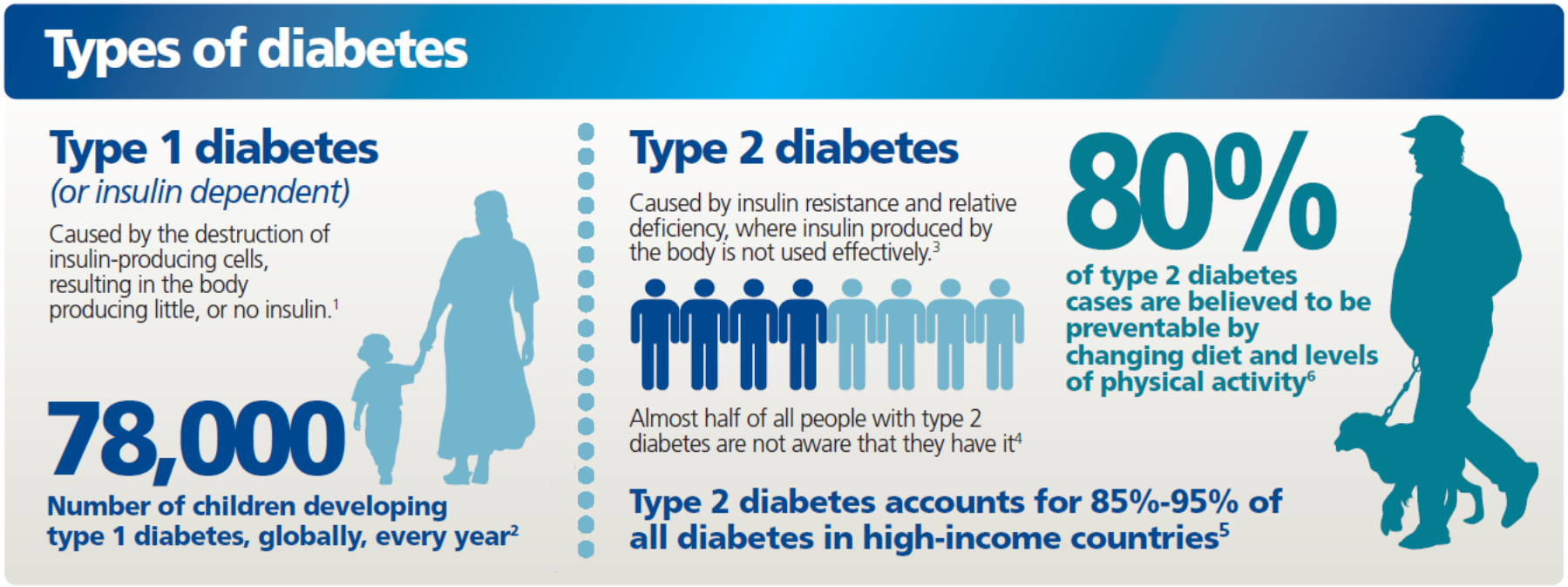
PREVENTION OF DIABETES

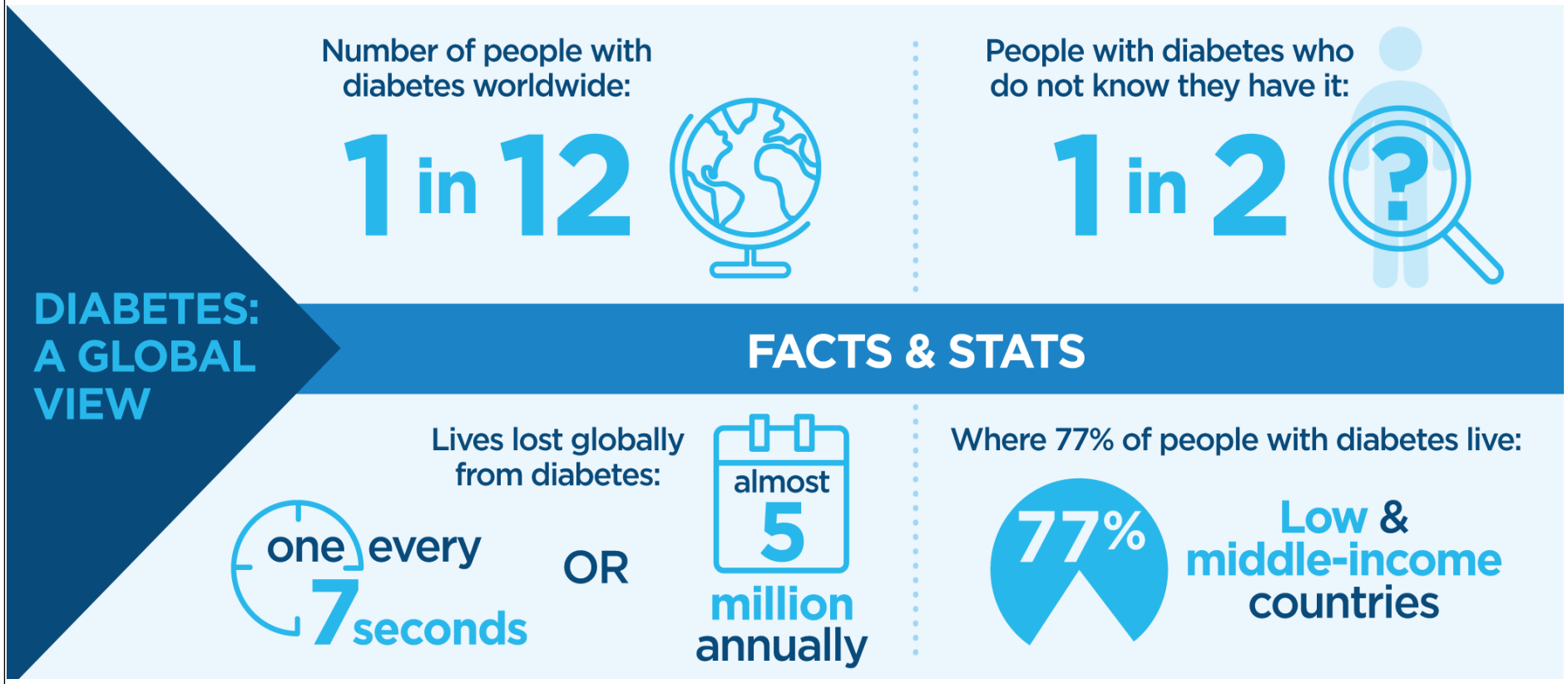
Introduction

- The burden of Type 2 diabetes (T2D) is increasing exponentially in the world with an alarming rise in developing countries.



Unnikrishnan R et al. Nat Rev Endocrinol. 2016 Jun;12(6):357-70

Diabetes Burden



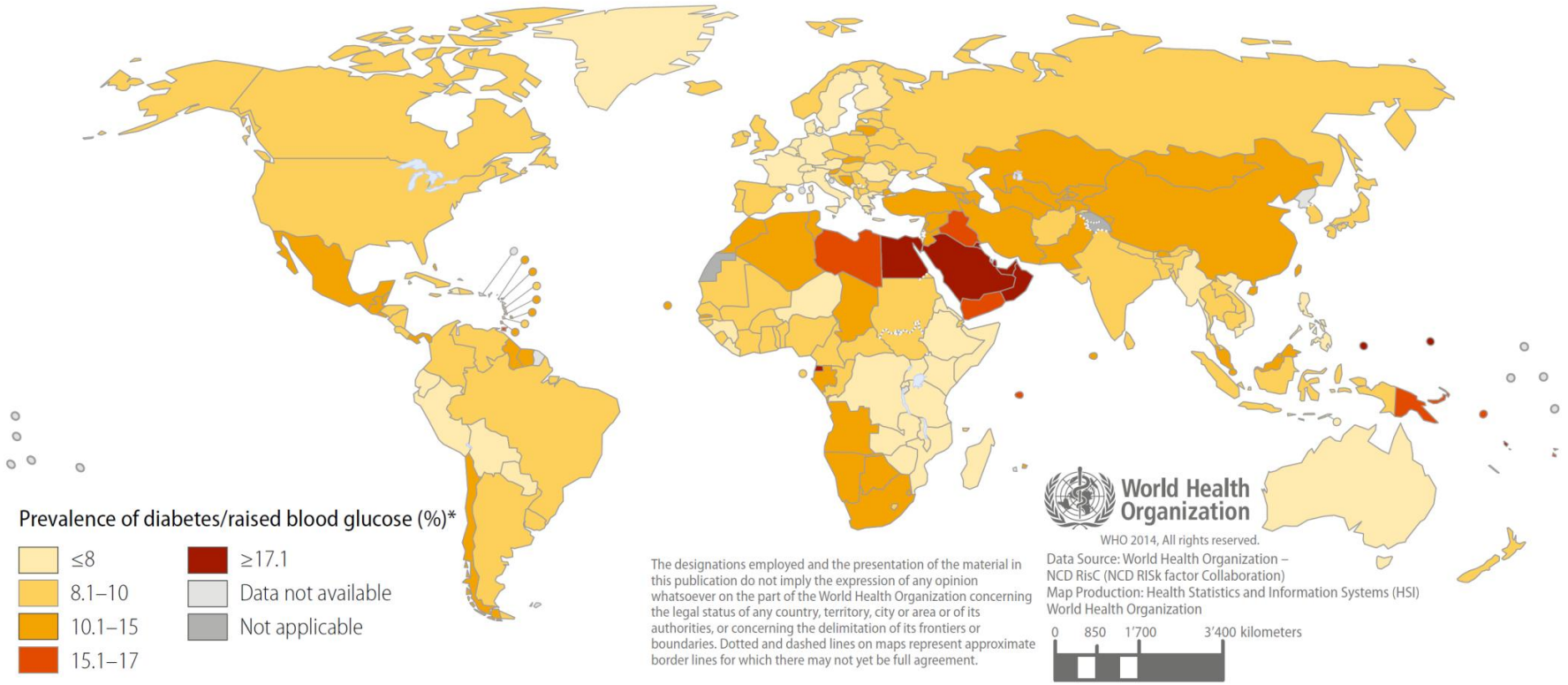
Unnikrishnan R et al. Nat Rev Endocrinol. 2016 Jun;12(6):357-70

Diabetes in India

- India is one of the epicentres of the global diabetes mellitus pandemic.
- India has about 90 million diabetic patients, and the disease leads to the enormous burden on the health care systems of the country
- In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus followed by China (20.8 million) with the United States (17.7 million) in second and third place respectively.

Kumar KH et al. Med J DY Patil Univ 2016;9:195-9

Diabetes in India



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

Unnikrishnan R et al. Nat Rev Endocrinol. 2016 Jun;12(6):357-70

Top 10 countries with diabetics

2015

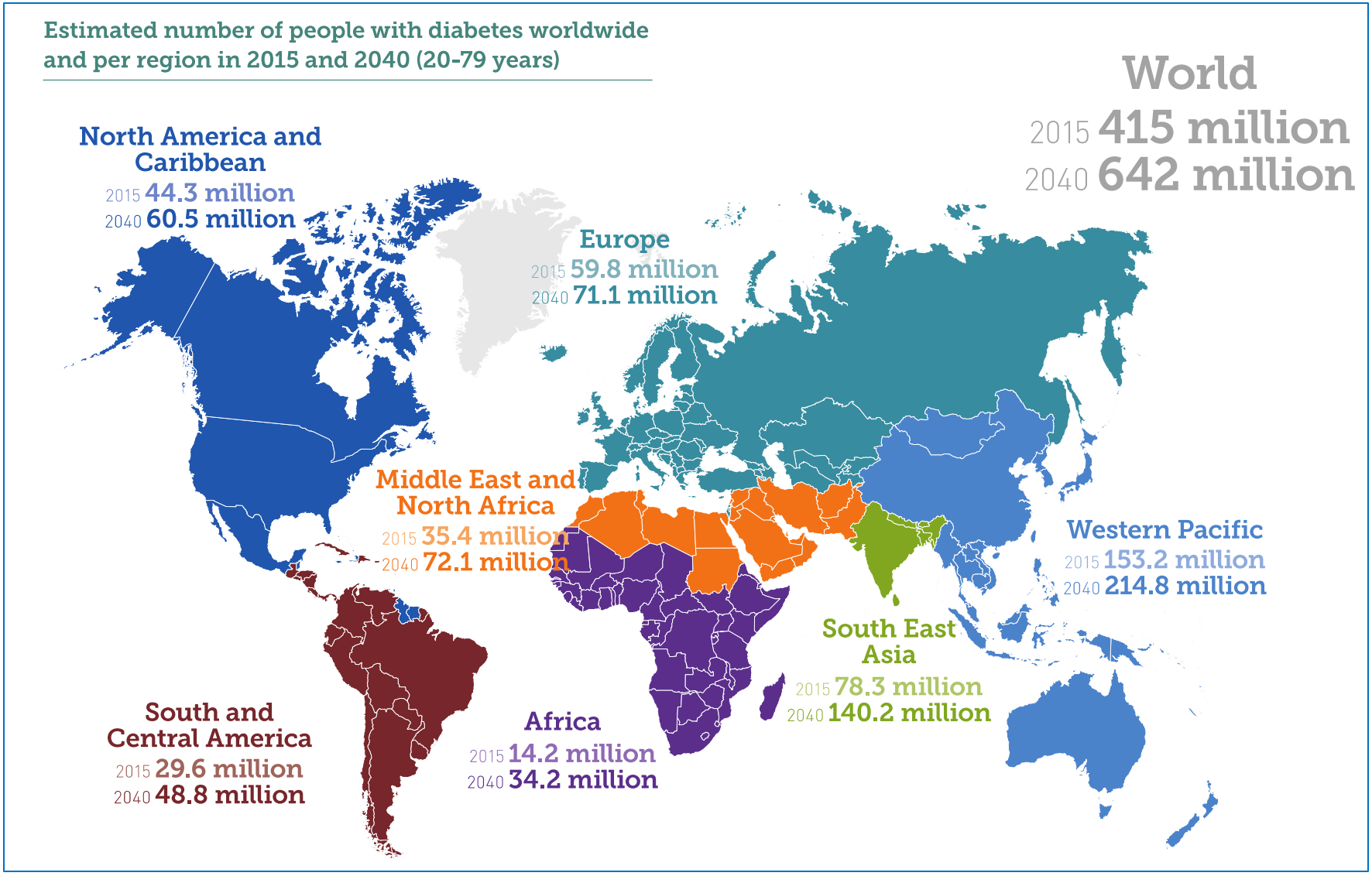
Rank	Country/territory	Number of people with diabetes
1	China	109.6 million (99.6-133.4)
2	India	69.2 million (56.2-84.8)
3	United States of America	29.3 million (27.6-30.9)
4	Brazil	14.3 million (12.9-15.8)
5	Russian Federation	12.1 million (6.2-17.0)
6	Mexico	11.5 million (6.2-13.7)
7	Indonesia	10.0 million (8.7-10.9)
8	Egypt	7.8 million (3.8-9.0)
9	Japan	7.2 million (6.1-9.6)
10	Bangladesh	7.1 million (5.3-12.0)

2040

Rank	Country/territory	Number of people with diabetes
1	China	150.7 million (138.0-179.4)
2	India	123.5 million (99.1-150.3)
3	United States of America	35.1 million (33.0-37.2)
4	Brazil	23.3 million (21.0-25.9)
5	Mexico	20.6 million (11.4-24.7)
6	Indonesia	16.2 million (14.3-17.7)
7	Egypt	15.1 million (7.3-17.3)
8	Pakistan	14.4 million (10.6-20.4)
9	Bangladesh	13.6 million (10.7-24.6)
10	Russian Federation	12.4 million (6.4-17.1)

IDF Diabetes Atlas, 2015

Diabetes Rise



Unnikrishnan R et al. Nat Rev Endocrinol. 2016 Jun;12(6):357-70

IDF Diabetes Atlas, 2015

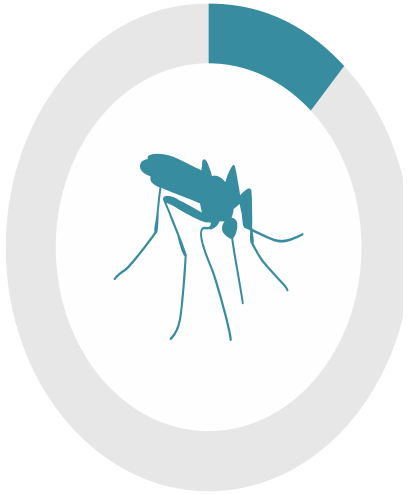
Mortality due to diabetes

Adults who died from diabetes, HIV/AIDS, tuberculosis, and malaria

5.0 million
from diabetes
2015
IDF

1.5 million
from HIV/AIDS
2013
WHO Global Health Observatory Data Repository 2013

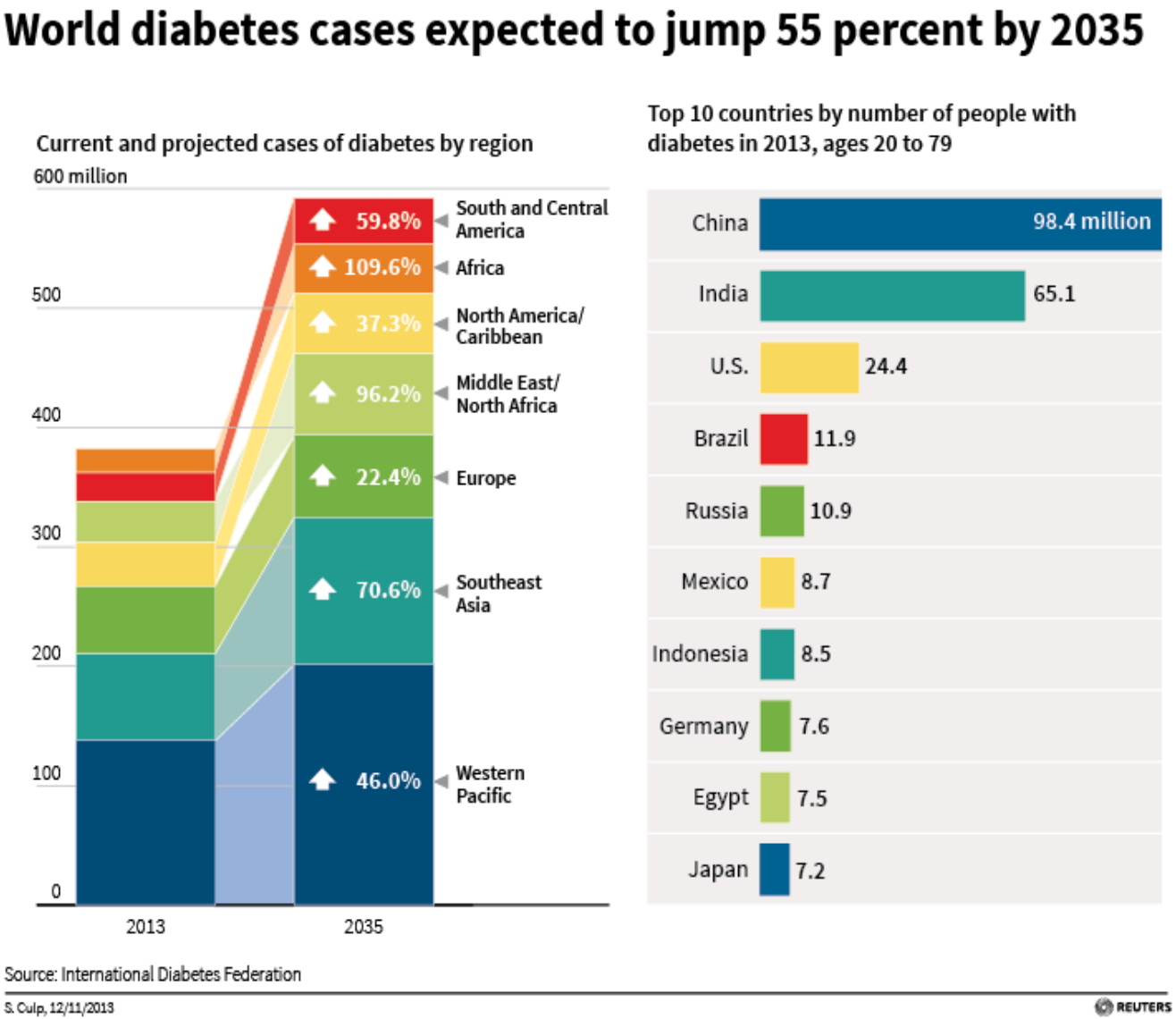
1.5 million
from tuberculosis
2013
WHO Global Health Observatory Data Repository 2013



0.6 million
from malaria
2013
WHO Global Health Observatory Data Repository 2013

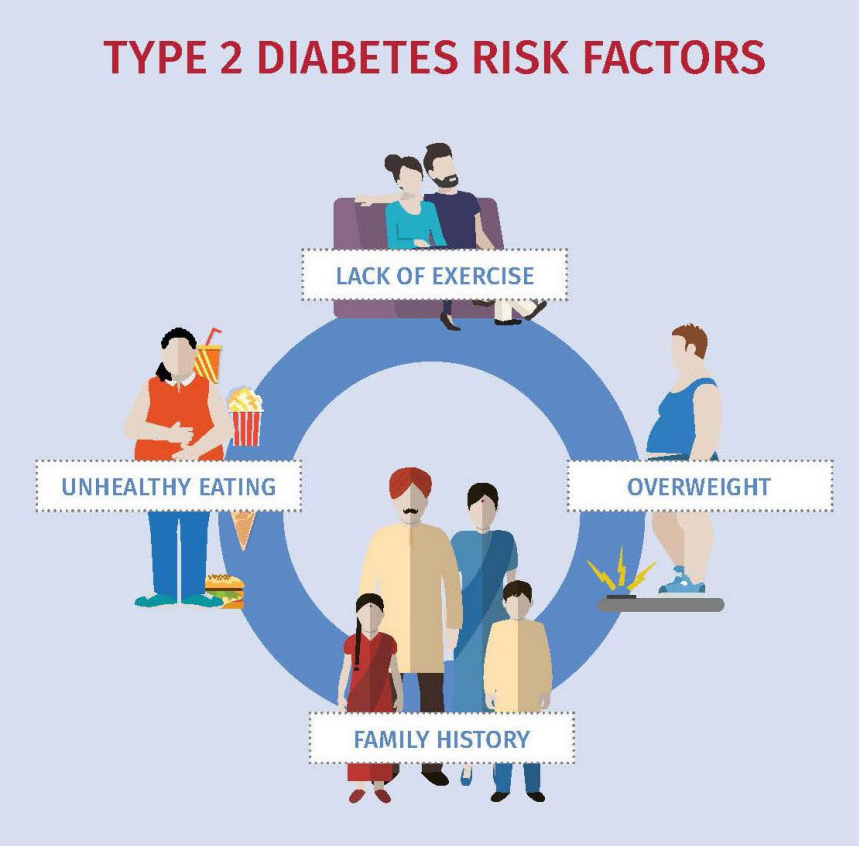
IDF Diabetes Atlas, 2015

Trends in diabetes burden



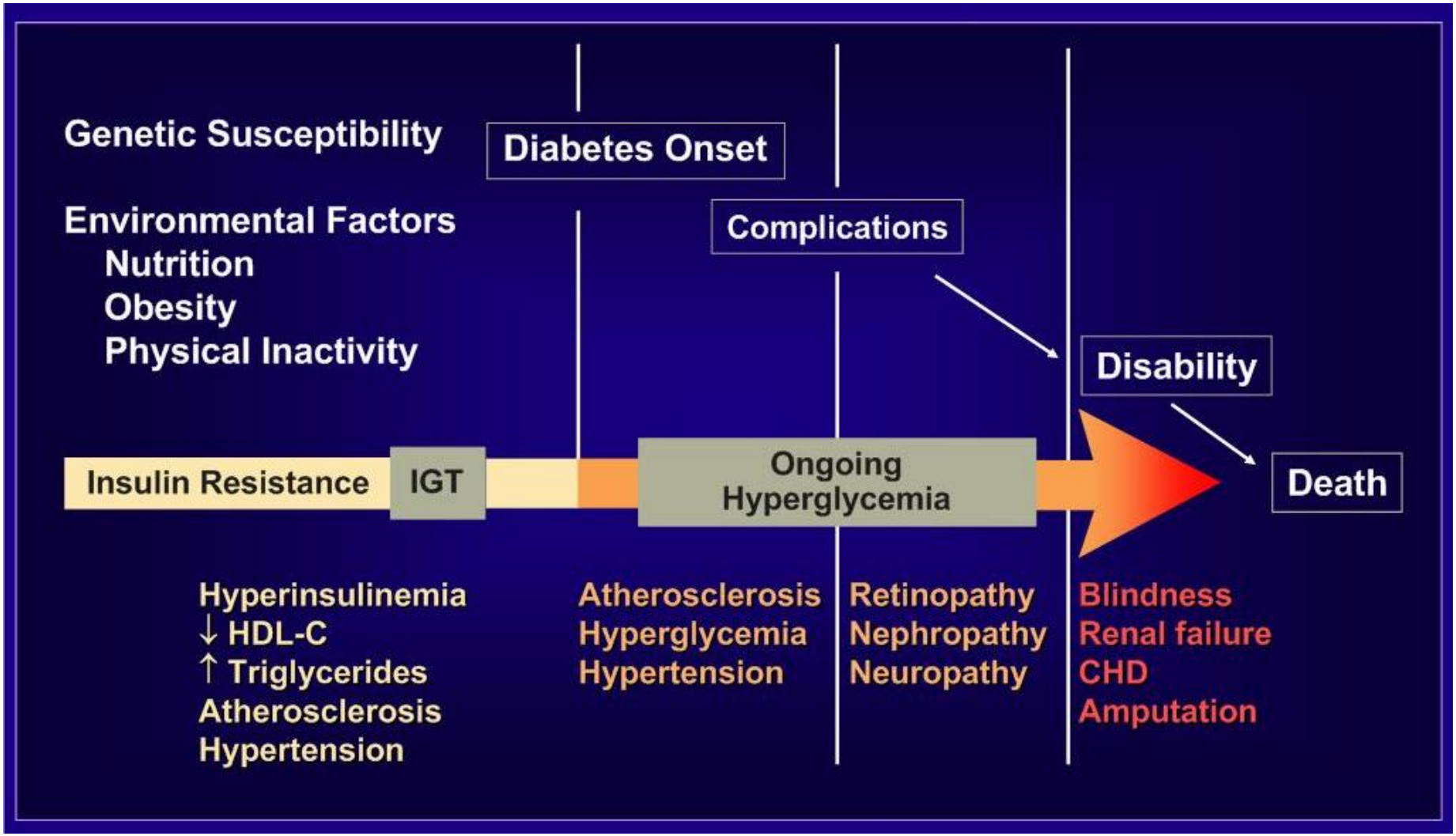
Diabetes: Risk Factors

- Family history of diabetes
- Overweight
- Unhealthy diet
- Physical inactivity
- Increasing age
- High blood pressure
- Ethnicity
- Impaired glucose tolerance
- History of gestational diabetes
- Poor nutrition during pregnancy



IDF Diabetes Atlas, 2015

Complications of Diabetes

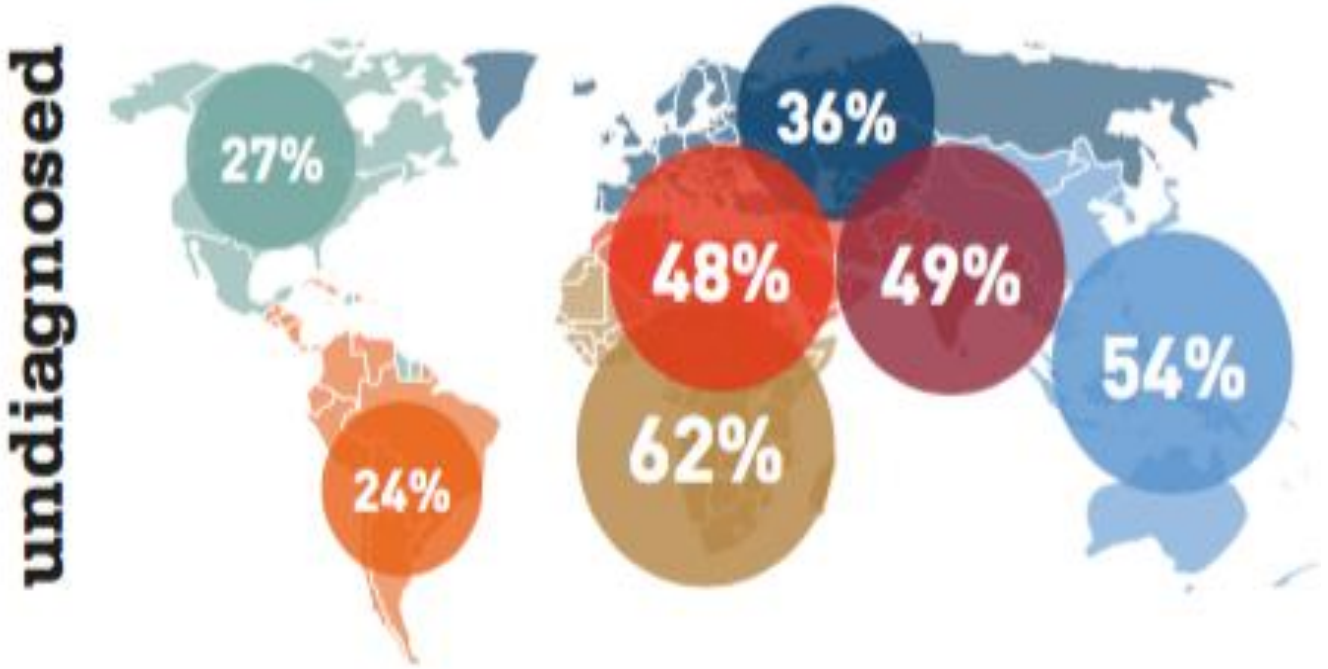


1. http://www.idf.org/membership/sea/india
2. http://www.searo.who.int/india/mediacentre/events/world_health_day/brief_note_on_diabetes_in_india-6april.pdf

Managing Diabetes

The human and economic costs of diabetes could be significantly reduced by investing in prevention, particularly early detection, in order to avoid the onset of diabetic complications

At least 50% of all people with diabetes are unaware of their condition



IDF Diabetes Atlas, 2015

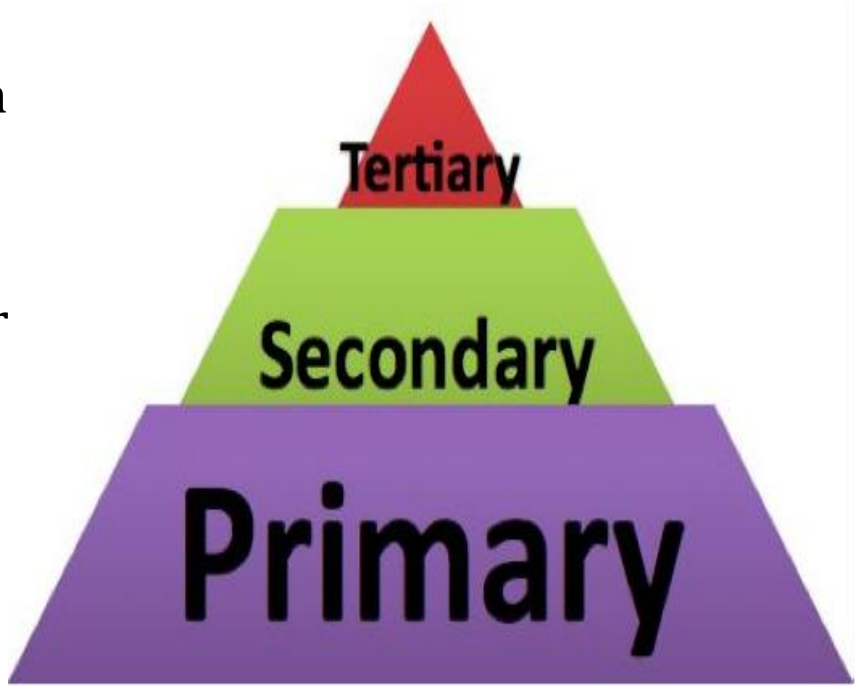
Prevention of Diabetes

Why should we prevent diabetes?

- **To reduce human suffering.**
- **To alleviate the economic burden.**
- **To prevent morbidity and mortality from diabetes-related CVD.**

Levels of prevention in Type 2 DM

- Primary
  - Includes activities aimed at preventing diabetes from occurrin in susceptible populations
- Secondary
  - Early diagnosis and effective contr of diabetes in order to delay the progress of the disease
- Tertiary
  - Prevent complications and disabilities due to diabetes



Kumar KH et al. Med J DY Patil Univ 2016;9:195-9

Primary prevention Strategies

- **Behavioral interventions:**
  - Changing diet
  - Increasing physical activity
- **Pharmacological interventions:**
  - utilizing pharmaceutical agents to improve glucose tolerance and insulin sensitivity

Garber AJ et al. Endocr Pract. 2016 Jan;22(1):84-113.

Primary Prevention: Approaches

- Population strategy
  - Primordial prevention (prevention of emergence of risk factors)
  - Maintain body weight through adoption of healthy nutritional habits and physical exercise

- High risk strategy
  - Lifestyle modification
  - Avoid alcohol
  - Stop Smoking
  - Management of BP
  - Management of dyslipidemia

Garber AJ et al. Endocr Pract. 2016 Jan;22(1):84-113.

Behavioral interventions

- Several studies has shown that diet and physical activity reduced the incidence of Type 2 diabetes.

- Example: The Swedish Malmo study showed that diet and exercise for 5 years in men with IGT reduced the incidence of Type 2 diabetes by 50%.

Eriksson et al, Diabetologia 1991; 34: 891-8

DaQing Chinese study

- The DaQing Chinese study showed that over 6 years there were significant and similar reductions in the incidence of diabetes in subjects with IGT who were randomized to diet, exercise, or combined diet-exercise treatment groups.

Pan et al, Diabetes Care, 1997; 20: 537-44

Finnish Diabetes Prevention Study

- The Finnish Diabetes Prevention Study showed that Type 2 diabetes can be prevented by changes in the lifestyles of high-risk subjects (middle-aged, overweight subjects with IGT). The risk of diabetes was reduced by 58% in the intervention group. The cumulative incidence was 11% in the intervention group compared to 23% in the control group.

Tuomilehto et al. NEJM, 2001; 344: 1343-50

National Prevention Program

- Diabetes Prevention Program (USA)
- In this program, subjects were randomised to Diet, physical activity, metformin and placebo.
- The results showed that 58% reduction in incidence of diabetes with lifestyle intervention, 31% with metformin

Garber AJ et al. Endocr Pract. 2016 Jan;22(1):84-113.

Pharmacological interventions for prevention

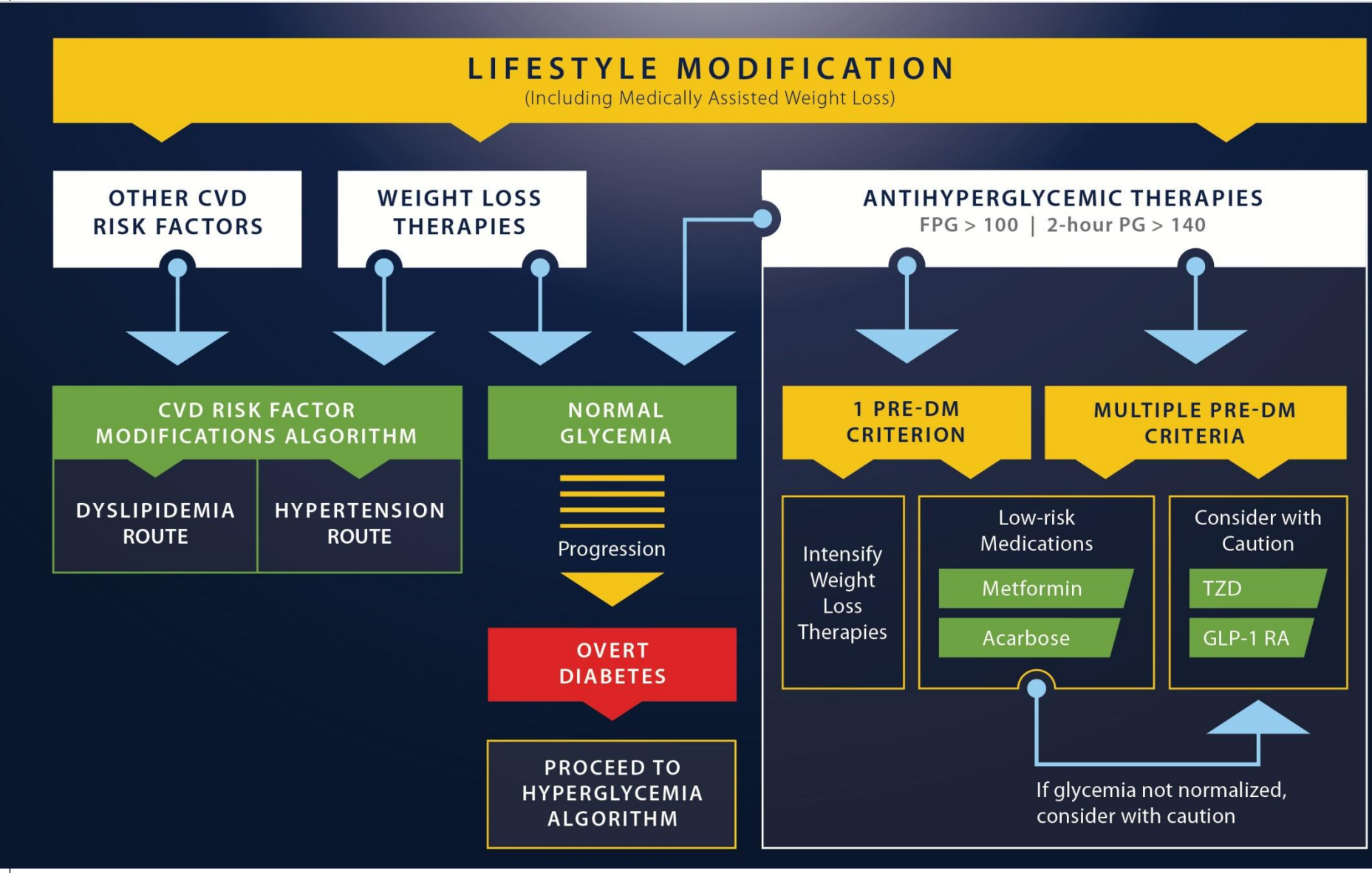
- Metformin therapy for prevention of type 2 diabetes should be considered in those with prediabetes, especially in those with BMI .35 kg/m2, those aged 60 years, and women with prior gestational diabetes mellitus.

- At least annual monitoring for the development of diabetes in those with prediabetes is suggested.

- Screening for and treatment of modifiable risk factors for cardiovascular disease is suggested.

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142

Prevention of Diabetes ALGORITHM



Garber AJ et al. Endocr Pract. 2016 Jan;22(1):84-113.

Screening approaches

- **Population screening**
- **Selective screening**
- **Opportunistic screening**

Criteria for Screening for T2D and Prediabetes in Asymptomatic Adults

- Age ≥45 years without other risk factors
- Family history of T2D
- Cardiovascular disease
- Overweight
  - BMI ≥30 kg/m^2
  - BMI 25-29.9 kg/m^2 plus other risk factors*
- Sedentary lifestyle
- Member of an at-risk racial or ethnic group: Asian, African American, Hispanic, Native American, and Pacific Islander
- Dyslipidemia
  - HDL-C <35 mg/dL
  - Triglycerides >250 mg/dL
- PCOS, acanthosis nigricans, NAFLD
- Hypertension (BP >140/90 mm Hg or therapy for hypertension)
- History of gestational diabetes or delivery of a baby weighing more than 4 kg (9 lb)
- Antipsychotic therapy for schizophrenia and/or severe bipolar disease
- Chronic glucocorticoid exposure
- Sleep disorders in the presence of glucose intolerance

- **Screen at-risk individuals with glucose values in the normal range every 3 years**
- **Consider annual screening for patients with 2 or more risk factors**

BMI = body mass index; BP = blood pressure;HDL-C = high density lipoprotein cholesterol; NAFLD = nonalcoholic fatty liver disease; PCOS = polycystic ovary syndrome; T2D=type 2 diabetes.

Handelsman et al. Endocr Pract. 2015 Apr; 21(Suppl 1): 1–87.

Diagnostic Criteria for Prediabetes and Diabetes in Nonpregnant Adults

Normal	High Risk for Diabetes	Diabetes
FPG <100 mg/dL	IFG FPG ≥100-125 mg/dL	FPG ≥126 mg/dL
2-h PG <140 mg/dL	IGT 2-h PG ≥140-199 mg/dL	2-h PG ≥200 mg/dL Random PG ≥200 mg/dL + symptoms*
A1C <5.5%	5.5 to 6.4% For screening of prediabetes†	≥6.5% Secondary‡

*Polydypsia (frequent thirst), polyuria (frequent urination), polyphagia (extreme hunger), blurred vision, weakness, unexplained weight loss.

†A1C should be used only for screening prediabetes. The diagnosis of prediabetes, which may manifest as either IFG or IGT, should be confirmed with glucose testing.

‡Glucose criteria are preferred for the diagnosis of DM. In all cases, the diagnosis should be confirmed on a separate day by repeating the glucose or A1C testing. When A1C is used for diagnosis, follow-up glucose testing should be done when possible to help manage DM.

FPG, fasting plasma glucose; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; PG, plasma glucose.

Handelsman et al. Endocr Pract. 2015 Apr; 21(Suppl 1): 1–87.

Diagnostic Criteria for Gestational Diabetes

Test	Screen at 24-28 weeks gestation
FPG, mg/dL	>92
1-h PG*, mg/dL	≥180
2-h PG*, mg/dL	≥153

*Measured with an OGTT performed 2 hours after 75-g oral glucose load.
FPG, fasting plasma glucose; OGTT, oral glucose tolerance test; PG, plasma glucose.

Handelsman et al. Endocr Pract. 2015 Apr; 21(Suppl 1): 1–87.

Diabetes Risk Test

1 How old are you?

Less than 40 years (0 points)
40—49 years (1 point)
50—59 years (2 points)
60 years or older (3 points)

Write your score in the box.

2 Are you a man or a woman?

Man (1 point) Woman (0 points)

3 If you are a woman, have you ever been diagnosed with gestational diabetes?

Yes (1 point) No (0 points)

4 Do you have a mother, father, sister, or brother with diabetes?

Yes (1 point) No (0 points)

5 Have you ever been diagnosed with high blood pressure?

Yes (1 point) No (0 points)

6 Are you physically active?

Yes (0 points) No (1 point)

7 What is your weight status? *(see chart at right)*

Height	Weight (lbs.)		
4' 10"	119-142	143-190	191+
4' 11"	124-147	148-197	198+
5' 0"	128-152	153-203	204+
5' 1"	132-157	158-210	211+
5' 2"	136-163	164-217	218+
5' 3"	141-168	169-224	225+
5' 4"	145-173	174-231	232+
5' 5"	150-179	180-239	240+
5' 6"	155-185	186-246	247+
5' 7"	159-190	191-254	255+
5' 8"	164-196	197-261	262+
5' 9"	169-202	203-269	270+
5' 10"	174-208	209-277	278+
5' 11"	179-214	215-285	286+
6' 0"	184-220	221-293	294+
6' 1"	189-226	227-301	302+
6' 2"	194-232	233-310	311+
6' 3"	200-239	240-318	319+
6' 4"	205-245	246-327	328+
	(1 Point)	(2 Points)	(3 Points)

You weigh less than the amount in the left column (0 points)

Add up your score.

If you scored 5 or higher:
You are at increased risk for having type 2 diabetes. However, only your doctor can tell for sure if you do have type 2 diabetes or prediabetes (a condition that precedes type 2 diabetes in which blood glucose levels are higher than normal). Talk to your doctor to see if additional testing is needed.

Type 2 diabetes is more common in African Americans, Hispanics/Latinos, American Indians, and Asian Americans and Pacific Islanders.

Higher body weights increase diabetes risk for everyone. Asian Americans are at increased diabetes risk at lower body weights than the rest of the general public (about 15 pounds lower).

Adapted from Bang et al., Ann Intern Med 151:775-783, 2009.
Original algorithm was validated without gestational diabetes as part of the model.

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142

Diabetes Prevention: Indian Diabetes Risk Score

Factors	Score
Age	
<35	0
35-49	20
>50	30
Abdominal obesity (WC)	
<80 cm (F), <90 (M)	0
80-89 cm (F), 90-99 (M)	10
>90 cm (M), >100 (M)	20
Physical activity	
Vigorous labour	0
Mild to moderate	20
No exercise	30
Family history	
None	0
One parent	10
Both parents	20

Interpretation:

Total score

< 30 - low risk

30-50 - medium risk

> 60 - high risk

Nagalingam S et al. Int J Adv Med. 2016; 3(2): 415-418

Classic Levers in the Public Health Response to Diabetes

Clinical services

- Glycemic control
- BP control
- Lipid management
- Annual eye examinations
- Foot care
- Kidney disease testing
- Preconception care
- Diabetes education
- Case Management
- Targeted Screening

Promotion of behaviors

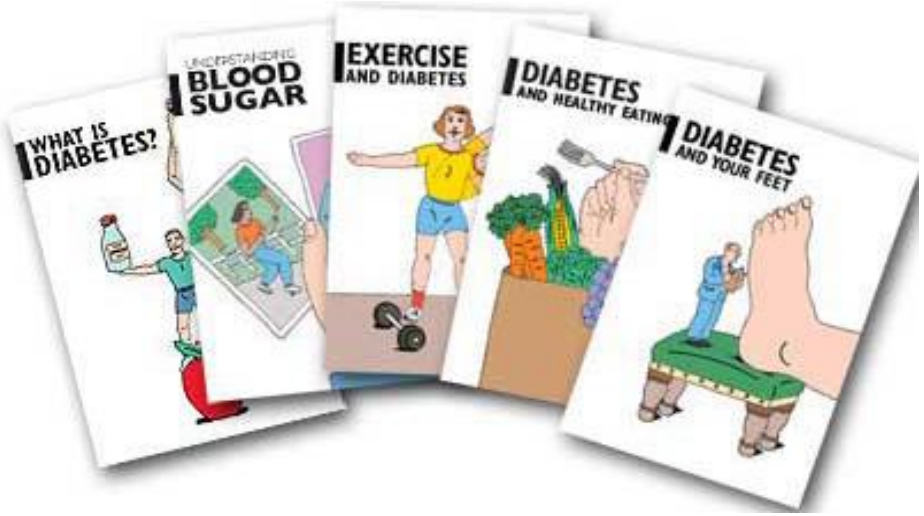
- Education and awareness for:
- Physical activity
- Reduced Tobacco
- Healthy diet
- Regular doctor visits
- Self monitoring
- Self mgt education

Population targeted policies

- Health care access legislation
- Drug and supply reimbursement policies
- Population registry and feedback systems

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

Education of diabetic patients



It is the corner stone of DM management

It should cover:

- Self care
- Changing behavior to prevent and control of complications
- Encourage interaction with health care providers

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

Types of education methods

- Individual counseling
- Group teaching
- Educational materials: posters, pamphlets, books
- Special educational programs are needed for special groups as children and pregnant women

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

Lifestyle Changes

- Patients should be educated to practice self-care which include:
  - Blood glucose monitoring
  - Body weight monitoring
  - Healthy lifestyle/diet or physical activity
  - Identify targets for control
  - Stopping smoking

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

Obstacles and barriers for prevention

- Economic problems: unavailability of needed resources
- Socio-cultural problems
- Lack of data, knowledge and skills

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

Socio-cultural barriers

Obesity is not considered negatively

Fatalism

Fad Food Culture has caught up

No time for physical exercise at work

Changing diet is very difficult

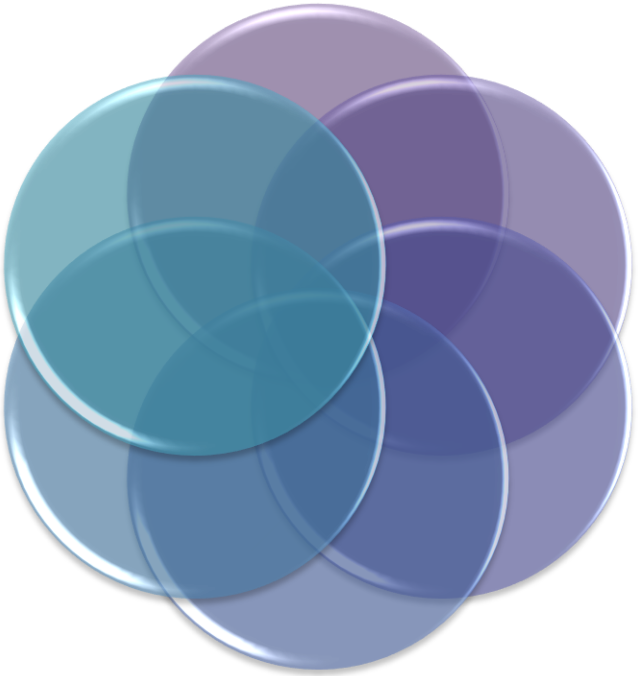
No value given to physical exercise

Diabetes Care 2017 Jan; 40 (Supplement 1): S1-S142
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

Tackling socio-cultural barriers

Dietary counselling

Sudden death assessment



Patient education

Aggressive follow-up

Physical activity

Medication compliance

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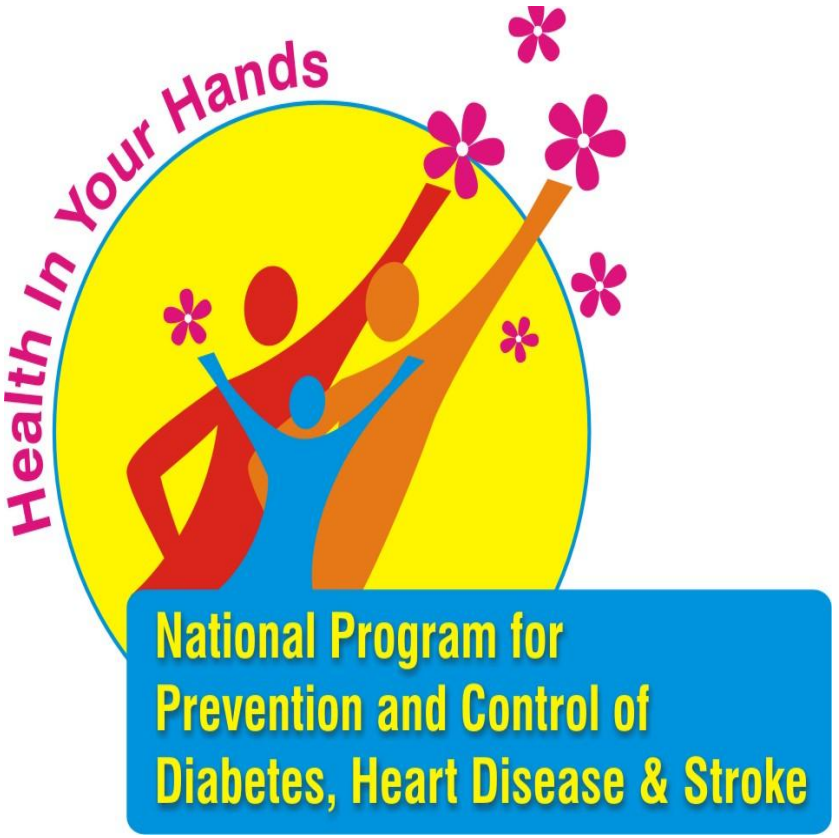
Ramachandran A et al. Indian J Endocr Metab 2014;18:252-3

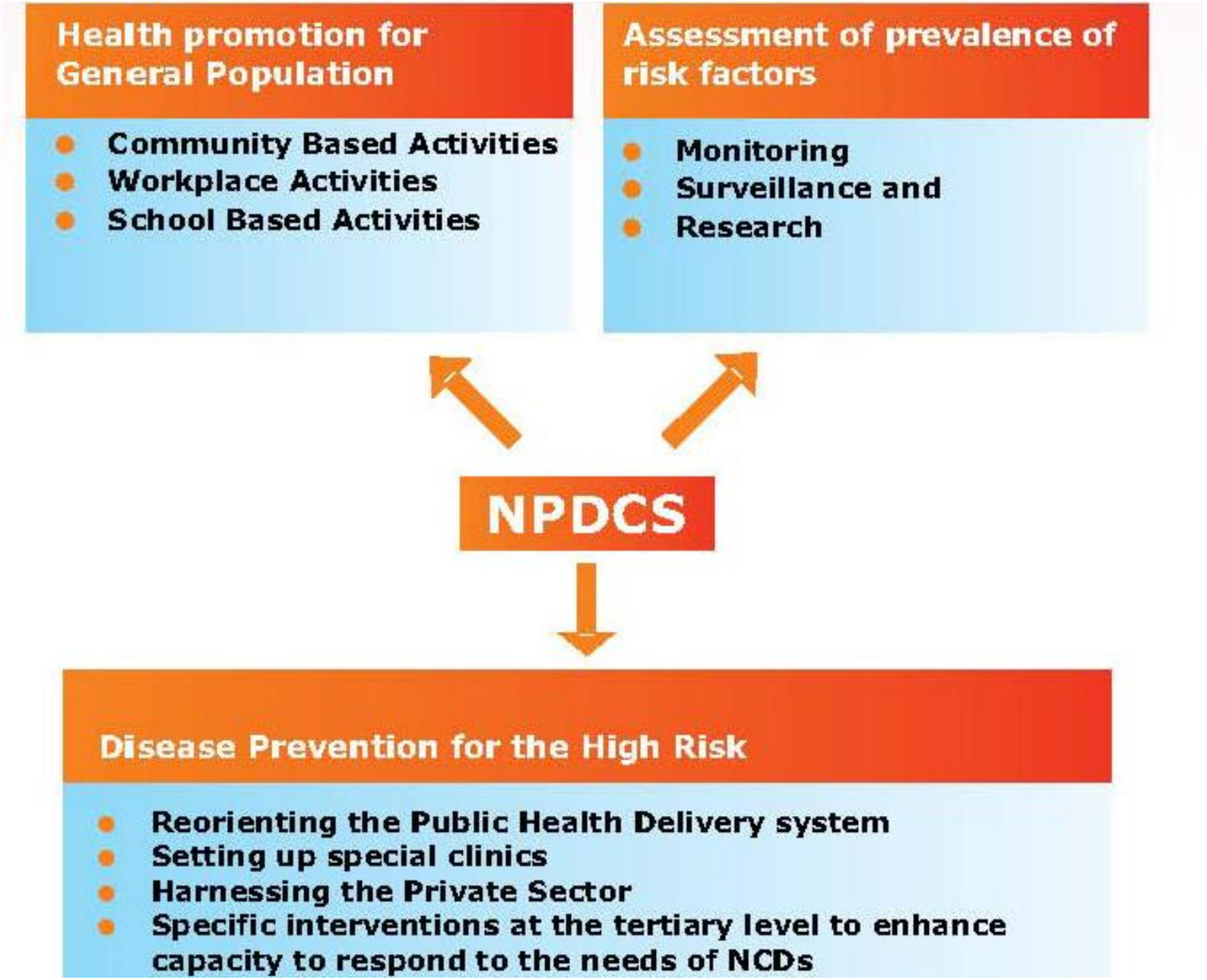
NPCDS

National Programme For Prevention and Control of Diabetes, Cardiovascular Disease And Stroke



- India's response to the growing burden of non-communicable diseases

http://www.searo.who.int/india/topics/cardiovascular_diseases/NCD_Resources_Training_module_for_NPDCS_for_health_workers.pdf



http://www.searo.who.int/india/topics/cardiovascular_diseases/NCD_Resources_Training_module_for_NPDCS_for_health_workers.pdf

Conclusion

- Preventing diabetes is of enormous value for any nation particularly in the developing world because of the high cost of treating diabetes and its complication.
- Management of Diabetes in India faces multiple challenges, such as low levels of awareness, paucity of trained medical and paramedical staff and unaffordability of medications and services
- The need of the hour is to develop pragmatic, cost effective strategies for primary prevention to extend the benefits to the population at large.
- Novel interventions using readily available resources and technology promise to revolutionise the care of patients with diabetes in India.

Thank You