TYPES OF DIABETES
Causes, Identification, & More

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CLASSIFICATION of Diabetes

1. Type 1 diabetes
   - due to autoimmune b-cell destruction, leading to absolute insulin deficiency

2. Type 2 diabetes
   - due to a progressive loss of b-cell insulin secretion, frequently on the background of insulin resistance

3. Gestational diabetes mellitus (GDM)
   - diabetes diagnosed in the second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation

4. Specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes
   - such as neonatal diabetes and maturity-onset diabetes of the young [MODY]), diseases of the exocrine pancreas (such as cystic fibrosis), and drug- or chemical-induced diabetes such as with glucocorticoid use, in the treatment of HIV/AIDS, or after organ transplantation

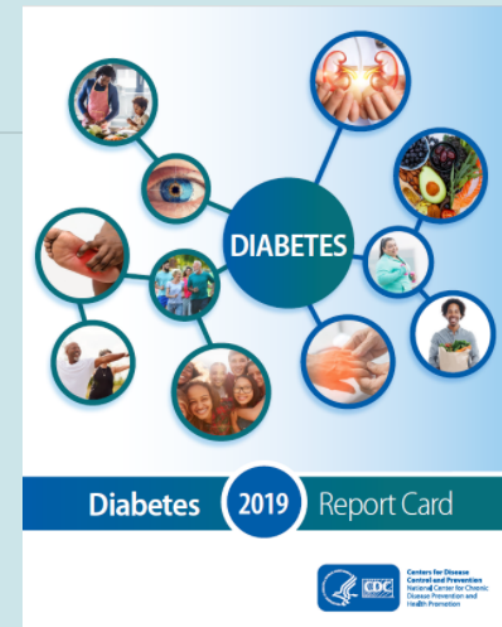WELL-AHEAD

CDC

Fast Facts on Diabetes

Diabetes
- **Total:** 37.3 million people have diabetes (11.3% of the US population)
- **Diagnosed:** 28.7 million people, including 28.5 million adults
- **Undiagnosed:** 8.5 million people (23.0% of adults are undiagnosed)

Prediabetes
- **Total:** 96 million people aged 18 years or older have prediabetes (38.0% of the adult US population)
- **65 years or older:** 26.4 million people aged 65 years or older (48.8%) have prediabetes

CDC

What's New?

- In the past decade, the annual rate of new cases of diabetes among US adults has been going down overall.

- Diabetes-related complications have increased among young adults aged 18–44 years and among middle-aged adults aged 45–64 years.

- The rate of new cases of diabetes among children and adolescents continues to grow.

- Nearly 1 in 5 adolescents aged 12–18 years and 1 in 4 young adults aged 19–34 years have prediabetes.

DIABETES

Diabetes 2019 Report Card

Centers for Disease Control and Prevention
National Center for Chronic Disease Prevention and Health Promotion

Statistics About Diabetes in the US

- **Deaths**

  ➢ Diabetes was the seventh leading cause of death in the United States

Diabetes by Race/Ethnicity

Rates of diagnosed diabetes in adults by race/ethnic background:

- 7.5% of non-Hispanic whites

- 9.2% of Asian Americans (highest rates among Asian Indians 12.6%)

- 12.5% of Hispanics (highest rates among Mexican Americans 14.4%)

- 11.7% of non-Hispanic blacks

- 14.7% of American Indians/Alaskan Natives

American Diabetes Association
Connected for Life

The Burden of Diabetes in Louisiana

Diabetes is an epidemic in the United States. According to the Centers for Disease Control and Prevention (CDC), over 34 million Americans have diabetes and face its devastating consequences. What's true nationwide is also true in Louisiana.

Louisiana's diabetes epidemic:

- Approximately **434,000 people in Louisiana**, or 12.1% of the adult population, **have diagnosed diabetes**.

- An additional **113,000 people in Louisiana have diabetes but don't know it**, greatly increasing their health risk.

- There are **1,243,000 people in Louisiana**, 33.8% of the adult population, who have **prediabetes** with blood glucose levels that are higher than normal but not yet high enough to be diagnosed as diabetes.

- **Every year** an estimated **30,000 people in Louisiana** are diagnosed with diabetes.

> **Diagnosed diabetes costs an estimated $5.7 billion Louisiana each year.**
>
> The serious complications include heart disease, stroke, amputation, end-stage kidney disease, blindness—and death.

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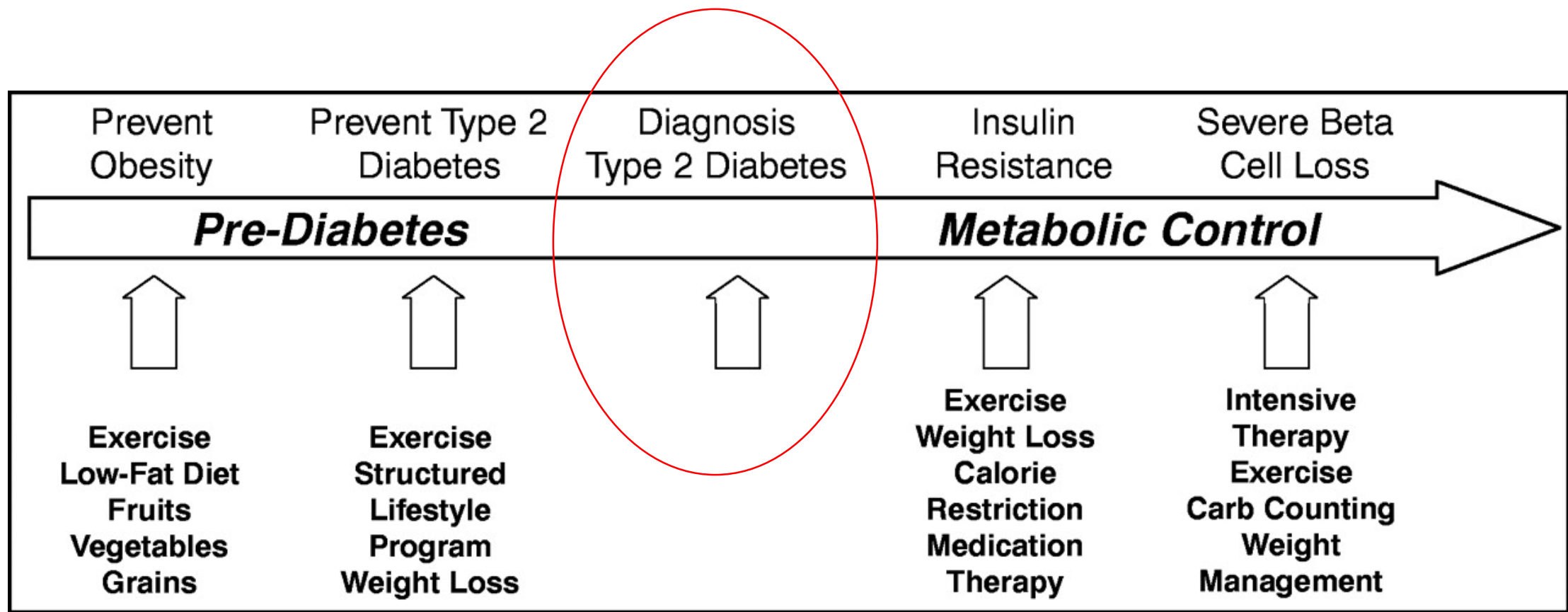
Managing Obesity in Type 2 Diabetes   **Managing Complications in Type 2 Diabetes**

ARE YOU AT RISK FOR TYPE 2 DIABETES?

American Diabetes Association

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)

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)

Write your score in the box.

Add up your score.

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)

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

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).

Lower Your Risk

The good news is that you can manage your risk for type 2 diabetes. Small steps make a big difference and can help you live a longer, healthier life.

If you are at high risk, your first step is to see your doctor to see if additional testing is needed.

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What is Prediabetes?

Fasting plasma glucose

Diabetes	
	→ 126 mg/dL
Prediabetes Impaired fasting glucose	
	→ 100 mg/dL
Normal	

2-h plasma glucose during OGTT

Diabetes	
	→ 200 mg/dL
Prediabetes Impaired glucose tolerance	
	→ 140 mg/dL
Normal	

Hemoglobin A1C

Diabetes	
	→ 6.5%
Prediabetes	
	→ 5.7%
Normal	
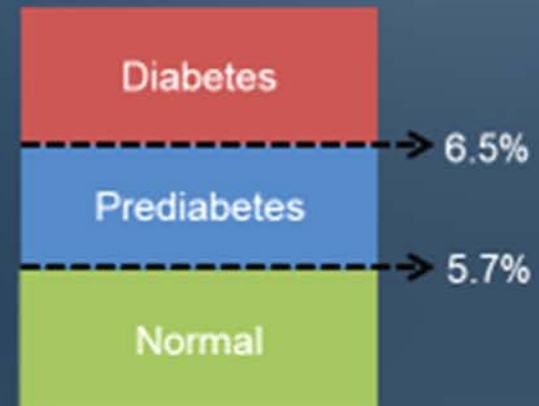
Any abnormality must be repeated and confirmed on a separate day using the same test

Diagnosis of diabetes can also be made based on unequivocal symptoms & a random plasma glucose ≥200 mg/dL

American Diabetes Association. 3. Prevention or delay of type 2 diabetes: Standards of Medical Care in Diabetes 2019. Diabetes Care 2019;42 (Suppl. 1):S29–S33

American Diabetes Association

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Common Comborbidities

- Cancer
- Cognitive Impairment/ Dementia
- Fatty Liver Disease
- Pancreatitis
- Fractures
- Hearing Impairment

- HIV
- Low Testosterone (Men)
- Obstructive Sleep Apnea
- Periodontal Disease
- Psychosocial/Emotional Disorders

American Diabetes Association. 4. Comprehensive medical evaluation and assessment of comorbidities: Standards of Medical Care in Diabetes 2019. Diabetes Care 2019;42(Suppl. 1):S34–S45

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Taking Care of Diabetes Complications

- Brain and cerebral circulation: Cerebrovascular disease
- Eyes: Retinopathy and blindness
- Oral health: Severe periodontal disease
- Heart and coronary circulation: Heart disease or stroke
- Kidney: Nephropathy
- Pregnancy and birth: Complications, birth defects
- Peripheral nervous system: Neuropathy
- Blood pressure: Hypertension
- Lower limbs: Loss of sensitivity
- Diabetic foot: Ulceration and amputation

- Eye care professional for annual dilated eye exam
- Family planning for women of reproductive age
- Registered dietitian for MNT
- DSMES
- Dentist for comprehensive dental and periodontal examination
- Mental health professional, if indicated

Recent FDA Approved Drugs

SGLT2 Inhibitors

BRAND NAME	OTHER NAME
Farxiga	dapagliflozin
Invokana	canagliflozin
Jardiance	empagliflozin
Steglatro	ertugliflozin

❖ Report Online at: www.fda.gov/medwatch
❖ Call **1-800-FDA-1088** to request a form.

GLP-1 receptor agonists

BRAND NAME	OTHER NAME
Adlyxin	lixisenatide
Bydureon	exenatide
Byetta	exenatide
Ozempic	semaglutide
Tanzeum	albiglutide
Trulicity	dulaglutide
Victoza	liraglutide

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PROFILES OF ANTIHYPERGLYCEMIC MEDICATIONS

	MET	GLP1-RA	SGLT2i	DPP4i	AGi	TZD (moderate dose)	SU / GLN	COLSVL	BCR-QR	INSULIN	PRAML
HYPO	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Moderate/Severe / Mild	Neutral	Neutral	Moderate to Severe	Neutral
WEIGHT	Slight Loss	Loss	Loss	Neutral	Neutral	Gain	Gain	Neutral	Neutral	Gain	Loss
RENAL / GU	Contra-indicated if eGFR <30 mL/min/1.73 m²	Exenatide Not Indicated CrCl <30; Potential Benefit of LA GLP1-RA	Not Indicated for eGFR <45 mL/min/1.73 m²; See #1; Genital Mycotic Infections; Potential CKD Benefit; See #1	Dose Adjustment Necessary (Except Linagliptin); Effective in Reducing Albuminuria	Neutral	Neutral	More Hypo Risk	Neutral	Neutral	More Hypo Risk	Neutral
GI Sx	Moderate	Moderate	Neutral	Neutral	Moderate	Neutral	Neutral	Mild	Moderate	Neutral	Moderate
CHF CARDIAC ASCVD	Neutral	Neutral; Potential Benefit of LA GLP1-RA	Prevent HF Hospitalization Manage HFrEF; See #2; See #3	See #4	Neutral	Moderate; May Reduce Stroke Risk	Neutral; Possible ASCVD Risk	Neutral; Lowers LDL-C	Neutral; Safe	CHF Risk; Neutral	Neutral
BONE	Neutral	Neutral	Neutral	Neutral	Neutral	Moderate Fracture Risk	Neutral	Neutral	Neutral	Neutral	Neutral
KETOACIDOSIS	Neutral	Neutral	DKA Can Occur in Various Stress Settings	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral

- Few adverse events or possible benefits
- Use with caution
- Likelihood of adverse effects

1. Canagliflozin indicated for eGFR ≥30 mL/min/1.73 m² in patients with CKD 3 + albuminuria.
2. Dapagliflozin—potential primary prevention of HF hospitalization & demonstrated efficacy in HFrEF.
3. Empagliflozin—FDA approved to reduce CV mortality. Canagliflozin—FDA approved to reduce MACE events.
4. Possible increased hospitalizations for heart failure with alogliptin and saxagliptin.

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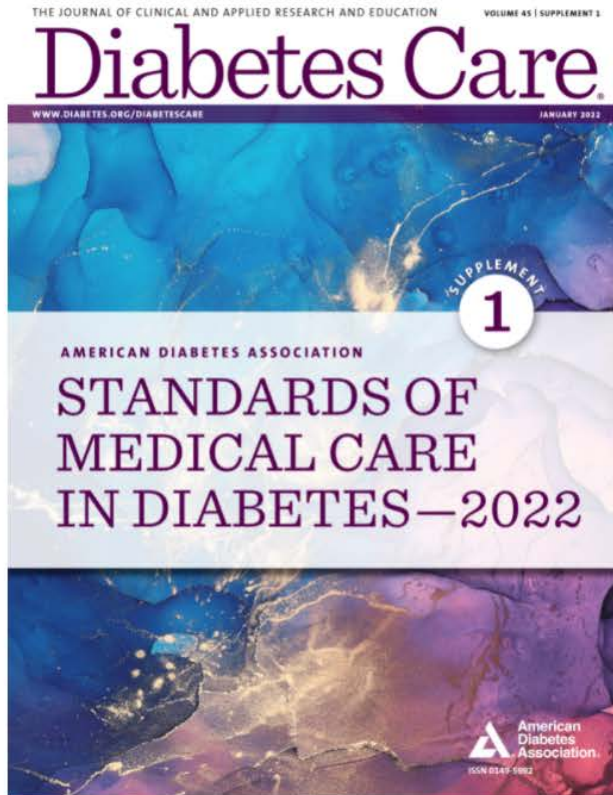
Standards of Medical Care in Diabetes

Abridged Standards of Care for Primary Care Providers

Standards of Care App

Standards of Medical Care in Diabetes—2020 Abridged for Primary Care Providers

American Diabetes Association

The American Diabetes Association's (ADA's) *Standards of Medical Care in Diabetes* is updated and published annually in a supplement to the January issue of *Diabetes Care*. The Standards are developed by the ADA's multidisciplinary Professional Practice Committee, which comprises physicians, diabetes educators, and other expert diabetes health care professionals. The Standards include the most current evidence-based recommendations for diagnosing and treating adults and children with all forms of diabetes. ADA's grading system uses A, B, C, or E to show the evidence level that supports each recommendation.

- A—Clear evidence from well-conducted, generalizable randomized controlled trials that are adequately powered

outcomes within the group"; these outcomes can be measured in terms of health outcomes (mortality, morbidity, health, and functional status), disease burden (incidence and prevalence), and behavioral and metabolic factors (exercise, diet, A1C, etc.).

Recommendations

1.1 Ensure treatment decisions are timely, rely on evidence-based guidelines, and are made collaboratively with patients based on individual preferences, prognoses, and comorbidities. B
1.2 Align approaches to diabetes management with the Chronic Care Model (CCM). This model emphasizes person-centered team care, integrated

2019 Update to: Management of Hyperglycemia in Type 2 Diabetes, 2018. A Consensus Report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD)
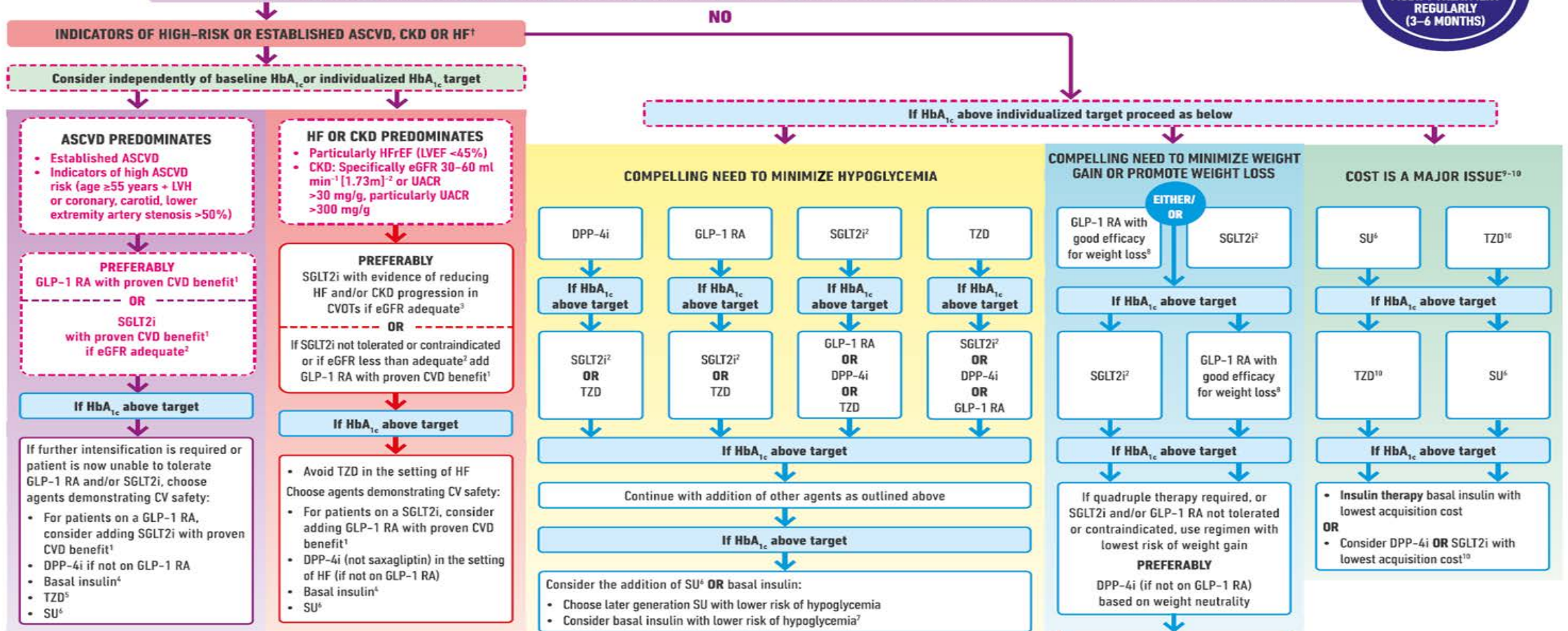
John B. Buse,[1] Deborah J. Wexler,[2,3] Apostolos Tsapas,[4] Peter Rossing,[5,6] Geltrude Mingrone,[7,8,9] Chantal Mathieu,[10] David A. D'Alessio,[11] and Melanie J. Davies[12]

GLUCOSE-LOWERING MEDICATION IN TYPE 2 DIABETES: OVERALL APPROACH

FIRST-LINE THERAPY IS METFORMIN AND COMPREHENSIVE LIFESTYLE (INCLUDING WEIGHT MANAGEMENT AND PHYSICAL ACTIVITY)

TO AVOID CLINICAL INERTIA REASSESS AND MODIFY TREATMENT REGULARLY (3–6 MONTHS)

INDICATORS OF HIGH-RISK OR ESTABLISHED ASCVD, CKD OR HF† — NO

Consider independently of baseline HbA$_{1c}$ or individualized HbA$_{1c}$ target

If HbA$_{1c}$ above individualized target proceed as below

ASCVD PREDOMINATES
- Established ASCVD
- Indicators of high ASCVD risk (age ≥55 years + LVH or coronary, carotid, lower extremity artery stenosis >50%)

PREFERABLY
GLP-1 RA with proven CVD benefit[1]
— OR —
SGLT2i with proven CVD benefit[1] if eGFR adequate[2]

If HbA$_{1c}$ above target

If further intensification is required or patient is now unable to tolerate GLP-1 RA and/or SGLT2i, choose agents demonstrating CV safety:
- For patients on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit[1]
- DPP-4i if not on GLP-1 RA
- Basal insulin[4]
- TZD[5]
- SU[6]

HF OR CKD PREDOMINATES
- Particularly HFrEF (LVEF <45%)
- CKD: Specifically eGFR 30–60 ml min^{-1} [1.73m]$^{-2}$ or UACR >30 mg/g, particularly UACR >300 mg/g

PREFERABLY
SGLT2i with evidence of reducing HF and/or CKD progression in CVOTs if eGFR adequate[3]
— OR —
If SGLT2i not tolerated or contraindicated or if eGFR less than adequate[2] add GLP-1 RA with proven CVD benefit[1]

If HbA$_{1c}$ above target

- Avoid TZD in the setting of HF

Choose agents demonstrating CV safety:
- For patients on a SGLT2i, consider adding GLP-1 RA with proven CVD benefit[1]
- DPP-4i (not saxagliptin) in the setting of HF (if not on GLP-1 RA)
- Basal insulin[4]
- SU[6]

COMPELLING NEED TO MINIMIZE HYPOGLYCEMIA

DPP-4i	GLP-1 RA	SGLT2i[2]	TZD
If HbA$_{1c}$ above target	If HbA$_{1c}$ above target	If HbA$_{1c}$ above target	If HbA$_{1c}$ above target
SGLT2i[2] OR TZD	SGLT2i[2] OR TZD	GLP-1 RA OR DPP-4i OR TZD	SGLT2i[2] OR DPP-4i OR GLP-1 RA

If HbA$_{1c}$ above target

Continue with addition of other agents as outlined above

If HbA$_{1c}$ above target

Consider the addition of SU[6] OR basal insulin:
- Choose later generation SU with lower risk of hypoglycemia
- Consider basal insulin with lower risk of hypoglycemia[7]

COMPELLING NEED TO MINIMIZE WEIGHT GAIN OR PROMOTE WEIGHT LOSS

EITHER/OR

GLP-1 RA with good efficacy for weight loss[8]	SGLT2i[2]

If HbA$_{1c}$ above target

SGLT2i[2]	GLP-1 RA with good efficacy for weight loss[8]

If HbA$_{1c}$ above target

If quadruple therapy required, or SGLT2i and/or GLP-1 RA not tolerated or contraindicated, use regimen with lowest risk of weight gain
PREFERABLY
DPP-4i (if not on GLP-1 RA) based on weight neutrality

If DPP-4i not tolerated or contraindicated or patient already on GLP-1 RA, cautious addition of:
- SU[6] - TZD[5] - Basal insulin

COST IS A MAJOR ISSUE[9–10]

SU[6]	TZD[10]
If HbA$_{1c}$ above target	If HbA$_{1c}$ above target
TZD[10]	SU[6]

If HbA$_{1c}$ above target

- Insulin therapy basal insulin with lowest acquisition cost
OR
- Consider DPP-4i OR SGLT2i with lowest acquisition cost[10]

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1. Proven CVD benefit means it has label indication of reducing CVD events.
2. Be aware that SGLT2i labeling varies by region and individual agent with regard to indicated level of eGFR for initiation and continued use
3. Empagliflozin, canagliflozin, and dapagliflozin have shown reduction in HF and to reduce CKD progression in CVOTs. Canagliflozin has primary renal outcome data from CREDENCE. Dapagliflozin has primary heart failure outcome data from DAPA-HF
4. Degludec and U100 glargine have demonstrated CVD safety
5. Low dose may be better tolerated though less well studied for CVD effects
† Actioned whenever these become new clinical considerations regardless of background glucose-lowering medications.
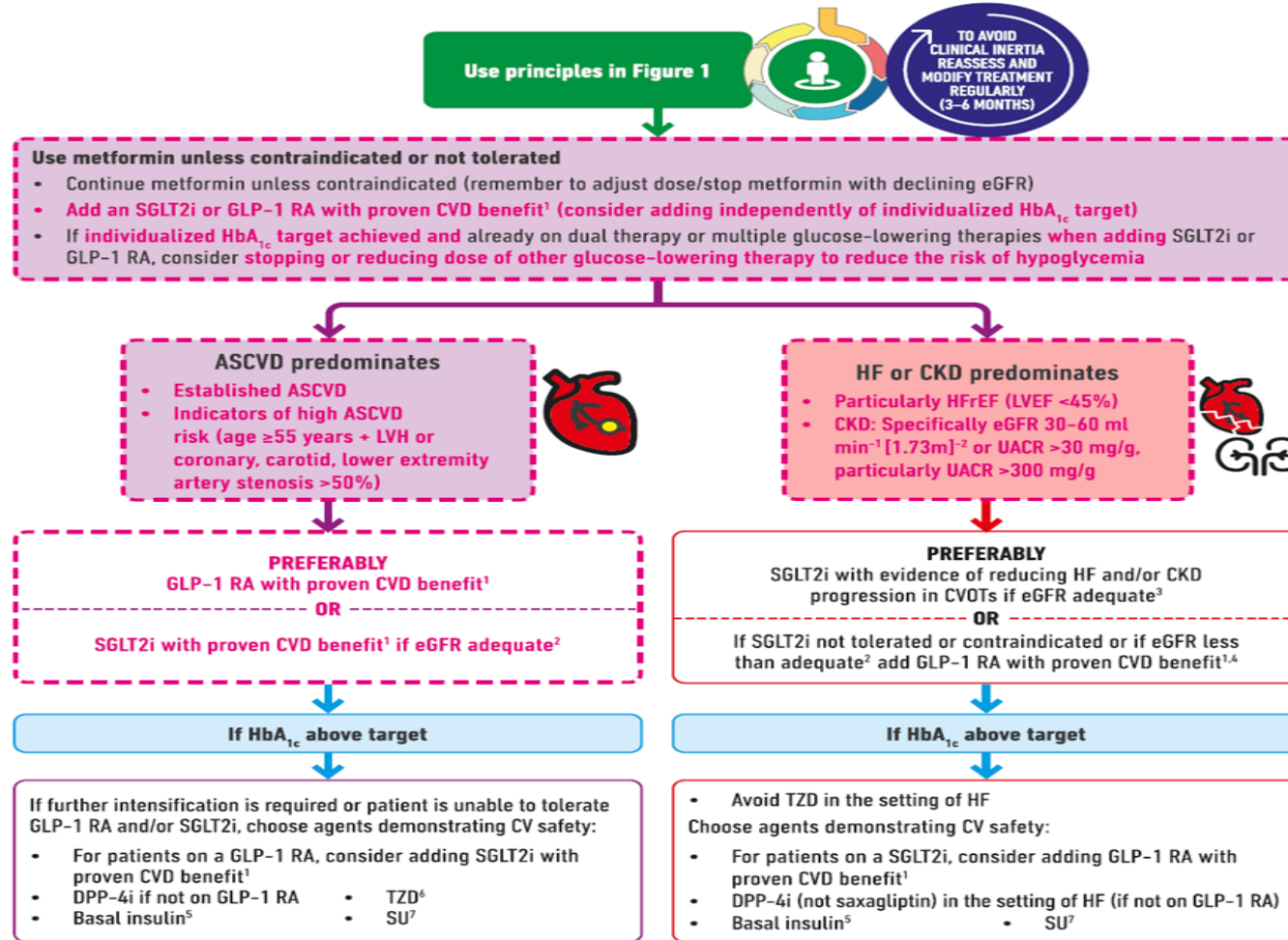
6. Choose later generation SU to lower risk of hypoglycemia. Glimepiride has shown similar CV safety to DPP-4i
7. Degludec / glargine U300 < glargine U100 / detemir < NPH insulin
8. Semaglutide > liraglutide > dulaglutide > exenatide > lixisenatide
9. If no specific comorbidities (i.e. no established CVD, low risk of hypoglycemia and lower priority to avoid weight gain or no weight-related comorbidities)
10. Consider country- and region-specific cost of drugs. In some countries TZDs relatively more expensive and DPP-4i relatively cheaper

Updates to the 2018 consensus report are indicated in magenta font

LVH = Left Ventricular Hypertrophy; HFrEF = Heart Failure reduced Ejection Fraction
UACR = Urine Albumin-to-Creatinine Ratio; LVEF = Left Ventricular Ejection Fraction

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CHOOSING GLUCOSE-LOWERING MEDICATION IN THOSE WITH **INDICATORS OF HIGH-RISK** OR ESTABLISHED ATHEROSCLEROTIC CARDIOVASCULAR DISEASE (ASCVD), CHRONIC KIDNEY DISEASE (CKD) **OR HEART FAILURE (HF)**

Use principles in Figure 1

TO AVOID CLINICAL INERTIA REASSESS AND MODIFY TREATMENT REGULARLY (3–6 MONTHS)

Use metformin unless contraindicated or not tolerated
- Continue metformin unless contraindicated (remember to adjust dose/stop metformin with declining eGFR)
- Add an SGLT2i or GLP-1 RA with proven CVD benefit[1] (consider adding independently of individualized HbA$_{1c}$ target)
- If individualized HbA$_{1c}$ target achieved and already on dual therapy or multiple glucose-lowering therapies when adding SGLT2i or GLP-1 RA, consider stopping or reducing dose of other glucose-lowering therapy to reduce the risk of hypoglycemia

ASCVD predominates
- Established ASCVD
- Indicators of high ASCVD risk (age ≥55 years + LVH or coronary, carotid, lower extremity artery stenosis >50%)

HF or CKD predominates
- Particularly HFrEF (LVEF <45%)
- CKD: Specifically eGFR 30–60 ml min^{-1} [1.73m]$^{-2}$ or UACR >30 mg/g, particularly UACR >300 mg/g

PREFERABLY
GLP-1 RA with proven CVD benefit[1]
------------ **OR** ------------
SGLT2i with proven CVD benefit[1] if eGFR adequate[2]

PREFERABLY
SGLT2i with evidence of reducing HF and/or CKD progression in CVOTs if eGFR adequate[3]
------------ **OR** ------------
If SGLT2i not tolerated or contraindicated or if eGFR less than adequate[2] add GLP-1 RA with proven CVD benefit[1,4]

If HbA$_{1c}$ above target

If HbA$_{1c}$ above target

If further intensification is required or patient is unable to tolerate GLP-1 RA and/or SGLT2i, choose agents demonstrating CV safety:
- For patients on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit[1]
- DPP-4i if not on GLP-1 RA
- Basal insulin[5]
- TZD[6]
- SU[7]

- Avoid TZD in the setting of HF

Choose agents demonstrating CV safety:
- For patients on a SGLT2i, consider adding GLP-1 RA with proven CVD benefit[1]
- DPP-4i (not saxagliptin) in the setting of HF (if not on GLP-1 RA)
- Basal insulin[5]
- SU[7]

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Approach to the Management of Hyperglycemia

Patient/Disease Features

more stringent ← A1C 7% → less stringent

Patient/Disease Features	more stringent		less stringent
Risk of hypoglycemia/drug adverse effects	low		high
Disease Duration	newly diagnosed		long-standing
Life expectancy	long		short
Important comorbidities	absent	Few/mild	severe
Established vascular complications	absent	Few/mild	severe
Patient attitude & expected treatment efforts	highly motivated, adherent, excellent self-care capabilities		less motivated, nonadherent, poor self-care capabilities
Resources & support system	readily available		limited

Usually not modifiable

Potentially modifiable

Glycemic Targets:
Standards of Medical Care in Diabetes - 2018. Diabetes Care 2018; 41 (Suppl. 1): S55-S64

American Diabetes Association

REDUCTION IN THE INCIDENCE OF TYPE 2 DIABETES WITH LIFESTYLE INTERVENTION OR METFORMIN
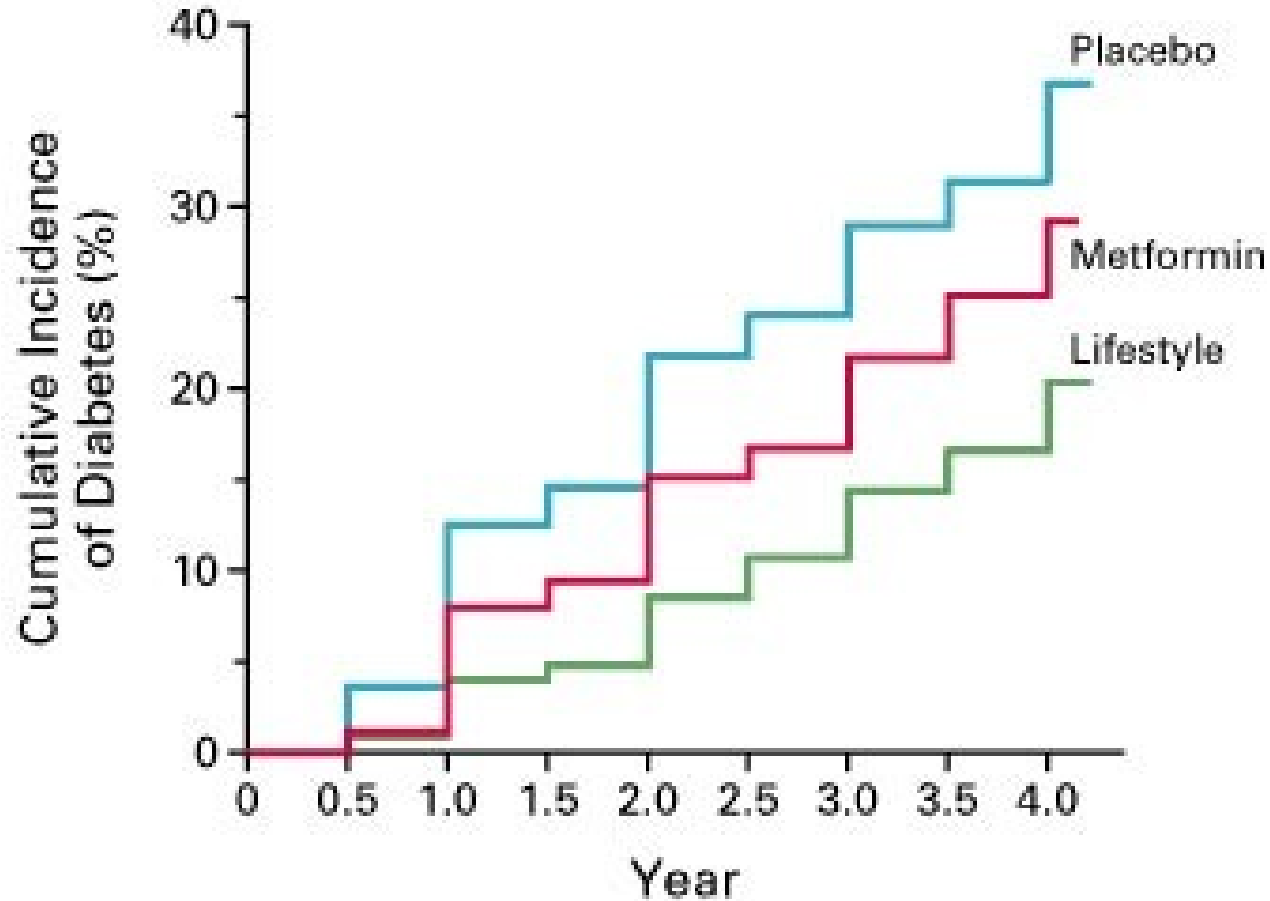
Lifestyle changes and treatment with metformin both reduced the incidence of diabetes in persons at high risk. The lifestyle intervention was more effective than metformin.

Lifestyle Modification Intervention

Lifestyle intervention continues to have an effect, even after 20 years

Study		n	Intervention	Treatment	Risk reduction
Da Qing[1,2]	IGT	577	Lifestyle	6 years 23 years	51% 45%
Finnish DPS[3,4]	IGT	523	Lifestyle	3+ years 7 years	58% 43%
Diabetes Prevention Program (DPP)[5,6]	IGT	3,324	Lifestyle	3 years 10 years	58% 34%

1. *Diabetes Care.* 1997;20:537-544.   2. *Lancet.* 2008;371:1783-1789.
3. *N Engl J Med.* 2001;344:1343-1350.   4. *Lancet.* 2006;368:1673-1679.
5. *N Engl J Med.* 2002;346:393-403.   6. *Lancet.* 2009;374:1677-1686.

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Standardization of the National DPP

1. Structured curricula available through CDC

2. DPP Lifestyle Coach training and certification for lay persons and for healthcare personnel who will deliver DPP

3. Intervention delivery method and intensity
   - In-person group or combined with virtual/online
   - Program duration of 12 months minimum
   - Two phases:
        Phase 1 - months 0 – 6 is lifestyle change for weight loss goals (16 weekly sessions)
        Phase 2 - months 7 – 12 is maintenance (6 monthly sessions)

4. Performance metrics are required to certify a program through CDC.

Achieving Healthy Eating Habits: *Plate Method*

Non-starchy vegetables

- Spinach
- Carrots
- Lettuce
- Greens
- Cabbage
- Green beans
- Broccoli
- Cauliflower
- Tomatoes

Grains and starchy foods

- Whole grain breads
- Sweet potatoes
- Corn
- High-fiber

Protein

- Chicken/turkey without skin
- Fish (tuna, salmon, cod, catfish)
- Tofu, eggs, low-fat cheese
- Lean beef and pork
- Beans