies are 2 years of age or more
- a variety of safe, nutritious and adequate foods at 6 months of age to complement breastfeeding
- preventing the consumption of foods that are high in energy, fats, sugars and sodium
- facilitating physical activity

Supportive environments for physical activity

- The physical or built environment plays an important role in facilitating physical activity for many people.
- Urban planning and active transport policies can ensure that walking, cycling and other forms of non-motorized transport are accessible and safe for all.
- The physical environment can also provide sports, recreation and leisure facilities, and ensure there are adequate safe spaces for active living for both children and adults.
- The poorest groups in society, especially women, may have less time and fewer resources to participate in leisure-time activity, making policy interventions that target active transport and incidental physical activity throughout the day much more important.
- Promotion of stair use – including placement of physical activity promotion messages on stairs – as part of a workplace programme has been shown to increase awareness and use of stairs.
- The sports sector can encourage regular structured activities, especially among children and adolescents, and can strengthen the link between physical activity, sports and health.
- Partnerships with communities, the private sector and nongovernmental organizations can also contribute to developing facilities for physical activity.


AT HOME
Try balancing or stretching while watching TV or brushing your teeth
Cleaning counts as part of daily physical activity
Gardening is a good way to be physically active
AT SCHOOL
Physical activity can improve children's concentration
2+3=
Safe biking and walking routes to school benefit both children and parents
After school activities, such as organized sports and playground games, give children opportunites to be active
AT WORK
Physical activity at work increases productivity
Get off public transport a few stations before your destination
Use the stairs, not the elevators
IN THE COMMUNITY
Community gardens increase social integration and physical activity
Enjoy outdoor activities all year round
Access to green spaces, pavements and cycle-friendly roads make physical activity a part of daily life
REGULAR PHYSICAL ACTIVITY THROUGHOUT THE LIFE-COURSE
ENABLES PEOPLE TO LIVE BETTER AND LONGER LIVES

WHO, 2015

Settings-based interventions

- Interventions reach families and communities where they live, study, work and play.
- Should be comprehensive, make use of existing programmes when possible and focus on actions that do not require additional resources.
- A whole-of-school approach that focuses on improving both diet and physical activity.
- Successful school-based physical activity interventions should result in consistent improvements in the knowledge, attitudes and behaviour of children and, when tested, in physical and clinical outcomes.

- Worlplace interventions addressing diet and physical activity can be effective in changing behaviours and health related outcomes.
- Healthy eating messages in cafés and restaurants have been shown to stimulate consumption of healthy food − provided that healthy food items are made available.
- Workplaces can help develop environments that are conducive to physical activity at work and provide incentives and opportunities for active commuting to and from work.
- Workplaces may offer their employees free or discounted vouchers for physical activity facilities.

Fiscal, legislative and regulatory measures for healthy diet

- Fiscal measures
  - Policies that increase the price of foods high in fat, sugar and salt can decrease their consumption.
- Trade and agricultural policies that promote healthy diets
  - in 2000 Fiji banned the supply of high-fat mutton flaps under the Trading Standards Act.
  - Changes in agricultural subsidies to encourage fruit and vegetable production can be beneficial in increasing their consumption and improving diet.
- Regulation of marketing of foods high in sugars, fats and salt.
  - Marketing of foods and non-alcoholic beverages influences children's knowledge, attitudes, beliefs and preferences.
  - Nutrition labelling is a regulatory tool that can guide consumers towards healthier food choices. Nutrition labelling comprises nutrient declarations and supplementary nutrition information

Education, social marketing and mobilization

- Consumer awareness and knowledge of healthy diet and physical activity can be achieved through sustained media and educational campaigns.
- These campaigns have greater impact and are more cost-effective when used within multicomponent strategies.
- For example, a social marketing campaign in Tonga using netball has resulted in increased participation both in netball and leisure-time physical activity by women.

Preventing diabetes in people at high risk

- Intensive interventions that change people's diet, increase physical activity and lead to the loss of excess body weight can prevent type 2 diabetes in people with impaired glucose tolerance, with or without impaired fasting glucose.

  - **Diabetes Prevention Program (DPP) in the USA**
  - **Finnish Diabetes Prevention Study (DPS)**
  - **Chinese Da Qing Study**

- These studies showed that active intervention, lasting 2 to 6 years, could have extended benefits for glycaemic and cardiovascular outcomes that last for 10 to 20 years.

- Seversal pharmacological interventions (for example, metformin and acarbose) have also been shown to prevent or delay type 2 diabetes but, in the majority of studies, this is not as effective as changes in diet and physical activity, and the effect dissipates after discontinuation of the medication.

Criteria for testing for diabetes in asymptomatic adults

- Testing should be considered in **overweight** or **obese** adults who have one or more of the following risk factors:

a. First-degree relative with diabetes

b. History of CVD or Hypertension

c. Women with polycystic ovary syndrome

d. Physical inactivity

e. Conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)

- 2. Patients with prediabetes should be tested yearly.
- 3. Women who were diagnosed with GDM.
- 4. For all other patients, testing should begin at age 45 years.
- 5. If results are normal, testing should be repeated at a minimum of 3-year intervals

Global efforts

Global action plan for the prevention and control of non-communicable diseases 2013-2020

The WHO had nations sign:

GLOBAL ACTION PLAN FOR THE PREVENTION AND CONTROL OF NONCOMMUNICABLE DISEASES 2013-2020

From the goals

- Halt the rise in diabetes and obesity.
- A 25% relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases

Sustainable development goals by the UN

The **Sustainable Development Goals** (**SDGs**)

- A collection of 17 global goals set by the United Nations.

- The third goal is : Good health and well being


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

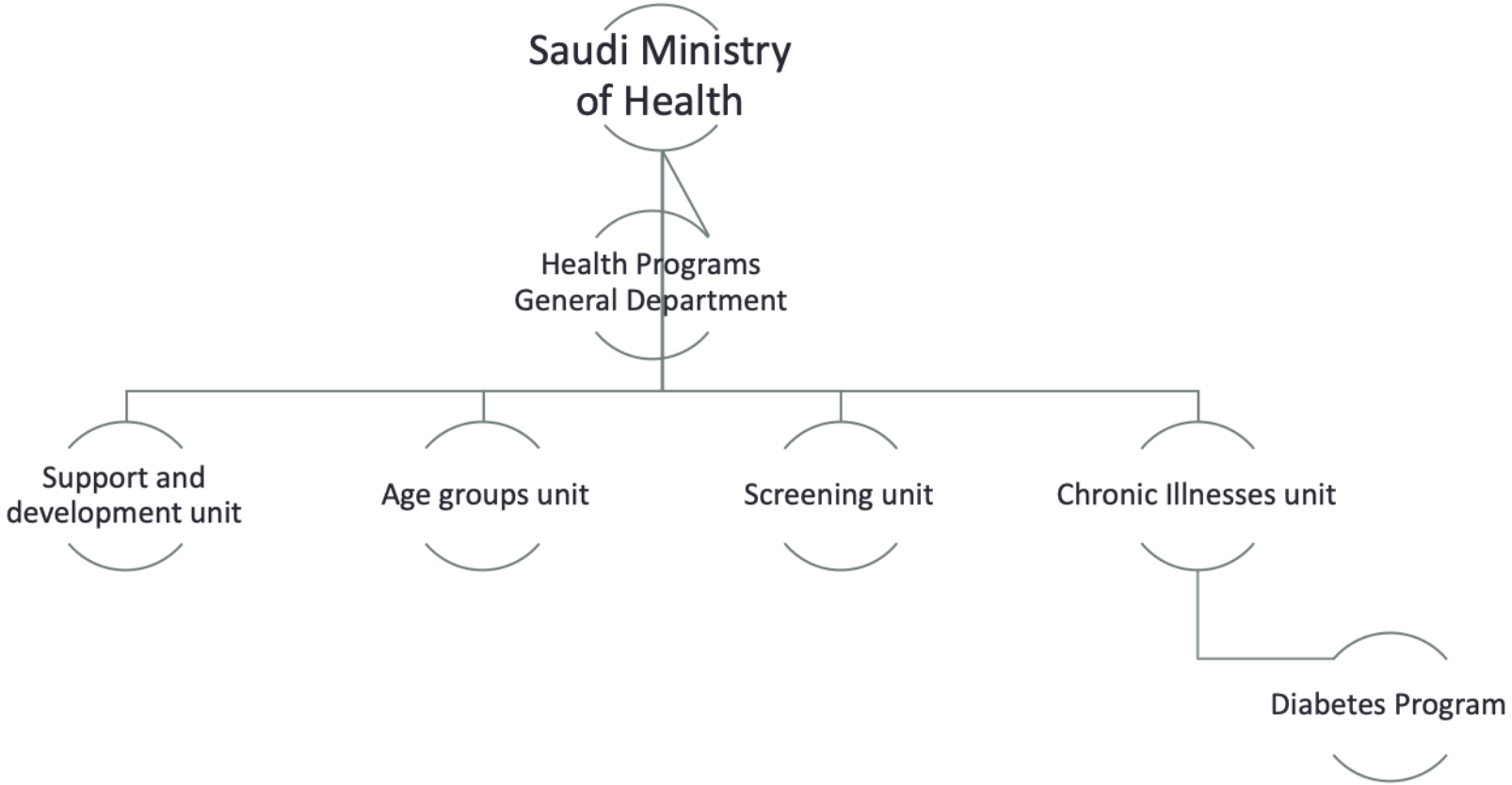
Saudi Efforts in preventing and controlling diabetes

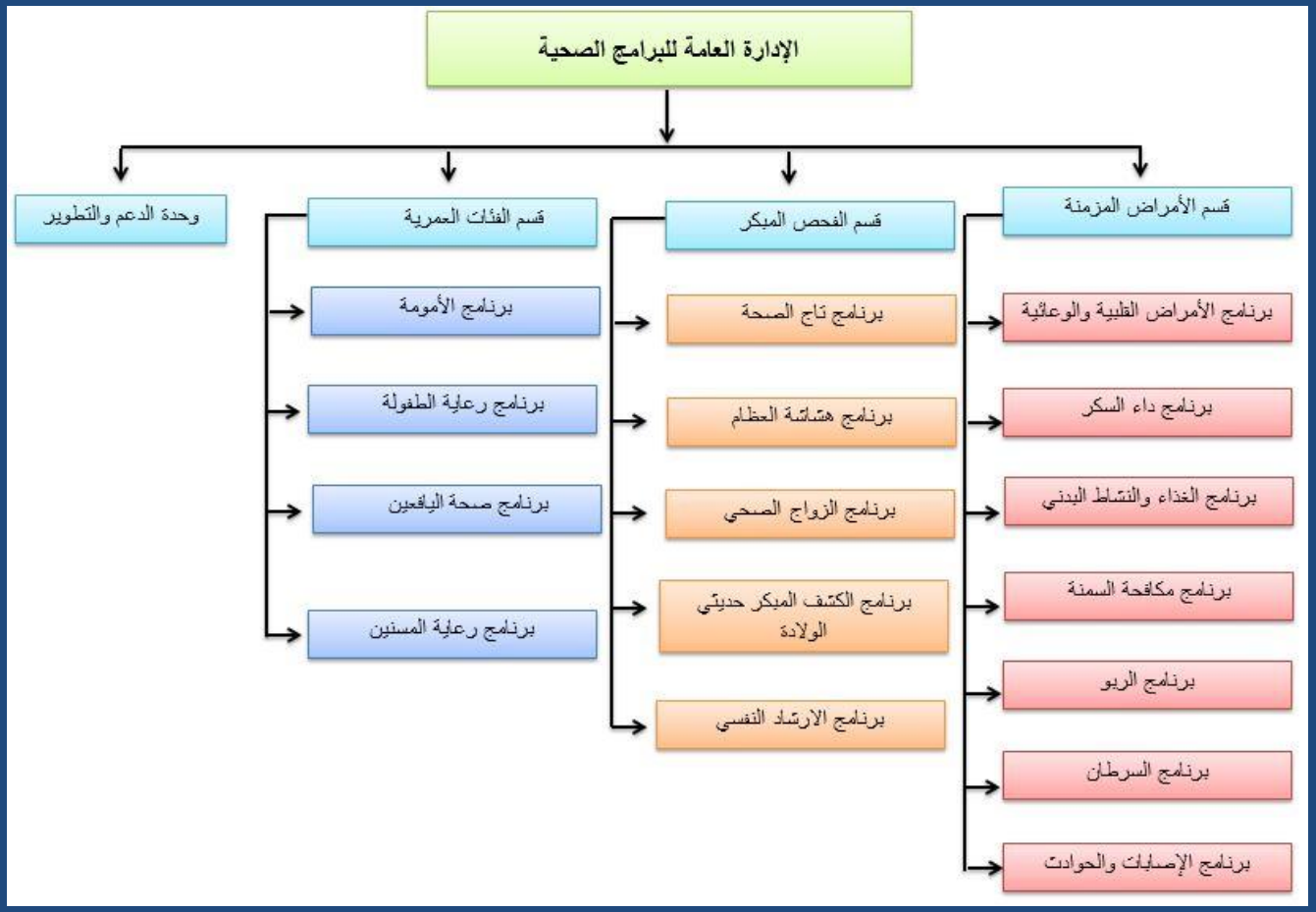
There are multiple sectors serving people with diabetes in Saudi Arabia both in the private and public sectors at primary, secondary, and third level preventions.

Examples:

- Saudi Charitable Association of Diabetes
- The Ministry of Health
- National Guard Health Affairs
- The Saudi Society of Endocrinology and Metabolism[under the umbrella of the Saudi Commission for Health Specialties.]

We will zoom on the most prominent entity, the Ministry of Health.


Saudi Ministry of Health
Health Programs General Department
Support and development unit
Age groups unit
Screening unit
Chronic Illnesses unit
Diabetes Program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وحدة الدعم والتطوير
قسم الفئات العمرية
برنامج الأمومة
برنامج رعاية الطفولة
برنامج صحة اليافعين
برنامج رعاية المسنين
قسم الفحص المبكر
برنامج تاج الصحة
برنامج هشاشة العظام
برنامج الزواج الصحي
برنامج الكشف المبكر حديثي الولادة
برنامج الارشاد النفسي
قسم الأمراض المزمنة
برنامج الأمراض القلبية والوعائية
برنامج داء السكر
برنامج الغذاء والنشاط البدني
برنامج مكافحة السمنة
برنامج الربو
برنامج السرطان
برنامج الإصابات والحوادث

National Diabetes Prevention and Control Program

البرنامج الوطني لمكافحة داء السكري
National Diabetes Prevention and Control Program

وزارة الصحة
Ministry of Health

Twitter account:

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The program's goals

- Suggest research pertaining to diabetes
- Work on creating a national registry for diabetes in Saudi Arabia
- Suggest collaborations and coordination efforts on a local level, Gulf region level, and international level to achieve set goals.
- Suggesting preventive and curative diabetes programs, as well as overlook their execution and development.
- Create sub-committees to follow up on created programs.
- Study reports form sub-committees, finalize them, and develop recommendations.
- Take decisions and develop recommendation in issues raised to the program.

http://www.ndpcp-moh.com/

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Thank You