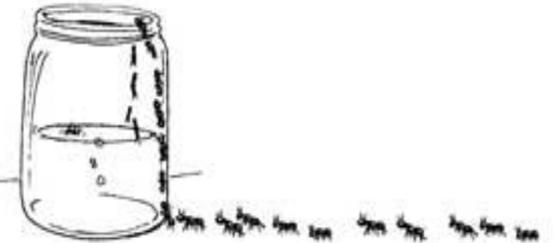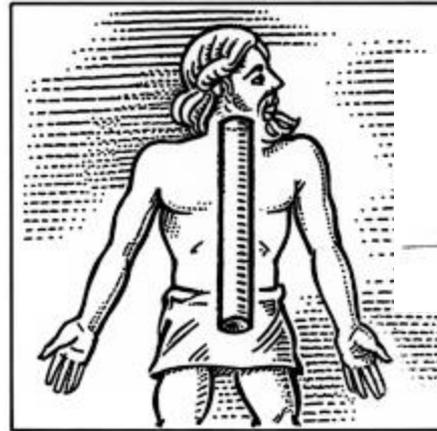# Diabetes
Community Health

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Historical background

Diabetes Means Siphon

- **Diabetes** mellitus is derived from the *Greek* word **diabetes** meaning siphon - to pass through and the *Latin* word **mellitus** meaning honeyed or sweet.

- Diabetes has been known about for many centuries. As early as the *5th century* AD descriptions of diabetes mentioned two forms, one in older, fatter people and the other in thinner people with short survival.

Definition

- The term diabetes describes a group of metabolic disorders characterized and identified by the presence of hyperglycaemia in the absence of treatment. The heterogeneous aetio-pathology includes *defects in insulin secretion*, *insulin action*, or *both*, and disturbances of carbohydrate, fat and protein metabolism (WHO, 2019).

Epidemiology and global burden of diabetes

- Diabetes is found in every population in the world and in all regions.

- In 2019, WHO estimated that diabetes was the **ninth leading cause** of death (1.5 million deaths directly caused by diabetes).

- **Almost half of all deaths (**48%) due to diabetes occurred **before the age of 70 years**.
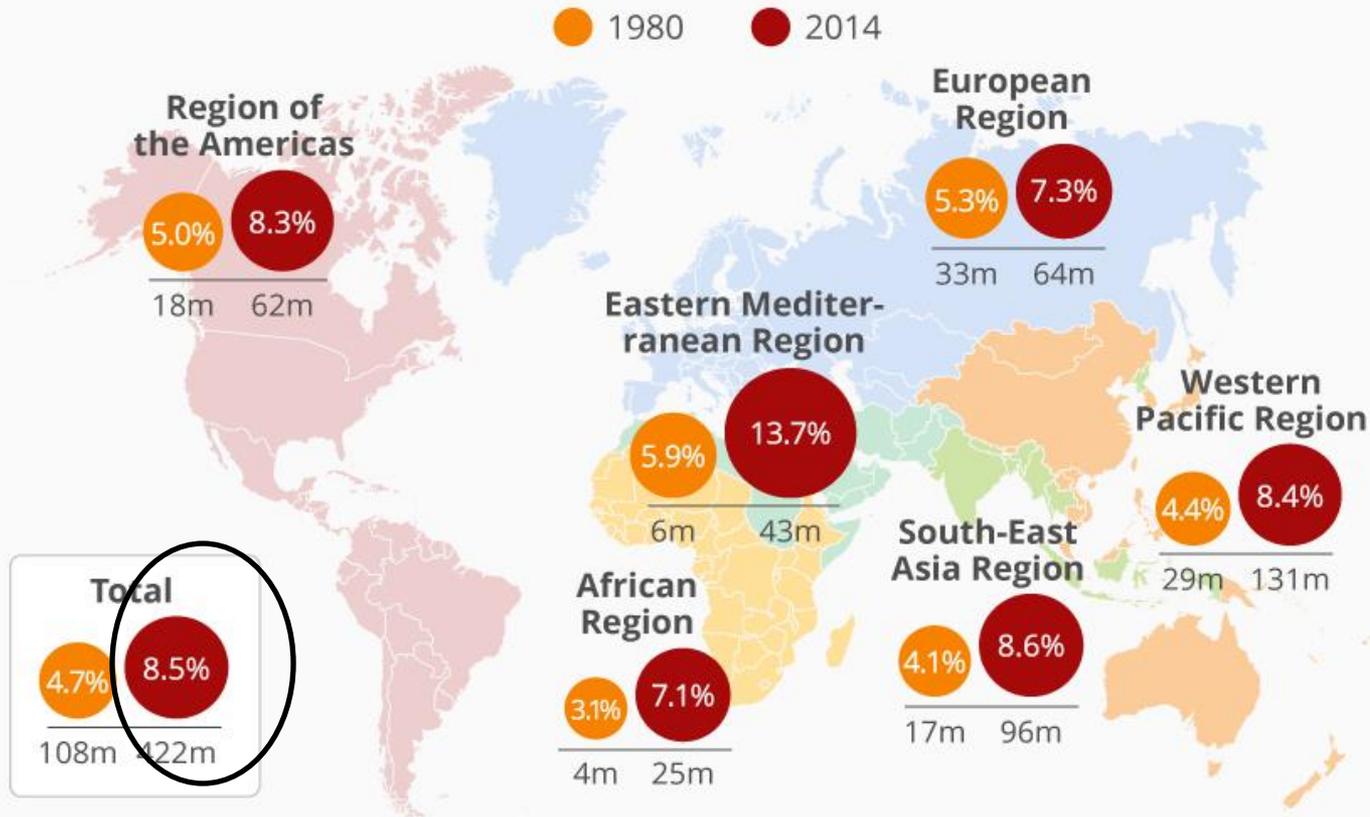
Epidemiology and global burden of diabetes

- The rising prevalence of T2DM is associated with rapid cultural and social changes, ageing populations, increasing urbanization, dietary changes, reduced physical activity and other unhealthy lifestyle and behavioural patterns.
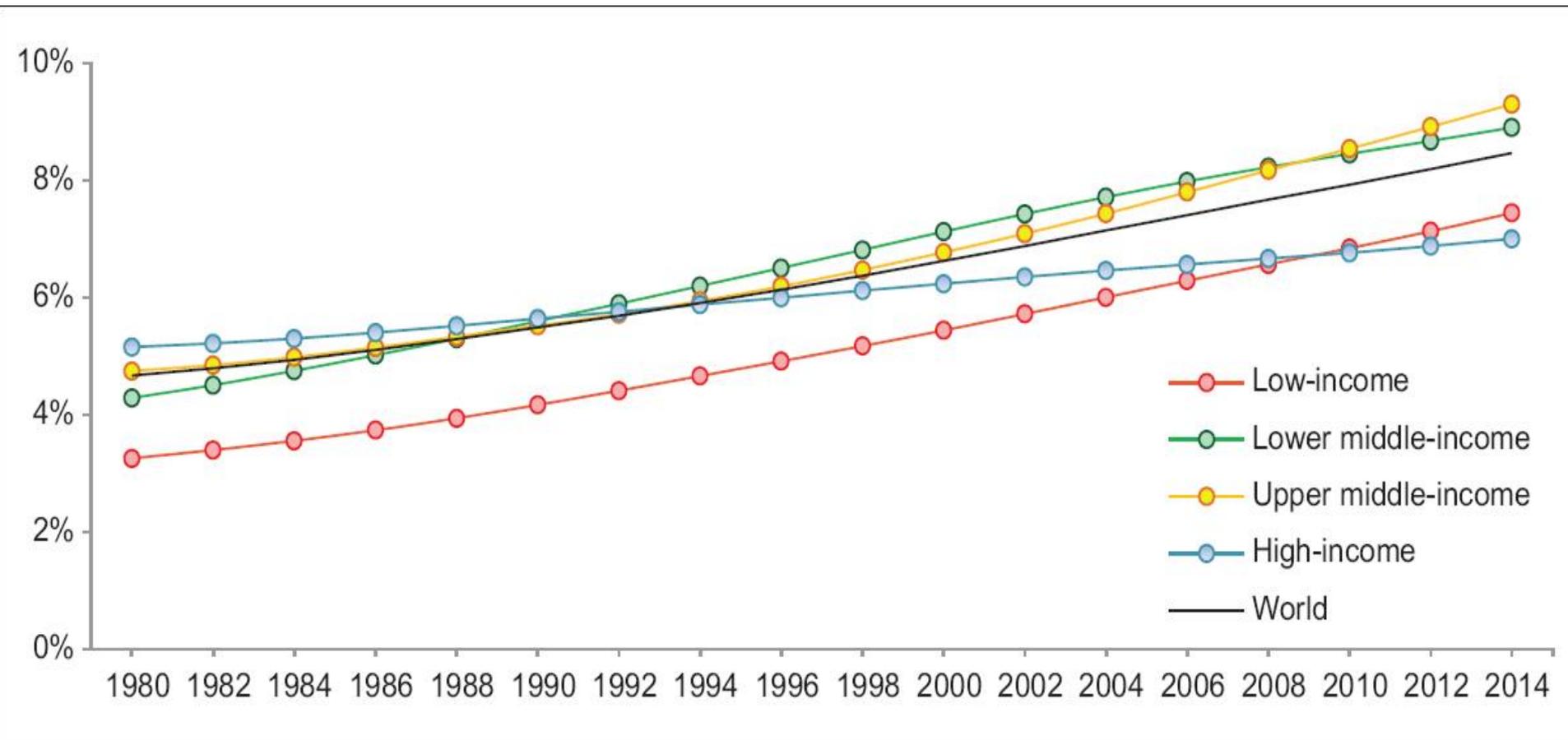
- As well as increased diagnosis.

The age-adjusted prevalence in adults is **8.5%** in 2014

The Unrelenting March Of Diabetes

% prevalence and number of adults with diabetes by WHO region in 1980 and 2014*

● 1980   ● 2014

Region of the Americas
5.0%   8.3%
18m   62m

European Region
5.3%   7.3%
33m   64m

Eastern Mediter-ranean Region
5.9%   13.7%
6m   43m

Western Pacific Region
4.4%   8.4%
29m   131m

South-East Asia Region
4.1%   8.6%
17m   96m

African Region
3.1%   7.1%
4m   25m

Total
4.7%   8.5%
108m   122m

* Millions of people and % of total regional population
@StatistaCharts   Source: World Health Organization

statista

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

Over the past decades, the greatest rise in low- and middle-income countries compared to high-income countries.

- If trends continue, the IDF predicts that an estimated 629 million people worldwide will be living with diabetes by 2045.
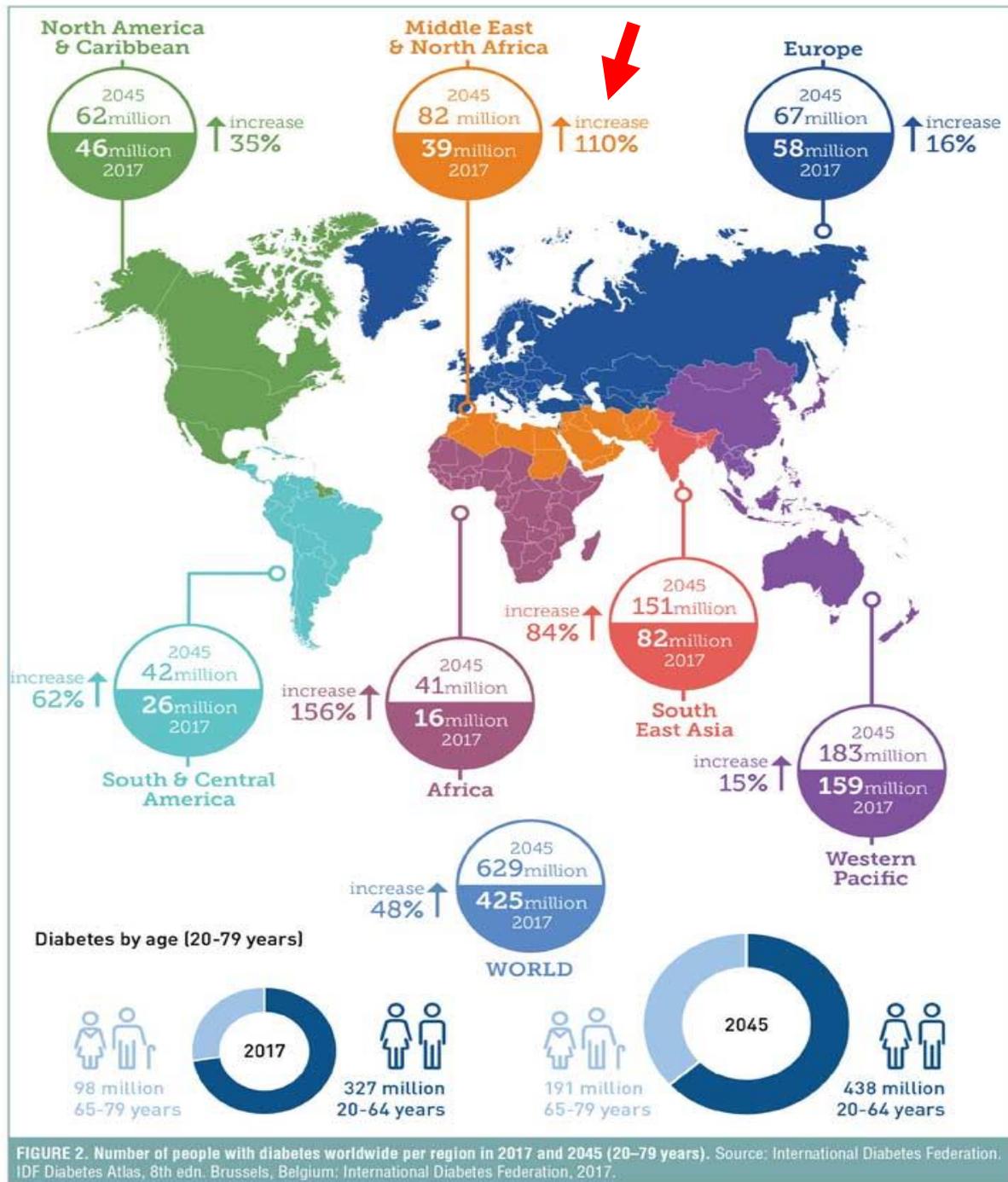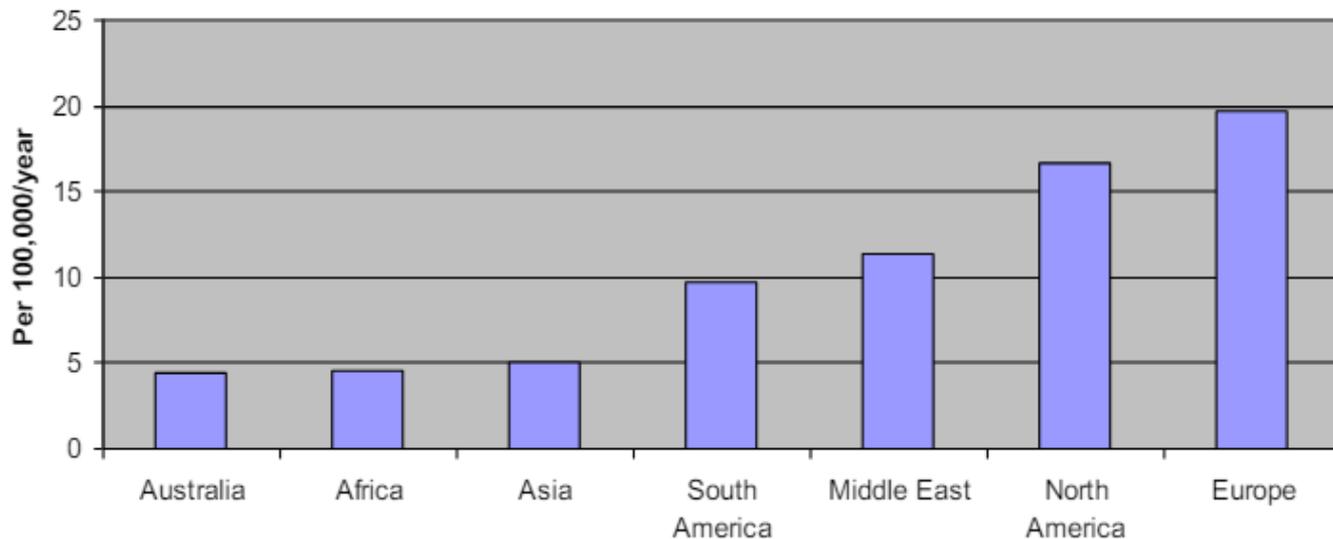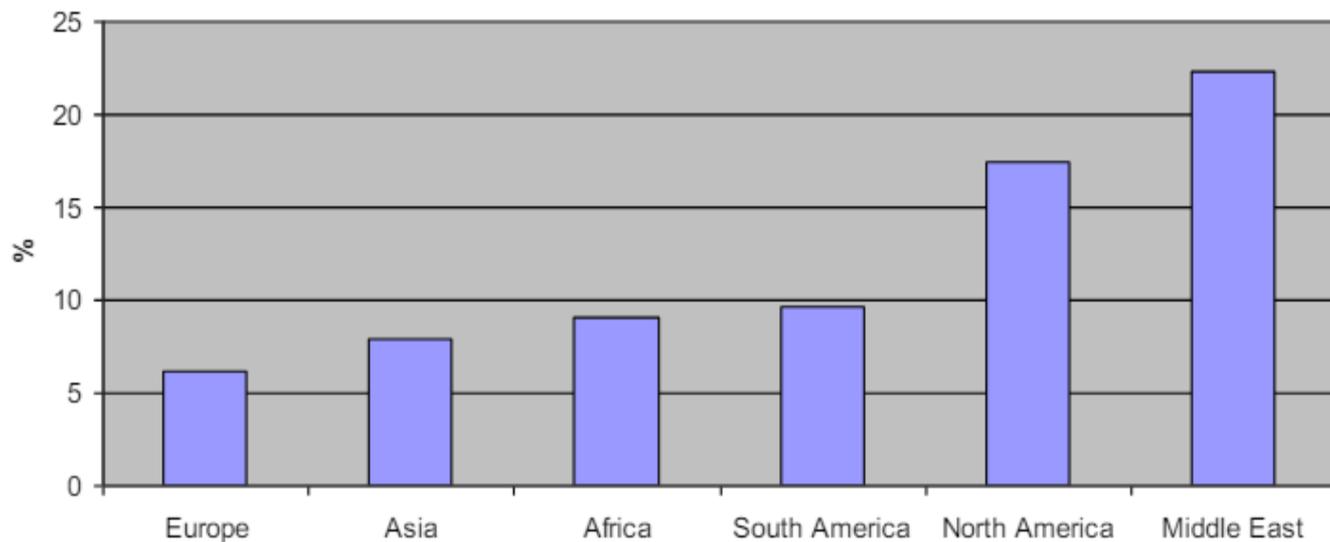

FIGURE 2. Number of people with diabetes worldwide per region in 2017 and 2045 (20–79 years). Source: International Diabetes Federation. IDF Diabetes Atlas, 8th edn. Brussels, Belgium: International Diabetes Federation, 2017.

Global Incidence of type I DM

Diabetes mellitus is highly prevalence in the Middle East.

Global prevalence of type II DM

In Jordan, T2DM

- Estimations of the prevalence of T2DM in Jordan were reported variably over the past decade to range from 11-17% (Ajlouni et al., 2008) (Internationa Diabetes Federation, 2015).

- An increase in the prevalence of T2DM by 31.5% was reported between 1998 and 2008 (Ajlouni et al. 1998; Ajlouni et al. 2008).

- Overweight 62.3%

- Obesity 28.1%

- Physical inactivity 12.1%

Increase in age, increase in body mass index, and having a family history of diabetes were associated with increased odds of diabetes and IFG.

WHO 2016

In Jordan, T1DM

- The incidence of type 1 diabetes mellitus in Jordanian children aged 0-14 years was calculated from 1992 to 1996, with rates ranging from 2.8 to 3.6 per 100,000 population.

- Male-to-female ratio: 1:1.03

- Seasonal variation: higher incidence in winter, lower in summer

- Despite being among the lowest in the region, there is a noted increase in incidence over the years.

Diabetes mellitus mortality rate account of **7% of** total deaths in all ages in Jordan
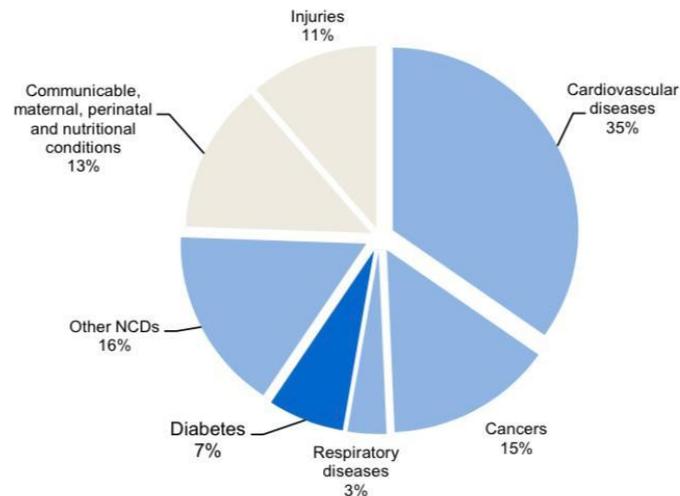

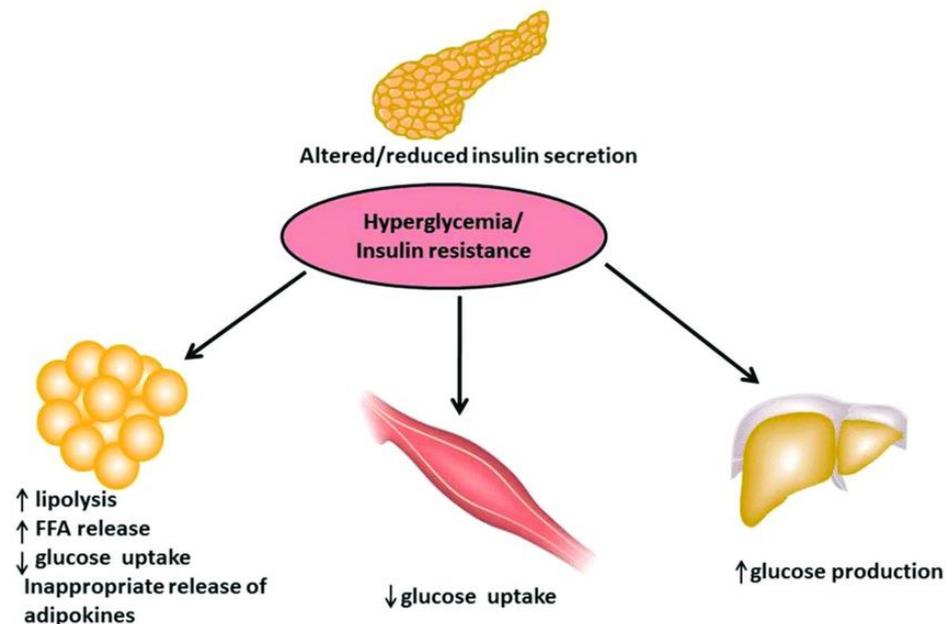
World Health Organization – Jordan Diabetes profiles, 2016
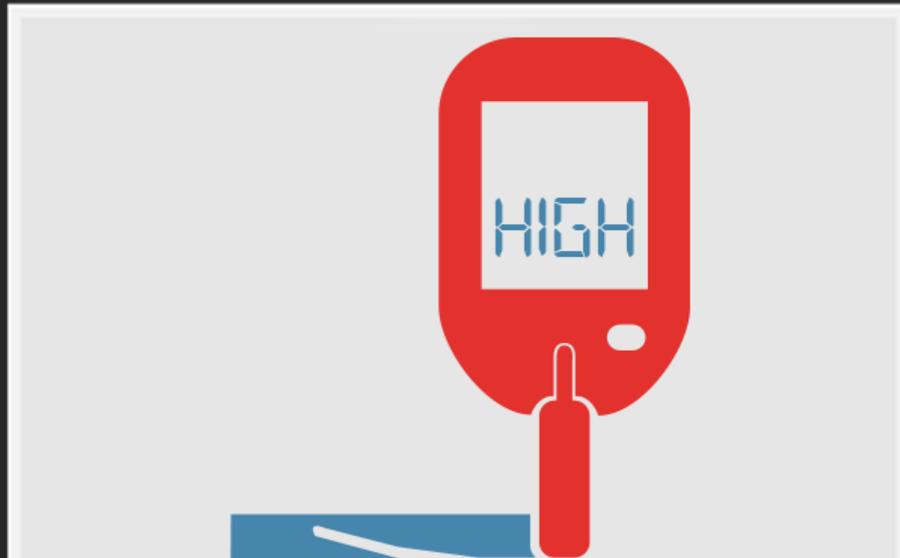
Epidemiology and global burden of diabetes

- One in two (50.1%) people living with diabetes do not know that they have diabetes.

- Annual global health care spending on diabetes among adults was US$ 850 billion (IDF, 2017).

- The effects of diabetes extend beyond the individual to affect their families and whole societies.

Aetio-pathology of diabetes

- The underlying characteristic common to all forms of diabetes is the dysfunction or destruction of pancreatic β-cells.

- Many mechanisms can lead to a decline in function or the complete destruction of β-cells (these cells are not replaced, **as the human pancreas seems incapable of renewing β-cells after the age of 30 years**).

- These mechanisms include genetic predisposition and abnormalities, epigenetic processes, insulin resistance, auto-immunity, concurrent illnesses, inflammation, and environmental factors.

Altered/reduced insulin secretion

Hyperglycemia/ Insulin resistance

↑ lipolysis
↑ FFA release
↓ glucose uptake
Inappropriate release of adipokines

↓ glucose uptake

↑ glucose production

Definition

Hyperglycemia

Normal Blood Glucose   High Blood Glucose

▶ Hyperglycaemia or raised blood sugar is a common effect of uncontrolled diabetes

- **Impaired glucose tolerance (IGT) and impaired fasting glycaemia (IFG):**

- Are intermediate conditions in the transition between "normality" and diabetes.

Table 3. Stages of Beta-Cell Dysfunction

Stage	Description
Stage 1: Compensation	Associated with higher overall rates of insulin secretion in an attempt to overcome the reduced insulin sensitivity, thereby maintaining normal blood glucose levels
Stage 2: Stable adaptation	While the beta-cells attempt to compensate for the reduced insulin sensitivity in this stage, blood glucose levels still rise between 5.0 and 6.5 mmol/L. At this point, beta-cell mass is lost and the normal functioning of the beta-cells begins to be disrupted
Stage 3: Unstable early decompensation	During this transient phase, glucose levels rise to those seen in stage 4. Associated with an inadequate beta-cell mass, this stage progresses relatively quickly
Stage 4: Stable decompensation	Most individuals with T2DM remain in this stage for the rest of their lives, while some progress to stage 5. Individuals in this stage typically demonstrate severe beta-cell differentiation
Stage 5: Severe decompensation	Represents a profound reduction in beta-cell mass and progression to ketoacidosis

Source: Reference 19.

https://www.uspharmacist.com/article/prediabetes-management-44469

WHO classification of diabetes 2019

Type 1 diabetes

Type 2 diabetes

Hyperglycaemia first detected during pregnancy

- Diabetes mellitus in pregnancy Type 1 or type 2 diabetes first diagnosed during pregnancy
- Gestational diabetes mellitus

Hybrid forms of diabetes

- Slowly evolving immune-mediated diabetes of adults
- Ketosis prone type 2 diabetes

Other specific types

- Monogenic diabetes
- Monogenic defects of β-cell function
- Monogenic defects in insulin action
- Diseases of the exocrine pancreas
- Endocrine disorders
- Drug- or chemical-induced
- Infections
- Uncommon specific forms of immune-mediated diabetes
- Other genetic syndromes sometimes associated with diabetes

Unclassified diabetes: This category should be used temporarily when there is not a clear diagnostic category especially close to the time of diagnosis of diabetes
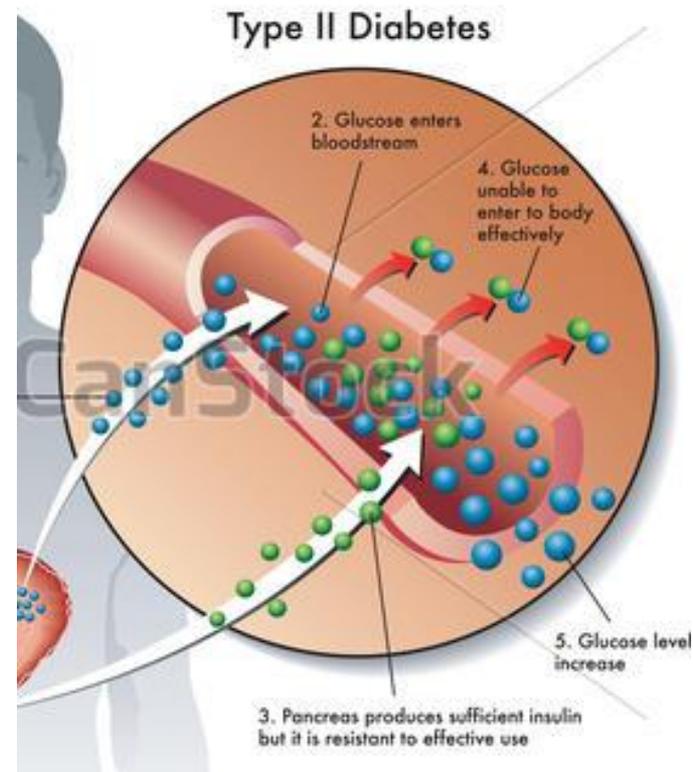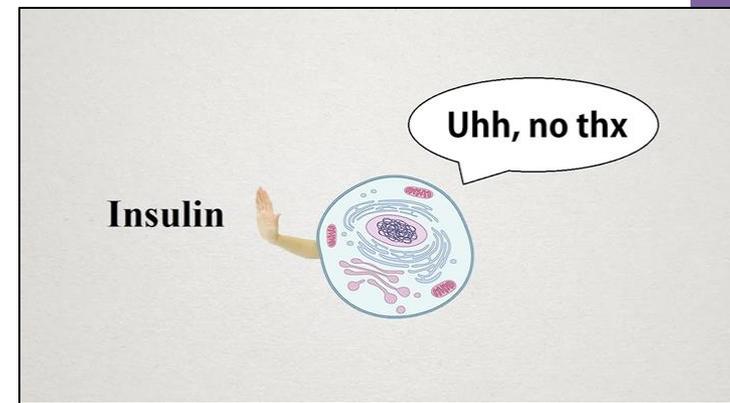
Type 1 diabetes (T1DM):

❖ Previously known as insulin-dependent or childhood-onset diabetes IDDM.

❖ Between 70% and 90% of people with T1DM at diagnosis have evidence of an **immune-mediated process** with β-cell autoantibodies against glutamic acid decarboxylase (GAD65), islet antigen-2 (IA-2), ZnT8 transporter or insulin

❖ <u>Characterized by a lack of insulin production.</u>

❖ Males and females are equally affected. Age of onset: <25 y. Despite T1DM occurring frequently in childhood, onset can occur in adults. (The rate of β-cell destruction is rapid in some individuals and slow in others).

❖ Lean body built

❖ In adults, T1DM accounts for approximately 5% of all diagnosed cases of diabetes globally (CDC, 2011).

Type 2 diabetes mellitus (T2DM)

❖ Formerly called Non–Insulin-Dependent Diabetes Mellitus (NIDDM) or adult-onset diabetes.

❖ It results from the body's ineffective use of insulin <u>and is the most common type among adults (90%)</u> (CDC, 2011).

❖ Unlike patients with T1DM, *patients with T2DM are not absolutely dependant on insulin*. This distinction was the basis for the older terminology for types 1 and 2 (Insulin Dependent and Non-Insulin Dependent Diabetes Mellitus) respectively (CDC, 2011).

❖ <u>Age of onset >40</u>

❖ <u>Obese body built</u>

❖ <u>T2DM is most common in adults, but an increasing number of children and adolescents are also affected</u>

Uhh, no thx

Insulin

Type II Diabetes

2. Glucose enters bloodstream

4. Glucose unable to enter to body effectively

5. Glucose level increase

3. Pancreas produces sufficient insulin but it is resistant to effective use

tock Photo - csp19194167

Risk factors for T2DM

Family history Lack of exercise Unhealthy eating Overweight

Aetiology of T2DM is multifactorial!

Many factors increase the risk of developing T2DM including .

Risk factors for type 2 diabetes:

- Overweight/obesity
- Physical inactivity
- Age
- Diabetes in first degree relatives
- History of gestational diabetes
- Cardiovascular disease and its risk factors
- hypertension or high blood pressure (140/90 mm Hg or higher)
- history of polycystic ovary syndrome
- low levels of HDL cholesterol (35 mg/dL) and high triglyceride
- acanthosis nigricans
- Ethnicity (South Asian, Afro-Caribbean, Hispanic, populations in the **Middle East**)

Hyperglycaemia first detected during pregnancy

1. Diabetes mellitus in pregnancy: defined by <u>the same criteria</u> as in non-pregnant persons.

2. Gestational diabetes mellitus

- It is considered as a risk factor for developing T2DM in mothers later in life.

- Diagnosed at glucose cut-off points that are <u>lower than those for diabetes</u>

Risk factors and risk markers for Gestational diabetes

- Age (the older a woman of reproductive age is, the higher her risk of GDM);
- Overweight or obesity;
- Excessive weight gain during pregnancy;
- A family history of diabetes;
- GDM during a previous pregnancy;
- A history of stillbirth or giving birth to an infant with congenital abnormality;
- History of birth to a baby weighing more than4.1kg
- and excess glucose in urine during pregnancy .

Diabetes in pregnancy and GDM increase the risk of future obesity and type 2 diabetes in offspring.

Symptoms and signs of diabetes

Symptoms of diabetes:

- thirst (Polydipsia)
- frequent urination (Polyuria)
- blurring of vision
- fatigue
- Slow healing infections
- Infections of skin vulva and urinary tract

Signs of Diabetes:

- unintentional weight loss with (Polyphagia)
- signs of acute metabolic deterioration (signs of severe dehydration, Kussmaul's respiration, vomiting, altered level of consciousness) Ketoacidosis (DKA) maybe the first presenting sign in T1DM.
- clinical signs of chronic complications (acute coronary disease, stroke, kidney disease, vision loss, diabetic foot)

Clinical presentation

- The course of T2DM is usually insidious!

T2DM often remains undiagnosed for many years because the hyperglycaemia is not severe enough to provoke noticeable symptoms of diabetes

- By the time these appear and diagnosis is confirmed, the majority of patients are likely to have already developed vascular complications , That's why early diagnosis is important.

Diagnosis

- Four diagnostic tests for diabetes are currently recommended including measurement of:
1. fasting plasma glucose;
2. 2-hour (2-h) post-load plasma glucose after a 75 g oral glucose tolerance test (OGTT);
3. HbA1c; and
4. A random blood glucose in the presence of signs and symptoms of diabetes.

Criteria for the Diagnosis of Diabetes

Fasting plasma glucose (FPG)
≥126 mg/dL (7.0 mmol/L)

OR

2-h plasma glucose ≥200 mg/dL
(11.1 mmol/L) during an OGTT

OR

A1C ≥6.5%

OR

Classic diabetes symptoms + random plasma glucose
≥200 mg/dL (11.1 mmol/L)

American Diabetes Association Standards of Medical Care in Diabetes.
Classification and diagnosis of diabetes. Diabetes Care 2017; 40 (Suppl. 1): S11-S24

Impaired glucose tolerance

- Two-hour glucose levels of 140 to 199 mg per dL (7.8 to 11.0 mmol) on the 75-g [oral glucose tolerance test](#).

- A patient is said to be under the condition of IGT when he/she has an intermediately raised [glucose](#) level after 2 hours, but less than would qualify for type 2 diabetes mellitus. The [fasting](#) glucose may be either normal or mildly elevated.

Impaired fasting glucose

- fasting blood glucose level is consistently elevated above what is considered normal levels; however, it is not high enough to be diagnosed as diabetes mellitus.

- This pre-diabetic state is associated with insulin resistance and increased risk of cardiovascular pathology, although of lesser risk than impaired glucose tolerance (IGT).

- There is a 50% risk over 10 years of progressing to overt diabetes. A recent study cited the average time for progression as less than three years
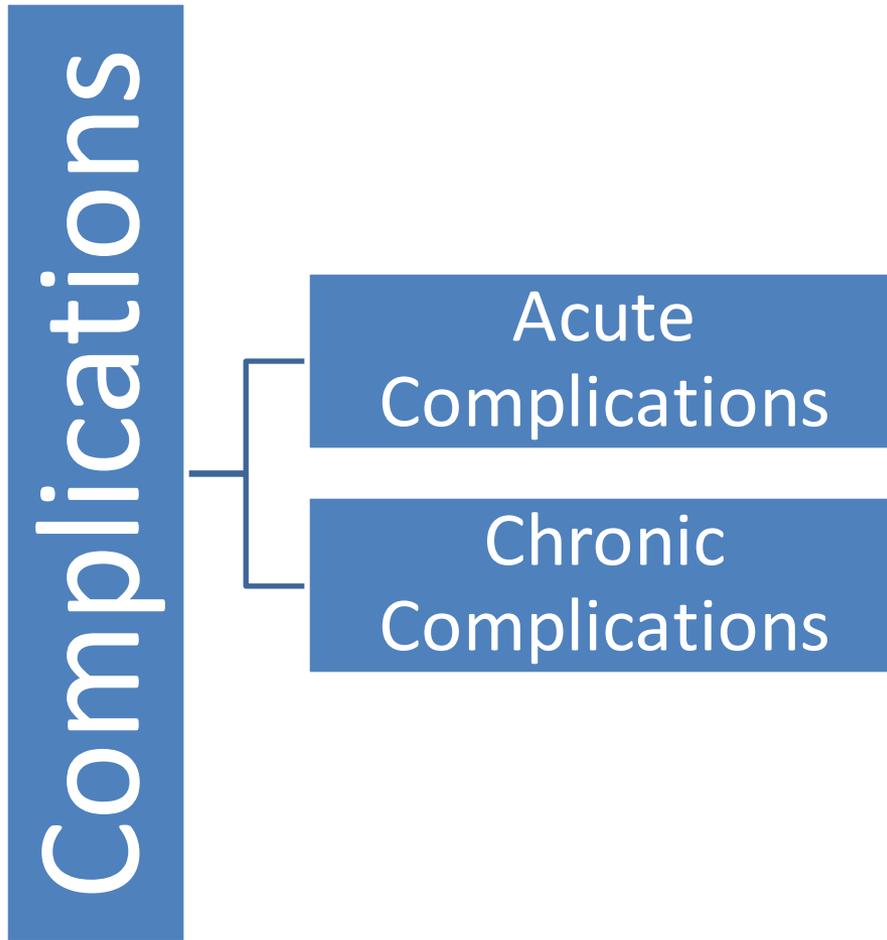
Prediabetes

- Broadly refers to an intermediate stage between completely normal glucose levels and the clinical entity of type 2 diabetes.

- At this stage, fasting glucose, glucose tolerance test or glycated haemoglobin (HbA1c) will be impaired.

Road to T2DM

	A1C Test	Fasting Blood Sugar Test	Glucose Tolerance Test
Diabetes	6.5% or Above	126 mg/dl or above	200 mg/dl or above
Prediabetes	5.7 - 6.4%	100 -125 mg/dl	140 - 199 mg/dl
Normal	Below 5.7%	99 mg/dl or below	140 mg/dl or below

Complications

Acute complications of diabetes

- Two important acute complications are hypoglycaemia and hyperglycaemic emergencies.

1. Hypoglycaemia (abnormally low blood glucose) It can cause loss of consciousness and coma and is potentially life-threatening. It is most frequently defined at plasma glucose of ≤3.9 mmol/L (70 mg/dL),

- Symptoms and signs of hypoglycaemia • headache • hunger • irritability, anxiety • paraesthesias • palpitations • sweating • trembling • difficulty in speaking • confusion • ataxia • stupor • pallor • seizures • coma

2. Hyperglycaemic emergencies: Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS) are life-threatening conditions with different biochemical features.

Chronic complications of diabetes

- **Macrovascular complications:** Coronary heart disease, cerebrovascular disease and peripheral vascular disease are a major cause of morbidity and mortality in people with diabetes.

- **Microvascular complications:**

1. Diabetic eye disease: Diabetic retinopathy is a leading causes of blindness.

2. Diabetic kidney disease: Diabetic Nephropathy. If untreated, once the stage of proteinuria is reached it often ends in renal failure in about 5 to 7 years

3. Diabetic Nerve damage (Neuropathy) *The most common forms are distal symmetrical peripheral neuropathy, which is predominantly sensory.* Loss of protective sensation in peripheral neuropathy is a predisposing condition leading to foot ulcer and amputation (Diabetic foot).

Prevention

- At present, **type 1 diabetes** cannot be prevented.
- For type 2 diabetes:

- Primary prevention: Key step is the primary prevention through **lifestyle modification** with **physical activity** and/or **healthy diet** can delay or prevent the onset of type 2 diabetes, decreased smoking.

- By losing 5 to 7 percent of their body weight and getting 150 minutes of physical activity a week, people with prediabetes can cut their risk of developing type 2 diabetes by more than half.

- **IDF recommends physical activity at least between three to five days a week, for a minimum of 30-45 minutes.**

- **The earlier healthy habits acquired, the better outcome.**

- **Community-based interventions** can reach individuals and families through campaigns, education, social marketing and encourage physical activity both inside and outside school and the workplace.

Prevention

- **Secondary prevention:**
- Early detection and diagnosis
- Optimal glycemic control
- Control of symptoms
- Prevention of acute complications **at the right time is beneficial in term of quality of life and is cost effective specially if it can prevent hospital admissions**
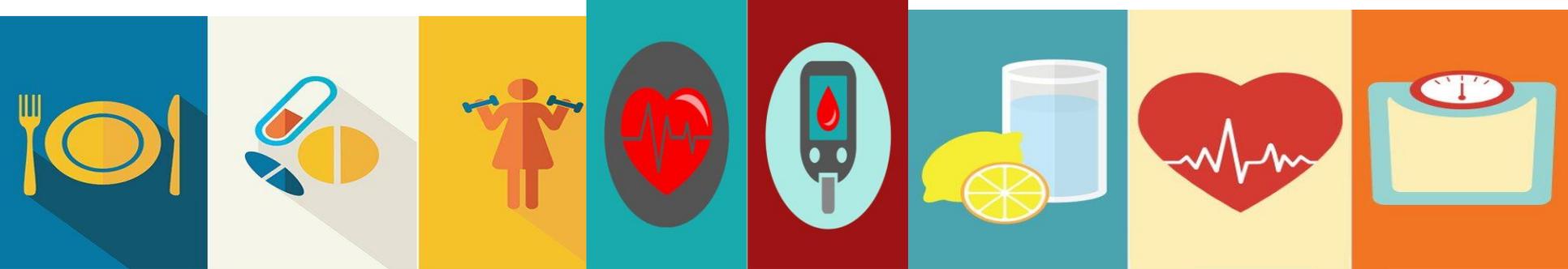
Treatment:
The aim is to maintain serum glucose level within normal.

T1DM

- Insulin

T2DM

- **Proper nutrition, weight loss, and physical exercise are the first line of treatment for DM 2.**
- The ideal Body Mass Index (BMI) for patients with type II diabetes mellitus is 20-22.5
- Advice patients to be active a total of 30 minutes most days. Always advise type II DM patients to exercise against resistance
- Advice your patients to check their feet every day for cuts, blisters, sores, swelling, redness, or sore toenails.
- All patients should be advised on avoidance of tobacco use and harmful use of alcohol.
- Medications are given either to increase insulin secretion to help overcome the resistance, or to directly decrease the resistance and re-sensitize insulin receptor.
- Many classes of drugs; biguanides (metformin) and sulfonylureas. Given orally.

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Complications management

- **The aim** is to treat complications and **rehabilitate** patient to lead a life as normal as possible.

- **For example :** periodic checkups for visual acuity and retina (retinopathy), renal function (nephropathy), and testing peripheral nerves sensation (neuropathy), in order to prevent farther deterioration and periodic foot examination.

- **T1DM :** annually after 5 years of diagnosis; patient is >15 years old.

- **T2DM :** annually, starting at the time of diagnosis.

Health services for diabetes patients IN JORDAN

- Health sectors (public and private) provide primary, secondary and tertiary healthcare services to patients with diabetes (MoH, 2014).

- In addition, *a National Centre for Diabetes, Endocrinology and Genetics (NCDEG) was established in 1996.*

- NCDEG attracts patients from all over the country who are either physician-referred or self-referred.

THANK YOU

https://www.who.int/publications/i/item/who-ucn-ncd-20.1