# PREVENTION OF DIABETES MELLITUS

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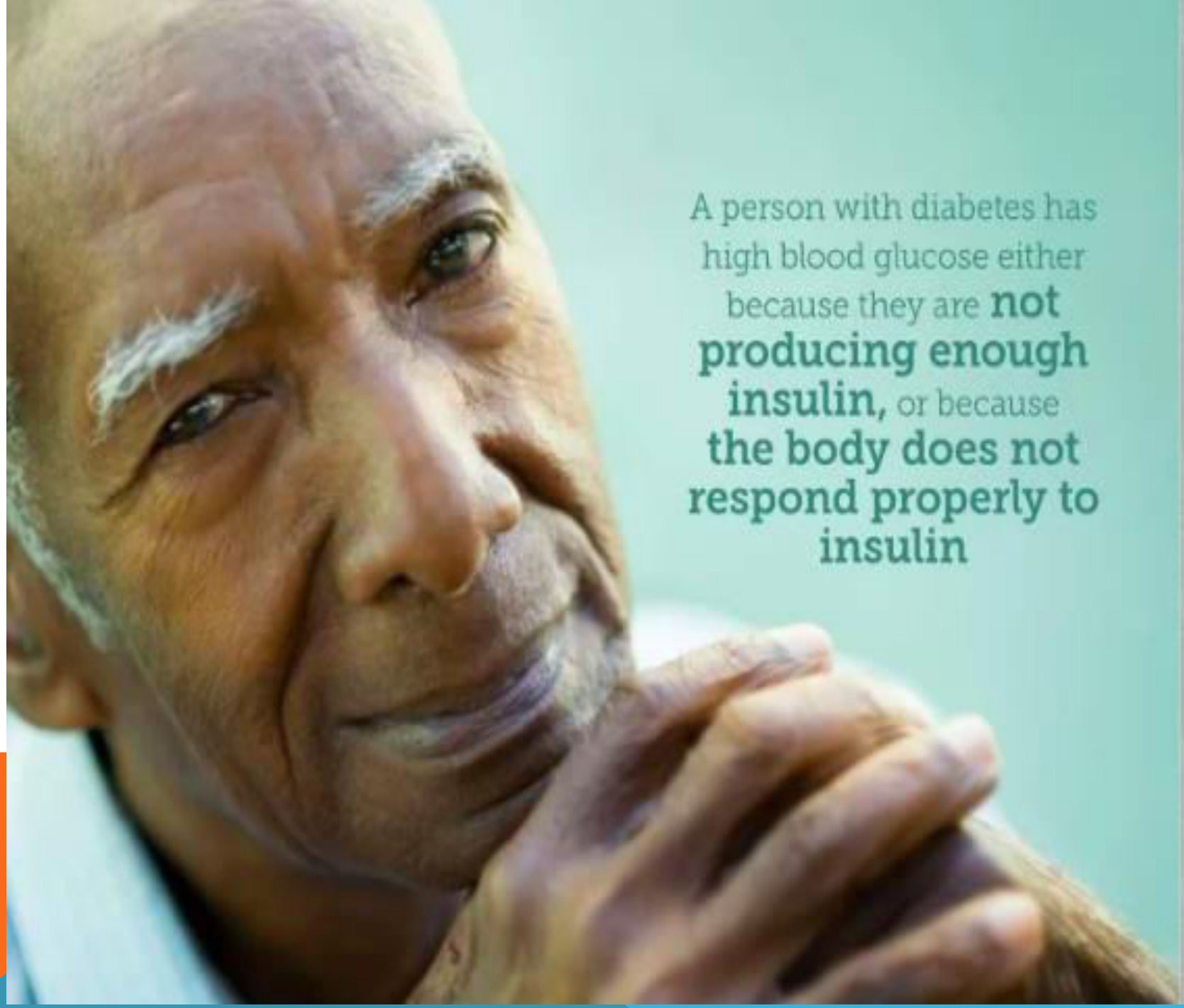
# LEARNING OBJECTIVES

By the end of this lecture you should be able to know

1. Discuss Prevalence of diabetes mellitus globally and in Pakistan
2. Discuss modifiable and non-modifiable risk factors for diabetes mellitus
3. Describe epidemiological determinants of diabetes
4. Discuss screening methods for diabetes mellitus
4. Discuss the prevention (Primary, secondary and tertiary) of diabetes mellitus



A person with diabetes has high blood glucose either because they are **not producing enough insulin,** or because **the body does not respond properly to insulin**

# What is diabetes?

# TYPES OF DIABETES

There are three main types of diabetes:

type 1,

type 2, and

gestational diabetes (diabetes while pregnant).

# TYPE 1 DIABETES

Type 1 diabetes (previously known as insulin-dependent, juvenile or childhood-onset) is characterized by deficient insulin production and requires daily administration of insulin.

In 2017 there were 9 million people with type 1 diabetes; the majority of them live in high-income countries.

Neither its cause nor the means to prevent it are known.

There's no known way to prevent type 1 diabetes. But researchers are working on preventing the disease or further damage of the islet cells in people who are newly diagnosed

# TYPE 2 DIABETES

Type 2 diabetes affects how your body uses sugar (glucose) for energy. It stops the body from using insulin properly, which can lead to high levels of blood sugar if not treated.

Over time, type 2 diabetes can cause serious damage to the body, especially nerves and blood vessels.

Type 2 diabetes is often preventable. Factors that contribute to developing type 2 diabetes include being overweight, not getting enough exercise, and genetics.

More than 95% of people with diabetes have type 2 diabetes. Type 2 diabetes was formerly called non-insulin dependent, or adult onset. Until recently, this type of diabetes was seen only in adults but it is now also occurring increasingly frequently in children.

# GESTATIONAL DIABETES

Gestational diabetes is hyperglycaemia with blood glucose values above normal but below those diagnostic of diabetes. Gestational diabetes occurs during pregnancy.

Women with gestational diabetes are at an increased risk of complications during pregnancy and at delivery. These women and possibly their children are also at increased risk of type 2 diabetes in the future.

Gestational diabetes is diagnosed through prenatal screening, rather than through reported symptoms.

# EPIDEMIOLOGY

Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves.

The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin. In the past 3 decades the prevalence of type 2 diabetes has risen dramatically in countries of all income levels. Type 1 diabetes, once known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin by itself

The number of people with diabetes rose from 108 million in 1980 to 422 million in 2014. Prevalence has been rising more rapidly in low- and middle-income countries than in high-income countries.

Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation.

In 2014, 8.5% of adults aged 18 years and older had diabetes.

In lower-middle-income countries, the mortality rate due to diabetes increased 13%.

Between 2000 and 2019, there was a 3% increase in diabetes mortality rates by age.

In 2019, diabetes and kidney disease due to diabetes caused an estimated 2 million deaths.

In 2019, diabetes was the direct cause of 1.5 million deaths

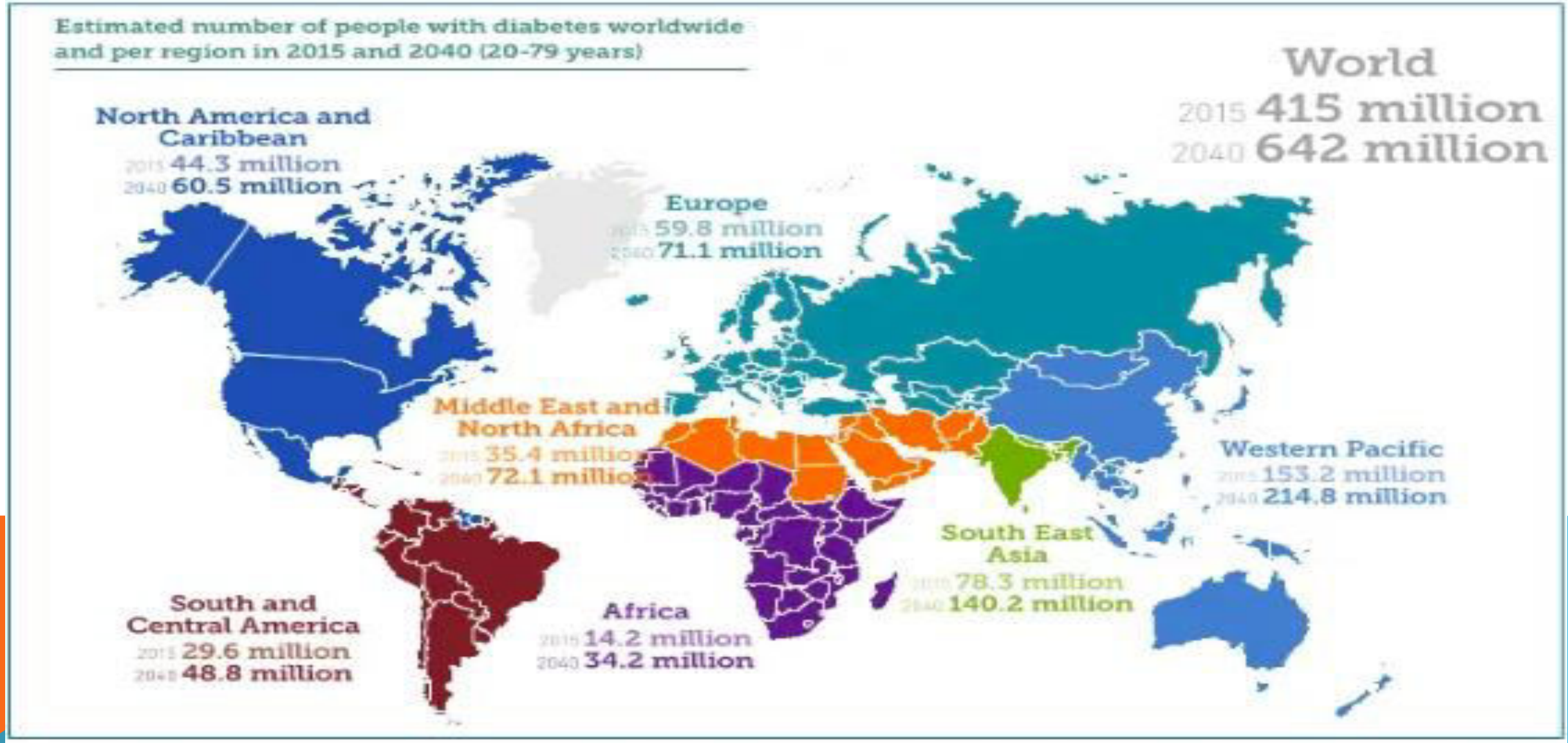
and 48% of all deaths due to diabetes occurred before the age of 70 years.

Another 460 000 kidney disease deaths were caused by diabetes, and raised blood glucose causes around 20% of cardiovascular deaths .

A 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.

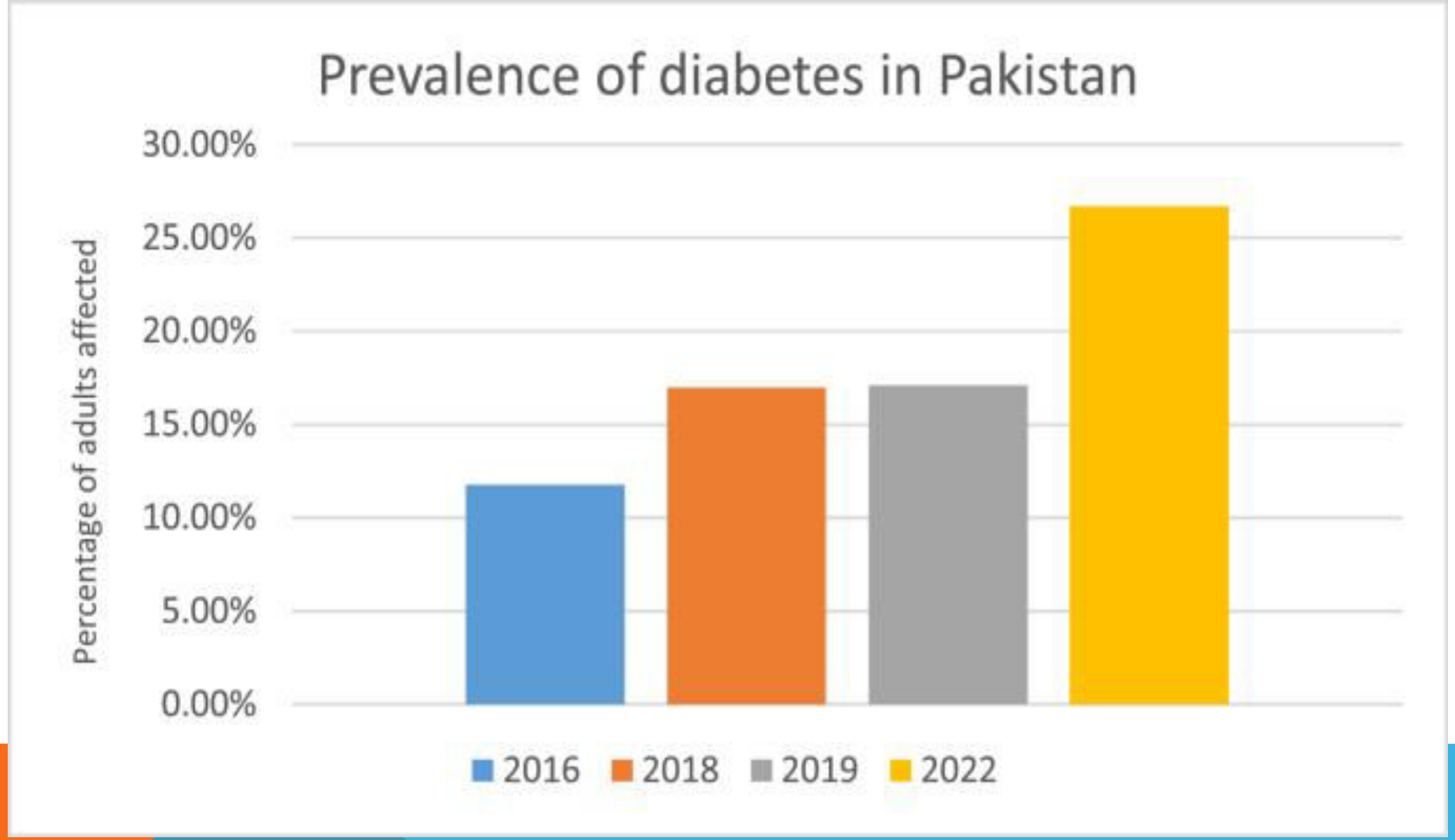
# GLOBAL BURDEN OF DIABETES



# DIABETES IN PAKISTAN

According to the International Diabetes Federation, in 2022, 26.7% of adults in Pakistan are affected by diabetes making the total number of cases approximately 33,000,000 . This number is alarmingly high and is also increasing with each passing year.

There is also reason to believe that many patients go undiagnosed, making both the actual prevalence and the risk of complications due to the absence of treatment much higher.

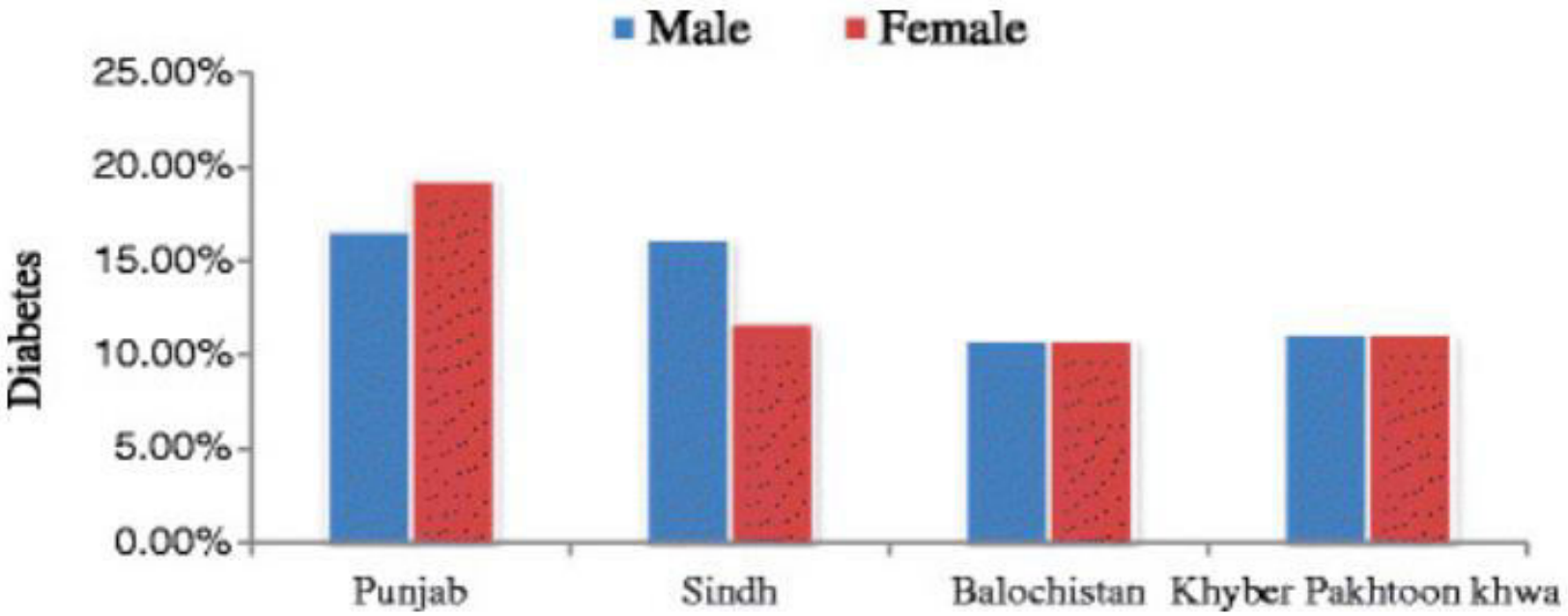

Prevalence of diabetes in Pakistan
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percentage of adults affected
2016
2018
2019
2022

The prevalence of diabetes in Pakistan in 2016 ,2018 , and 2019 was 11.77%, 16.98%, and 17.1%, respectively .

According to the International Diabetes Federation, in 2022, 26.7% of adults in Pakistan are affected by diabetes making the total number of cases approximately 33,000,000.

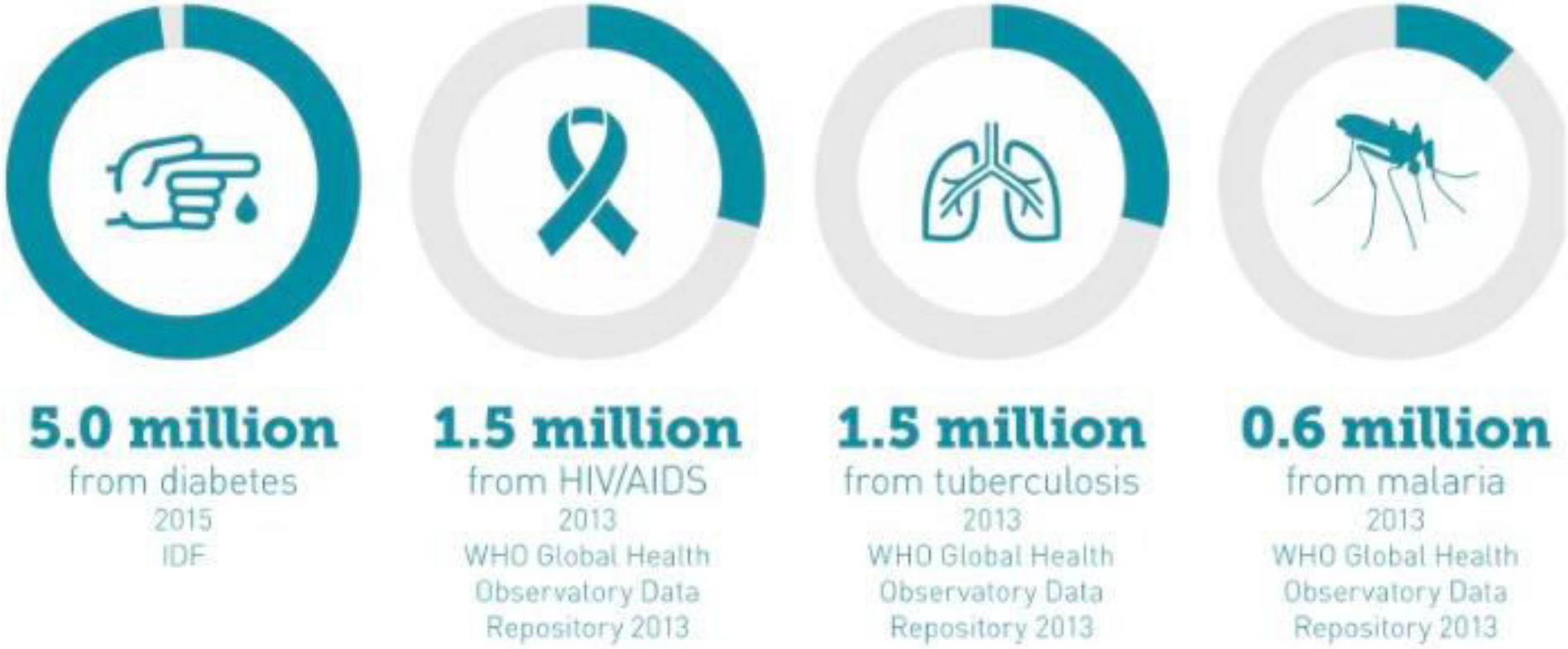
# REGIONAL PREVALANCE IN PAKISTAN

The prevalence of diabetes in Pakistan was revealed **14.62%** (10.651%–19.094%; 14 studies) based on 49,418 people using the inverse–variance random–effects model. The prevalence of prediabetes was 11.43% (8.26%–15.03%; 10 studies) based on a total sample of 26,999 people.




Regional and gender wise prevalence of diabetes in Pakistan.

# Mortality due to diabetes



# Etiology of Type 1 DM

- Autoimmune disease
- Selective destruction of β cells by T cells
- Several circulating antibodies against β cells
- Cause of autoimmune attack: unknown
- Both genetic & environmental factors are important

# Etiology of Type 2 DM

- Response to insulin is decreased
  - ↓glucose uptake (muscle, fat)
  - ↑glucose production (liver)
- The mechanism of insulin resistance is unclear
- Both genetic & environmental factors are involved
- Post insulin receptor defects

# RISK FOR TYPE 1 DIABETES

Family history. Anyone with a parent or sibling with type 1 diabetes has a slightly higher risk of developing the condition.

Genetics. Having certain genes increases the risk of developing type 1 diabetes.

Geography. ... travel away from the equator

Age

# RISK FOR TYPE 2 DIABETES

Have prediabetes.

Are overweight.

Are 45 years or older.

Have a parent, brother, or sister with type 2 diabetes.

Are physically active less than 3 times a week.

Have ever had gestational diabetes (diabetes during pregnancy) or given birth to a baby who weighed over 9 pounds.

# RISK FACTORS OF GESTATIONAL DIABETES

Being overweight or obese.

Not being physically active.

Having prediabetes.

Having had gestational diabetes during a previous pregnancy.

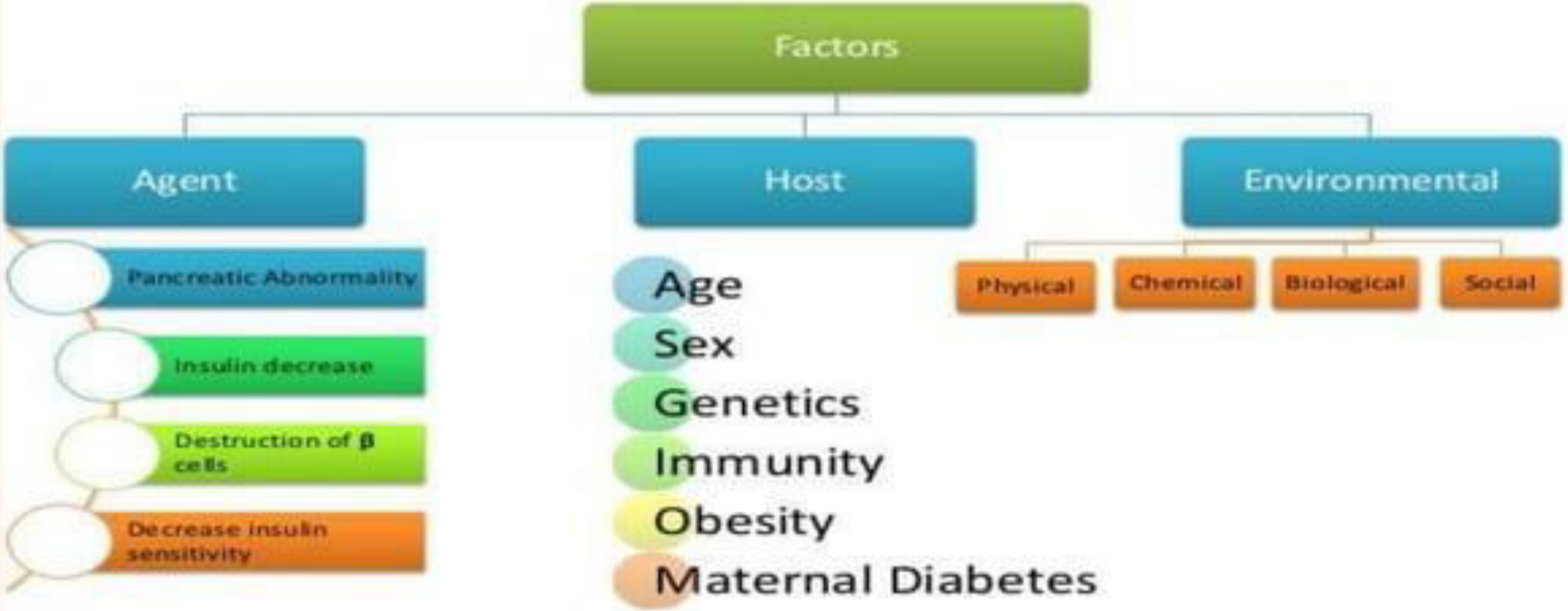
Having polycystic ovary syndrome.

Having an immediate family member with diabetes.

Having previously delivered a baby weighing more than 9 pounds (4.1 kilograms)

# EPIDEMIOLOGICAL DETERMINENTS OF DIABETES

# EPIDEMIOLOGICAL DETERMINANTS



# ENVIRONMENT FACTOR

- Sedentary life
- Diet
- Dietary fiber
- Malnutrition
- Alcohol
- Viral infection
- chemical agent
- stress
- socioeconomic status
- urbanization

# Screening methods for diabetes mellitus

# DIAGNOSIS OF DIABETES

| | | |
|---|---|---|
| Fasting plasma glucose | ≥7.0 mmol/l | 6.1–6.9 mmol/l |
| | ≥126 mg/dl | 110–125 mg/dl |
| 2 h plasma glucose after OGTT | ≥11.1 mmol/l | 7.8–11.0 mmol/l |
| | ≥200 mg/dl | 140–199 mg/dl |
| Random plasma glucose | ≥11.1 mmol/l | |
| | ≥200 mg/dl | |
| Glycosylated haemoglobin | ≥6.5% | |

*Adapted from World Health Organization and International Diabetes Federation.[6]

DM = diabetes mellitus; OGTT = oral glucose tolerance test.


1. Fasting for 8 - 12 hours
1
2
3
3. Glucose drink
4
2. Blood is withdrawn
to test fasting blood glucose level
4. Blood samples are drawn for
three times with the time interval
of one hour
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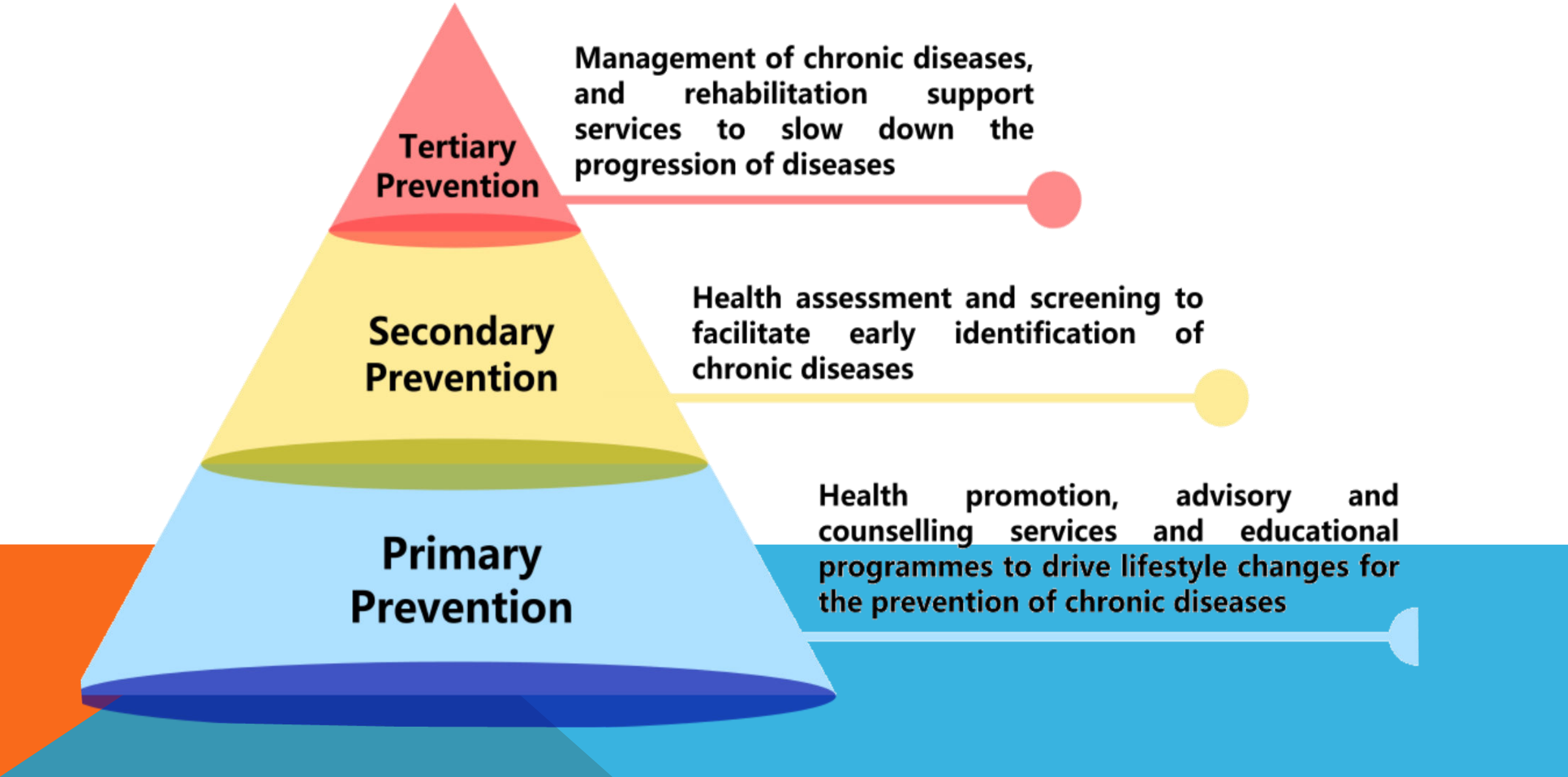
# 3 CURRENT DIAGNOSTIC CRITERIA FOR DIABETES MELLITUS?

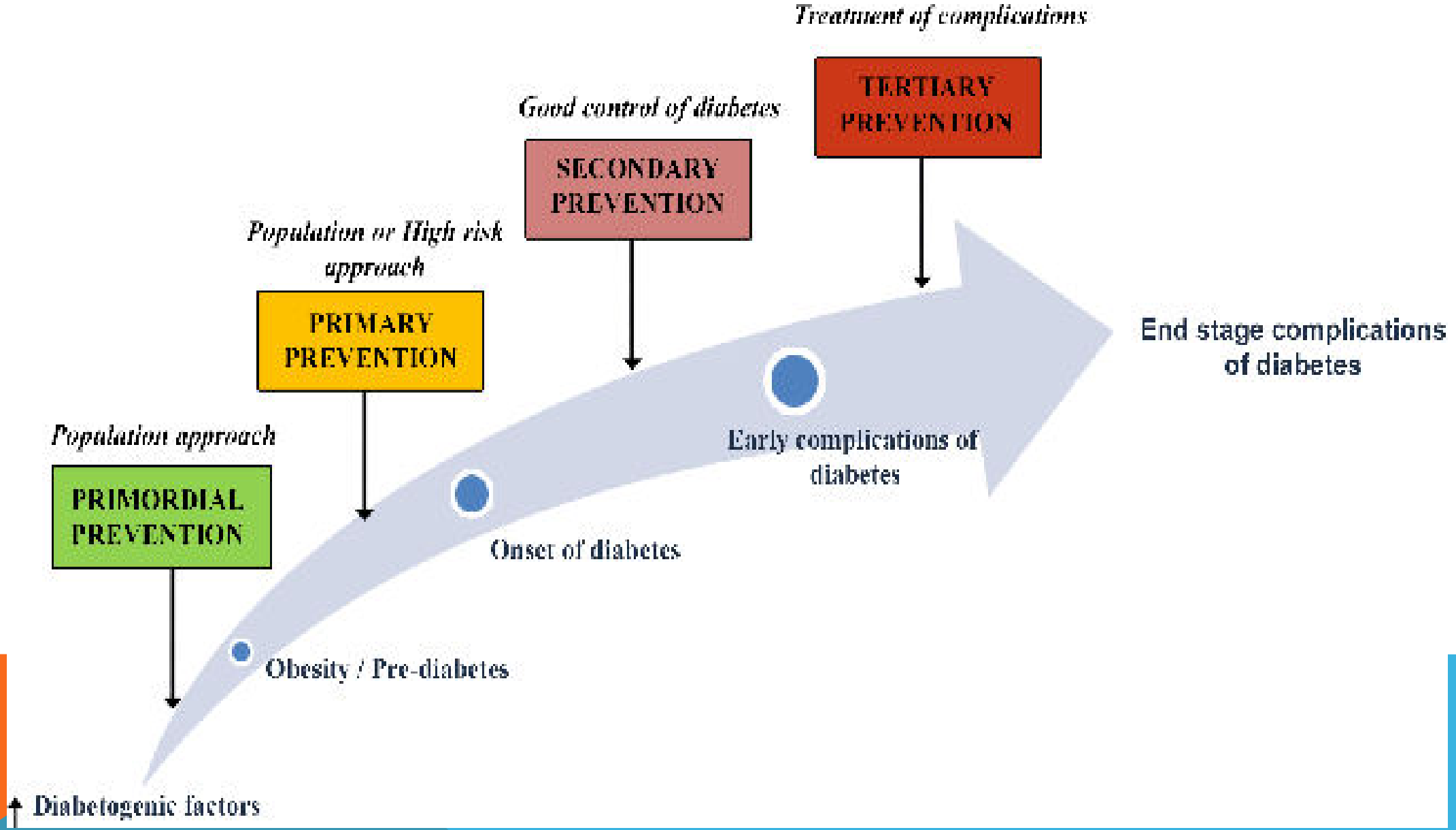
Diabetes is diagnosed at an HbA1C of greater than or equal to 6.5%

Diabetes is diagnosed at fasting blood glucose of greater than or equal to 126 mg/dl.

Diabetes is diagnosed at two-hour blood glucose of greater than or equal to 200 mg/dl.

# THE PREVENTION (PRIMARY, SECONDARY AND TERTIARY) OF DIABETES MELLITUS




Treatment of complications
TERTIARY PREVENTION
Good control of diabetes
SECONDARY PREVENTION
Population or High risk approach
PRIMARY PREVENTION
Population approach
PRIMORDIAL PREVENTION
End stage complications of diabetes
Early complications of diabetes
Onset of diabetes
Obesity / Pre-diabetes
Diabetogenic factors

# PRIMARY PREVENTION

## POPULATION STRATEGY –

- Primordial prevention
- Maintenance of normal body weight through adoption of healthy nutritional habits and physical exercise.
- An adequate protein intake,
- A high intake of dietary fibre and avoidance of sweet foods.
- Elimination of other less well defined factors such as protein deficiency and food toxins.
- education of patients and their families to optimize the effectiveness of primary health care services.

## HIGH-RISK STRATEGY –

- no special high-risk strategy for type 1 diabetes.
- Genetic counselling may be done but not feasible at present.
- Correction of sedentary lifestyle, over-nutrition and obesity for NIDDM.
- Avoidance of Alcohol, diabetogenic drugs like oral contraceptives.
- Reduction of factors that promote atherosclerosis, e.g., smoking, high blood pressure, elevated cholesterol and high triglyceride levels.
- May be directed at target population groups.

# SECONDARY PREVENTION

**EARLY DIAGNOSIS –**

a) Proper screening

b) Routine checking of blood sugar, of urine for proteins and ketones, of blood pressure, visual acuity and weight should be done periodically.

c) The feet should be examined for any defective blood circulation (Doppler ultrasound probes are advised), loss of sensation and the health of the skin.

d) Primary health care – of utmost importance.

# TERTIARY PREVENTION

- Diabetes is major cause of disability through its complications, e.g., blindness, kidney failure, coronary thrombosis, gangrene of the lower extremities, etc.
- The main objective at the tertiary level is to organize specialized clinics (Diabetic clinics) and units capable of providing diagnostic and management skills of a high order.
- The tertiary level should also be involved in basic, clinical and epidemiological research.
- local and national registries for diabetics should be established.

# Comparison between type 1 & 2 DM

| Comparison of type 1 and 2 diabetes | | |
|---|---|---|
| **Feature** | **Type 1 diabetes** | **Type 2 diabetes** |
| **Onset** | Sudden | Gradual |
| **Age at onset** | Any age (mostly young) | Mostly in adults |
| **Body habitus** | Thin or normal | Often obese |
| **Ketoacidosis** | Common | Rare |
| **Autoantibodies** | Usually present | Absent |
| **Endogenous insulin** | Low or absent | Normal, decreased or increased |
| **Concordance in identical twins** | 50% | 90% |
| **Prevalence** | Less prevalent | More prevalent - 90 to 95% of |

https://www.google.com/search?q=epidemiology+of+diabetes+in+pakistan&sca_esv=a8657e4f00d25584&sca_upv=1&sxsrf=ADLYWIIdoM9X9-UftF62V6bPqiKyhDl_5Q%3A1715836015115&ei=b5RFZuXUBtmbkdUP8KmAkAQ&oq=epidemiology+of+diabetes+&gs_lp=Egxnd3Mtd2I6LXNlcnAiGWVwaWRlbWlvbG9neSBvZiBkaWFiZXRlcyAqAggEMgoQABiABBhDGIoFMgoQABiABBhDGIoFMgoQABiABBhDGIoFMgoQABiABBhDGIoFMgUQABiABDIKEAAYgAQYQxiKBTIKEAAYgAQYFBiHAjIKEAAYgAQYQxiKBTIKEAAYgAQYQxiKBTIFEAAYgARImCNQRlhGcAF4AZABAJgB1gGgAdYBqgEDMi0xuAEByAEA-AEBmAICoAKHAsICChAAGLADGNYEGEfCAg0QABiABBiwAxhDGIoFmAMAiAYBkAYKkgcFMS4wLjGgB_cG&sclient=gws-wiz-serp

https://www.who.int/news-room/fact-sheets/detail/diabetes

https://www.google.com/search?q=types+of+diabetes+&sca_esv=6c1772c741fb3aa7&sca_upv=1&sxsrf=ADLYWIJdnvxHRS8bAVbWcDRr-F75zr4WoQ%3A1715833652452&ei=NItFZqWWG-PgkdUPkqeZ6As&ved=0ahUKEwilg0S6qpGGAxVjcKQEHZJTBr0Q4dUDCBA&uact=5&oq=types+of+diabetes+&gs_lp=Egxnd3Mtd2I6LXNlcnAiEnR5cGVzIG9mIGRpYWJldGVzIDIKECMYgAQYJxiKBTIFEAAYgAQyBRAAGIAEMgoQABiABBhDGIoFMgUQABiABDIFEAAYgAQyBRAAGIAESMMZUIcFWNIHcAF4AZABAJgBlAOgAf8EqgEHMi0xLjAuMbgBA8gBAPgBAZgCAqACvgLCAgoQABiwAxjWBBhHwglNEAAYgAQYsAMYQxiKBZgDAIgGAZAGCplHBTEuMC4xoAeeDg&sclient=gws-wiz-serp

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9289249/