

# Epidemiology of Diabetes Mellitus

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# Objectives

- To list the types of Diabetes Mellitus
- To describe the prevalence of Diabetes Mellitus
- To recognize the importance of diagnostic criteria for estimating the prevalence of diabetes mellitus
- To discuss the risk factors and complications of type II 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

# Types of diabetes

- Type 1: sudden onset absolute deficiency in insulin. Usually affects younger age group (not always)
- Type 2: gradual onset of relative insulin insensitivity. Usually older age group (not always)
- Gestational diabetes: Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy

# Types of diabetes

- Secondary diabetes: The diabetes is not the main illness, a secondary condition that results because of the main illness. If it is possible to treat the main illness successfully the diabetes may/will disappear e.g. cystic fibrosis, chronic pancreatitis, infections.
- Pre-diabetes: Impaired glucose tolerance A person with pre-diabetes has a blood sugar level higher than normal, but not high enough for a diagnosis of diabetes; & is at higher risk for developing type 2 diabetes. May remain undiagnosed for years; risk of complications same as for T2DM

# Global Prevalence of Diabetes

- 2.8% in 2000;4.4% in 2030 worldwide (171 million in 2000; 366 million by 2030)
- DM worldwide was already 366 million in 2011
- The prevalence increased to 382 millions (8.2%) by 2013 and current figures are >415 million
- There is a large percentage of undiagnosed cases and a large percentage at high risk of developing DM
- A huge percentage of the reported diabetics are in the 40-59 age group, among whom 80% live in countries with low and middle-income economies

# Global Prevalence of Diabetes

- In 2013, about half of all diabetes-related deaths in adults were in the age group below 60 years.
- Every six seconds there is a diabetes-related death and more so in the poorly-developed regions
- 35 out of 219 countries (16%) show very high prevalence of diabetes, more than 12%
- These countries fall mainly in the regions of the Middle-East, North Africa, South Asia and Western Pacific

# Estimated prevalence and number of people with diabetes (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
<b>Total<sup>a</sup></b>	<b>4.7%</b>	<b>8.5%</b>	<b>108</b>	<b>422</b>

a. Totals include non-Member States.

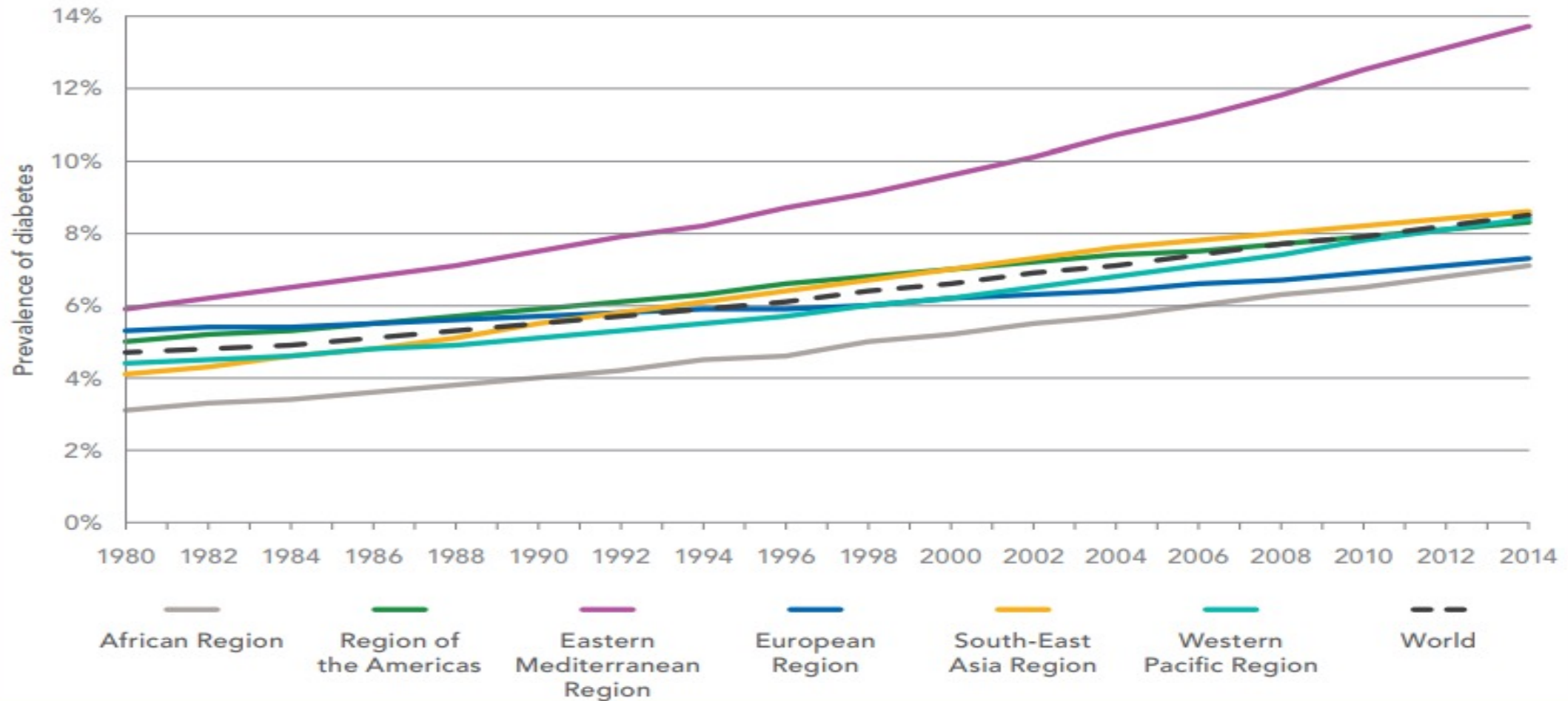
Source: (4).



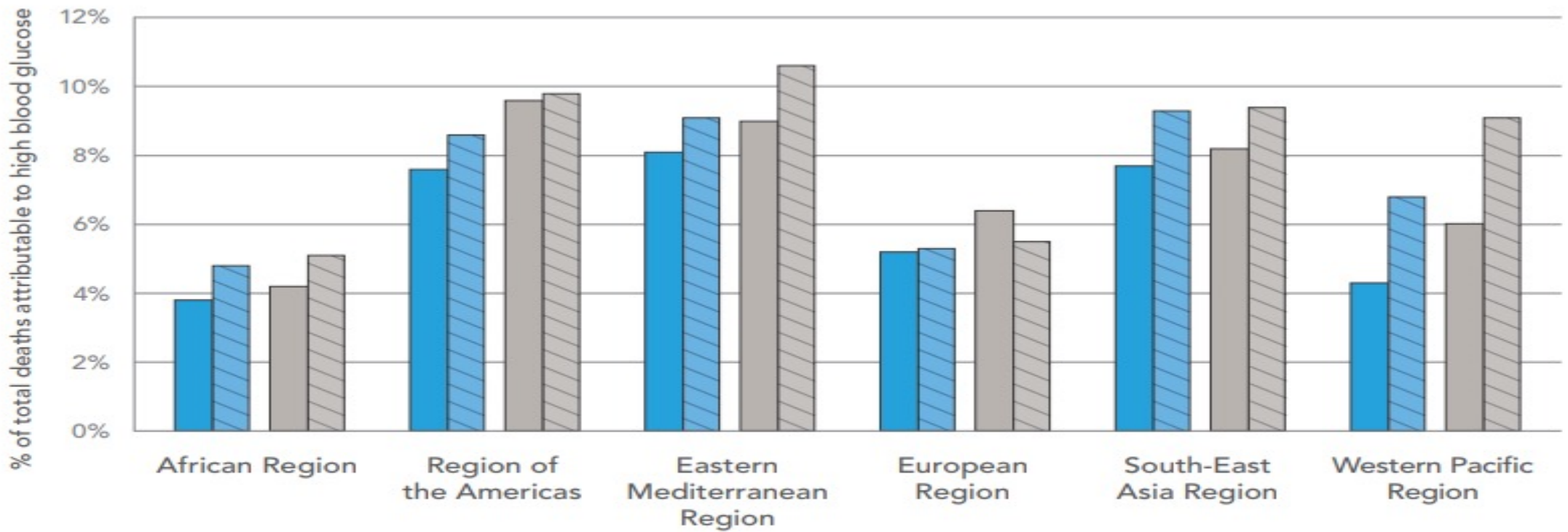
# High blood glucose age-standardized mortality rates per 100000 by WHO region, age 20+, 2012

	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

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



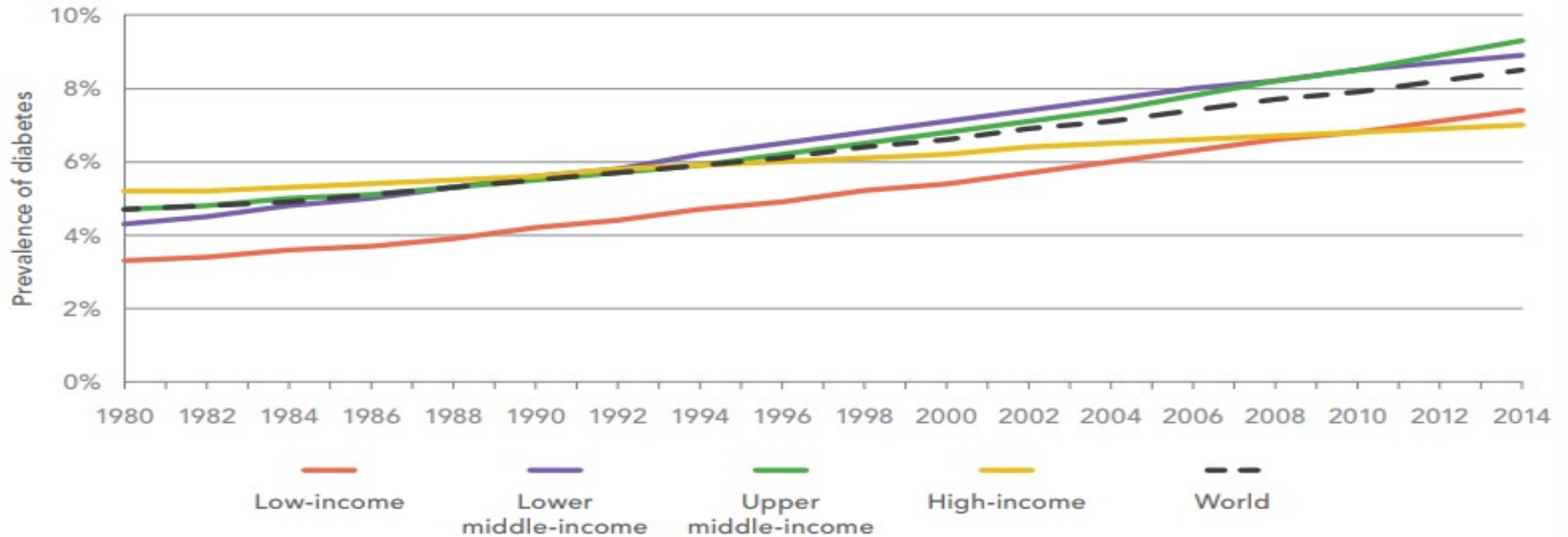
# Percentage of all deaths attributable to high blood glucose for adults aged 20–69 years, by WHO region and sex, 2000 and 2012



MEN: 2000 2012

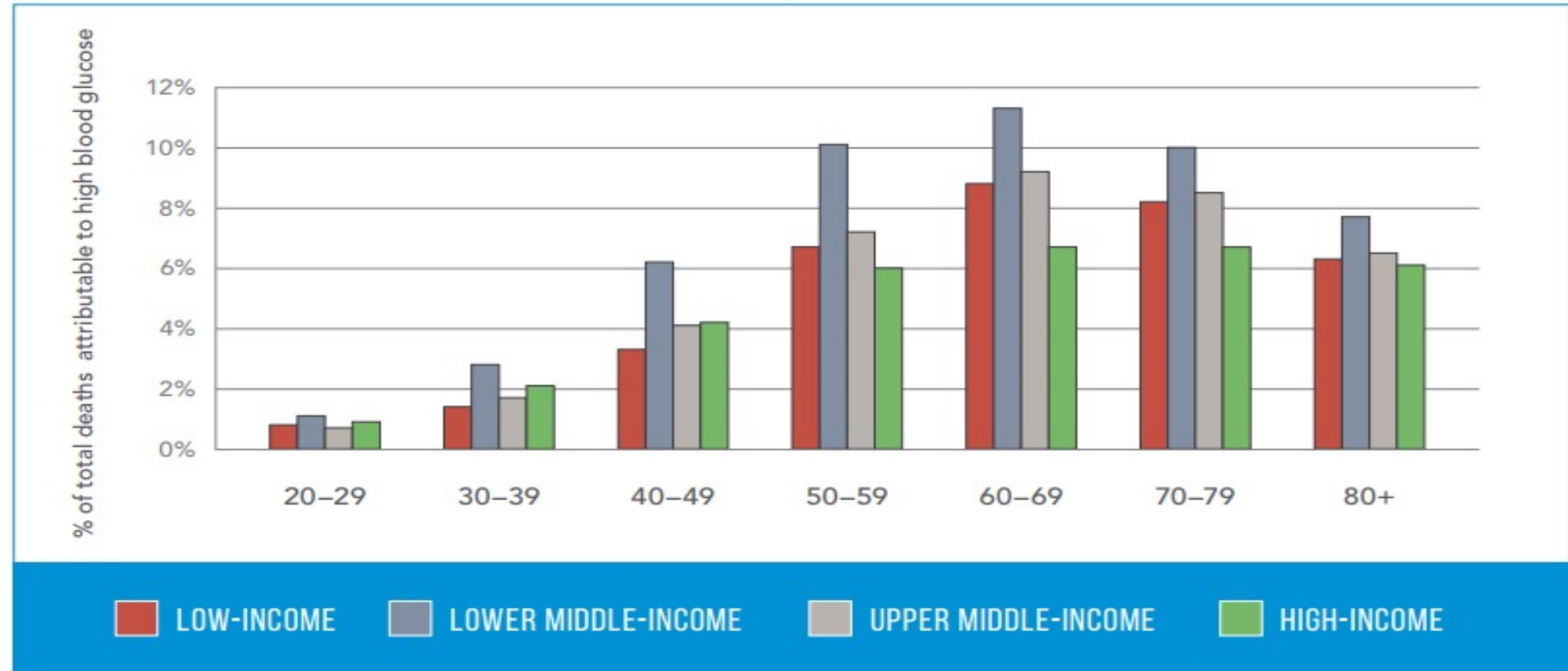
WOMEN: 2000 2012

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



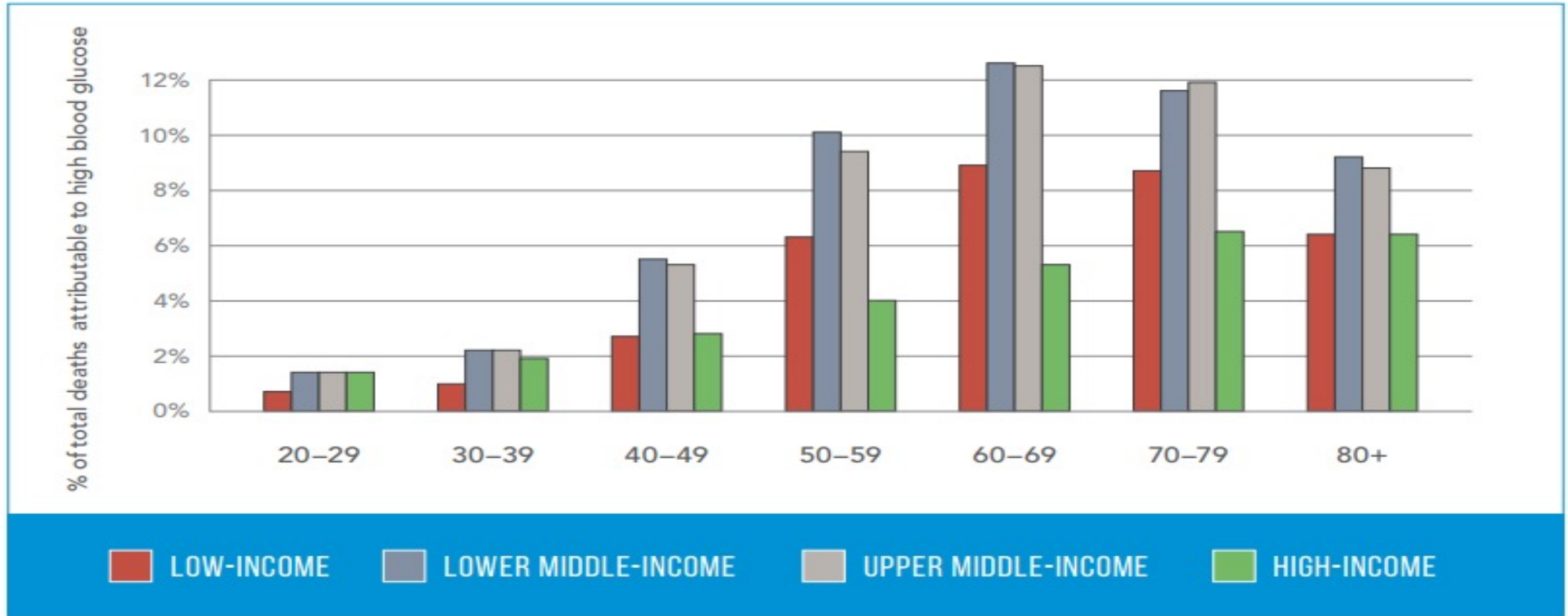
# Percentage of all-cause deaths globally attributed to high blood glucose in men, 2012

A (MEN)



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

## B (WOMEN)



a. As categorized by the World Bank for 2012.

# Regional and Local prevalence

- There are 20 Arab countries in which nearly 20.5 million people are living with diabetes and another 13.7 million are in the pre-diabetes stage, with Impaired Glucose Tolerance (IGT)
- Six of the top ten countries having the highest prevalence rates of diabetes globally are found in the Gulf region, namely:

Kuwait, Lebanon, Qatar, Bahrain, UAE and Saudi Arabia

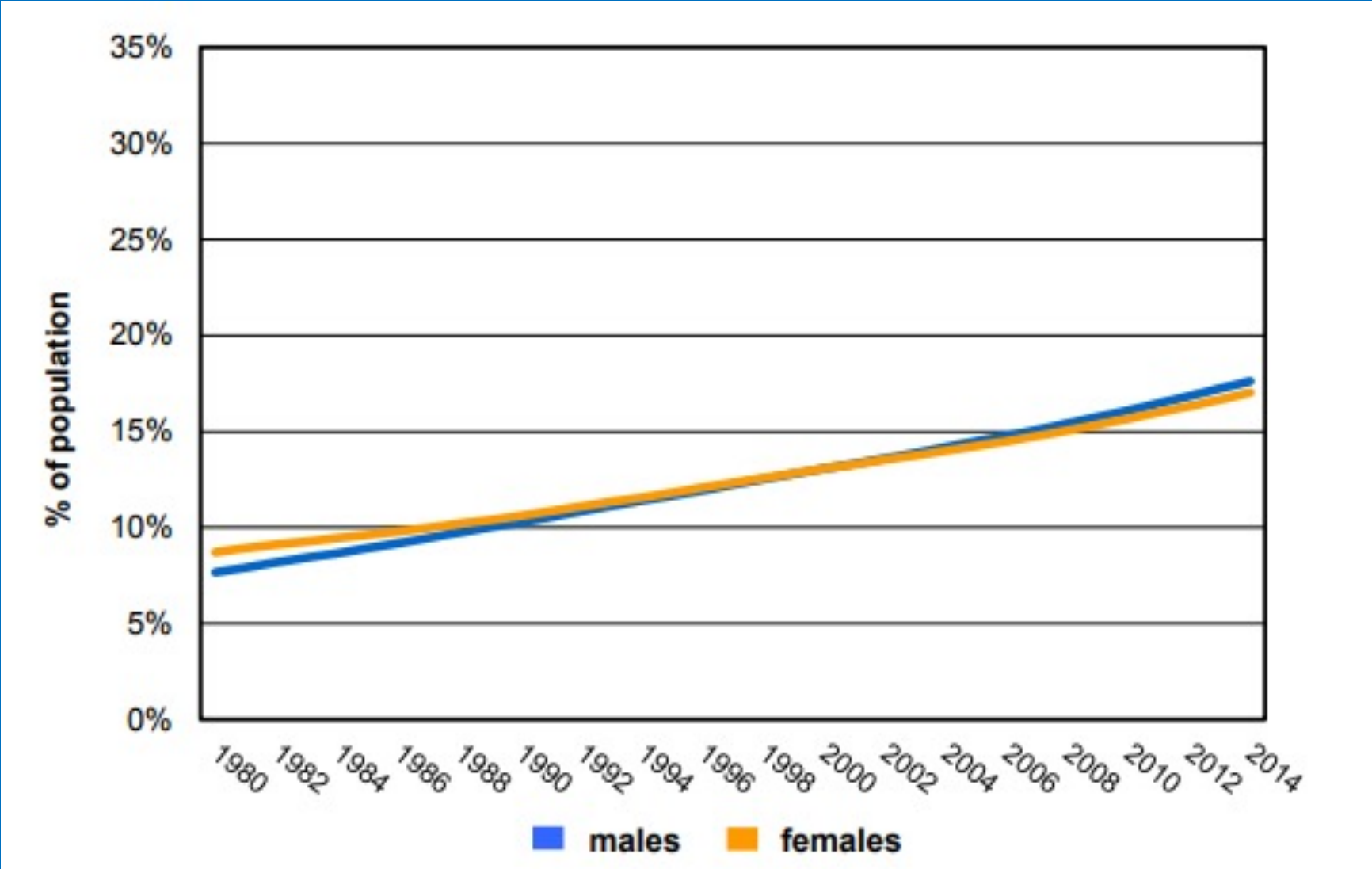
- Bahrain 15.4%; Kuwait 14.6%; UAE 18.7%; Qatar 15.4%

# Diabetes Mellitus and KSA

- WHO ranks SA 2<sup>nd</sup> in the prevalence of diabetes in the Middle East region & 7<sup>th</sup> in the world: considered an epidemic
- A more recent study reported that the prevalence of diabetes had risen to 34.1% in males and 27.6% in females.
- The mean reported age for diabetes onset in males and females is 57.5 and 53.4 years
- The number of deaths attributed to diabetes in Saudi Arabia is about 170,000 adults, which is greater than 10% of all deaths in the country



# Trends in age-standardized prevalence of diabetes in Saudi Arabia



# Diabetes Mellitus and KSA

- Saudi Arabia reported that 40.3% of diabetic patients are unaware of their having the disease
- Increasing age is a risk factor, recent studies showing different trend
- The incidence of T1DM is also on the increase over the last 30 years , with prevalence among the Saudi children and adolescents at 109.5 per 100,000
- Healthcare expenditures incurred by people with diabetes are increasing
- In 2010 on average, people diagnosed with diabetes spent ten times more towards medical healthcare expenditure

# Diabetes Mellitus and KSA

- Prevalence of DM in the central region (Riyadh), was 23.7% (age group 30-70 years), while another 14.1% had IFG
- The incidence of diabetes was significantly higher in the urban regions (25.5 vs 19.5 in the rural areas)
- The Northern (27.9%) and Eastern (26.4%) provinces showing greater rates of the prevalence of DM than the Southern region (18.2%), which supports a more rural lifestyle and a population with less tendency for obesity than those of the Northern and Eastern provinces

# Diagnosis (Sign & Symptoms)

- Thirst
- Passing lots of urine
- Fatigue
- Infections (thrush)
- Weight loss

## Diagnosis:

- Random plasma glucose
- Fasting plasma glucose
- Oral glucose tolerance test – 2h glucose

# Diagnosis

- The International committee on DM, recognized an intermediate group of subjects whose glucose levels, although not meeting criteria for diabetes, are nevertheless too high to be considered normal.

The categories of FPG values are as follows:

- FPG  $<100$  mg/dl (5.6 mmol/l) = normal fasting glucose;
- FPG 100–125 mg/dl (5.6–6.9 mmol/l) = IFG (impaired fasting glucose);
- FPG  $\geq 126$  mg/dl (7.0 mmol/l) = provisional diagnosis of diabetes (the diagnosis must be confirmed)

# Diagnosis

- The corresponding categories when the OGTT is used are the following:
- 2-h postload glucose  $<140$  mg/dl (7.8 mmol/l) = normal glucose tolerance;
- 2-h postload glucose 140–199 mg/dl (7.8–11.1 mmol/l) = IGT (impaired glucose tolerance);
- 2-h postload glucose  $\geq 200$  mg/dl (11.1 mmol/l) = provisional diagnosis of diabetes (the diagnosis must be confirmed)

# Diagnosis

1. Symptoms of diabetes plus casual plasma glucose concentration  $\geq 200$  mg/dl (11.1 mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss. OR

2. FPG  $\geq 126$  mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h. OR

3. 2-h postload glucose  $\geq 200$  mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 gms glucose dissolved in water.

Ref: Diagnosis and Classification of Diabetes Mellitus American Diabetes Association Diabetes Care 2006 Jan; 29(suppl 1): s43-s48

# Glycosylated Hemoglobin A1c

- In July 2009, the International Expert Committee recommended the use of the A1C test in the diagnosis of diabetes, with a threshold of 6.5%
- Internationally as marker to track the blood sugar control
- Limitations
- HbA1c may be increased falsely in certain medical conditions: kidney failure, chronic excessive alcohol intake, and hypertriglyceridemia. Medical conditions that may falsely decrease HbA1c include acute or chronic blood loss, sickle cell disease or thalassemia,
- Gestational diabetes may falsely increase or decrease HbA1c.



# Why is diabetes so important?

## **Complications**

- Cardiovascular
- Eyes
- Renal - Hypertension, renal failure
- Feet and Skin infections,
- sexual, psycho-sexual, depression
- Quality of life
- Premature mortality

## **Social Factors**

The burden to patients and the family and to the health system

# Complications

- Diabetes accounts for more than 5% of the global deaths, which are mostly due to CVD
- Study in one province of SA, found >70% patients having  $\geq 1$  complication
- Diabetes is responsible for over one third of end-stage renal disease requiring dialysis (23% to 29%)
- Amputations are at least 10 times more common in people with diabetes (61% PAD, 31% neuropathy)
- A leading cause of blindness & visual impairment
- Diabetics are 20 times more likely to develop blindness than non-diabetics

# Complications

- High risk for Diabetes nephropathy: Diabetes duration, retinopathy, neuropathy, hypertension, age >45 years, hyperlipidemia, male gender, smoking, and poor glycemic control
- Number of diabetic patients seeking renal replacement therapy increased from 4% in the early 1980s to 14.8% in the mid-1990s, even higher to 40% in the late 1990s.
- Most of the deaths [60%] in dialysis patients are of those with DM
- Nearly 37–41% of diabetic patients in Saudi Arabia develop a stroke while 61% of them develop peripheral artery disease
- It is recommended that every Saudi above 30 years of age should undergo screening for both T2DM and T1DM and pre-diabetes

# Risk factors

Risk factors for Type 2 DM are complex modifiable and non-modifiable risk factors

- Age, Gender, SES, obesity
- Genetics
- Life style factors (overfeeding and sedentary life)
- There are patho-physiological changes (weight gain insulin resistance and reduction of insulin secretion) may lead to glucose intolerance and diabetes
- Important factors are physical inactivity, dietary imbalance and infections

# Risk factors

- Autoimmune disease and viral infections may be risk factors for T1DM
- Physiologic or emotional stress: causes prolonged elevation of stress hormone levels (cortisol, epinephrine, glucagon and growth hormone), which raises blood glucose levels
- Pregnancy as predisposing factor causes weight gain and increases levels of estrogen and placental hormones, which antagonize insulin
- Medications that are known to antagonize the effects of insulin: thiazide diuretics, adrenal corticosteroids, oral contraceptives

# Future Directions

- Tackling environmental factors and lifestyle
- Appropriate use of screening tools to control diabetes mellitus
- Early interventions in high risk populations
- Therapeutic and management choices and updated criteria for treatment
- Rehabilitation services for complications

# Future Directions

- The Saudi National Diabetes Registry (SNDR) was recently established with the primary goal of developing a database including all the diagnosed national diabetic patients
- The objective of the SNDR is to act as an electronic medical file to provide the medical teams correct clinical, investigational, and management data.
- It is a surveillance-monitoring tool for clinical and epidemiology practitioners by identifying the significant performance indicators linked to this disease in either acute or chronic cases.
- The SNDR also provides data relating to the association of diabetes with hypertension, hyperlipidemia, and obesity

# References

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