# Diabetes Mellitus Study Guide

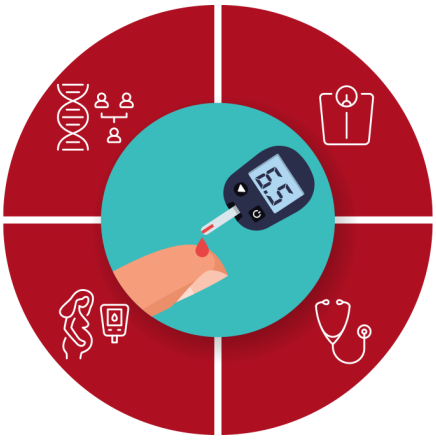
FAMILY MEDICINE COURSE

Fifth Year – Mutah University

## Classification

Type 1 diabetes (idiopathic or autoimmune β-cell destruction)

Gestational diabetes mellitus (GDM; detected at 24–28 weeks of gestation in individuals without previously identified diabetes or high-risk glucose metabolism)



Type 2 diabetes (non-autoimmune progressive loss of adequate β-cell insulin secretion frequently on the background of insulin resistance and metabolic syndrome)

Diabetes from other causes (e.g., monogenic diabetes syndromes, diseases of the exocrine pancreas, and drug- or chemical-induced diabetes)

This study guide will focus on Type 2 diabetes.

## Prevalence in Jordan

The prevalence of type 2 diabetes in Jordan is high and has been increasing, becoming a significant public health concern. Studies indicate that between 14% and 24.9% of the Jordanian population has type 2 diabetes or is borderline diabetic. Specifically, one study showed a prevalence of 23.7% in 2017, highlighting a significant rise from 13% in 1997. This trend is expected to continue, with projections estimating a prevalence of 20.6% by 2050.

*"Characterizing the type 2 diabetes mellitus epidemic in Jordan up to 2050", "Time trends in diabetes mellitus in Jordan between 1994 and 2017"*

## Screening

Screening for prediabetes and type 2 diabetes should be performed in asymptomatic adults with an informal assessment of risk factors or a validated risk calculator; https://diabetes.org/diabetes-risk-test

### *Informal Risk Factor Assessment for Prediabetes and Type 2 Diabetes*


Adults (≥18 years of age) with overweight or obesity (BMI ≥25 kg/m² or ≥23 kg/m² in Asian American individuals) who have one or more of the following risk factors:

- ☐ First-degree relative with diabetes
- ☐ High-risk race/ethnicity
- ☐ History of cardiovascular disease
- ☐ Hypertension (≥130/80 mmHg or on therapy for hypertension)
- ☐ Polycystic ovary syndrome
- ☐ HDL cholestorol <35 mg/dL (<0.9 mmol/L) and/or trigylcerides >250 mg/dL (>2.8 mmol/L)
- ☐ Physical inactivity
- ☐ Other clinical conditions associated with insulin resistance

**Clinical Notes**

- If results are normal, repeat screening at least every 3 years (annually for those with prediabetes), or sooner with symptoms or changes in risk.
- Risk-based screening for prediabetes or type 2 diabetes should be considered after the onset of puberty or after 10 years of age, whichever occurs earlier, in children and adolescents with overweight (BMI ≥85th percentile) or obesity (BMI ≥95th percentile) who have one or more risk factors for diabetes.

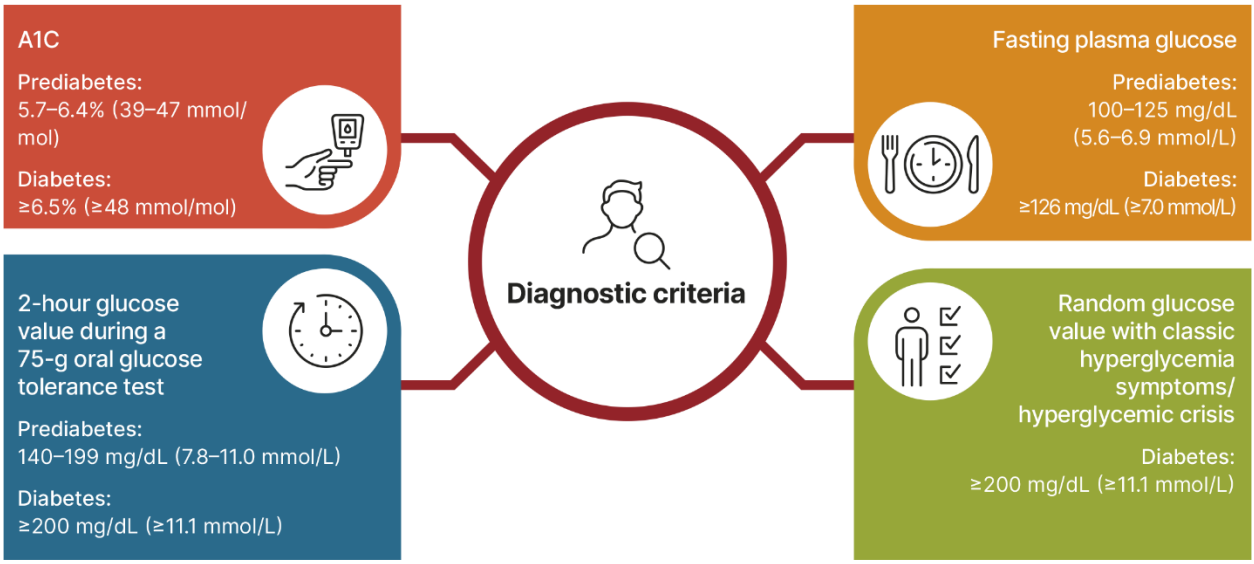
***Additional Screening Guidelines***

| Condition | Clinical Tips | Best Test |
|---|---|---|
| An altered relationship between A1C and glycemia | A mismatch between A1C and glycemia could be caused by some hemoglobin variants, pregnancy (second and third trimesters and the postpartum period), glucose-6-phosphate dehydrogenase deficiency, HIV, hemodialysis, recent blood loss or transfusion, anemia, or erythropoietin therapy. People with HIV should be screened for diabetes and prediabetes before and 3–6 months after starting or changing antiretroviral therapy, and annually if initial results are normal. | Fasting plasma glucose |
| Acute pancreatitis | Screen for diabetes 3-6 months after an episode of acute pancreatitis and annually thereafter. | Any standard test for diagnosing diabetes |
| Cystic fibrosis | Annual screening should begin by the age of 10 years in all people with cystic fibrosis not previously diagnosed with cystic fibrosis-related diabetes | Oral glucose tolerance test |
| Posttransplantation status | Screen for hyperglycemia after organ transplantation. Posttransplantation diabetes mellitus should be diagnosed when the individual is stable on immunosuppressive therapy and free of acute infections. | Oral glucose tolerance test |
| Possible monogenic diabetes | Suspect monogenic diabetes in people diagnosed with diabetes in the first 6 months of life and in children and young adults with atypical characteristics of type 1 or type 2 diabetes, who often have a family history of diabetes in successive generations (suggestive of an autosomal dominant pattern of inheritance). | Any standard test for diagnosing diabetes plus appropriate genetic testing |
| Therapy with certain medications | Consider screening people for prediabetes or diabetes if they are on certain medications known to increase diabetes risk, such as glucocorticoids, statins, thiazide diuretics, some HIV medications, and second-generation antipsychotic medications. | Any standard test for diagnosing diabetes |

**Diagnosis**

- Symptoms and presentation of significant hyperglycemia may include:
    - Polyuria
    - Polydipsia
    - Polyphagia
    - Blurred vision
    - Spontaneous weight loss
    - Hyperosmolar hyperglycemic state
    - Diabetic ketoacidosis (DKA) (less common than in diabetes mellitus type 1)
- Symptoms associated with chronic hyperglycemia may include:
    - Peripheral neuropathy
    - Frequent infections
    - Visual impairment
    - Sexual dysfunction
    - Bowel or bladder dysfunction
    - Kidney dysfunction
    - Cardiovascular dysfunction (for example, chest pain)
- **Diagnostic criteria for diabetes is any of:**
    - **Symptoms** of hyperglycemia (such as polyuria or polydipsia) or hyperglycemic crisis with a **random plasma glucose ≥ 200 mg/dL** (11.1 mmol/L)
    - No unequivocal hyperglycemia, but **2 abnormal test results** from either 2 separate test samples or same sample, including:
        - **Fasting plasma glucose ≥ 126 mg/dL** (7 mmol/L) (with no caloric intake for ≥ 8 hours)
        - **2-hour plasma glucose ≥ 200 mg/dL** (11.1 mmol/L) during the oral glucose tolerance test (OGTT), administered as described by the World Health Organization (WHO) guidelines using 75 g anhydrous glucose dissolved in water or equivalent

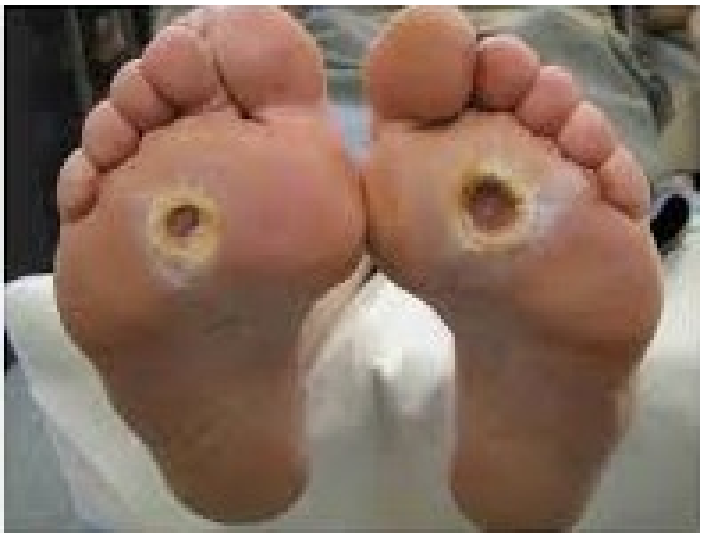
- **HbA1c ≥ 6.5%** (48 mmol/mol)




- Additional testing to evaluate for comorbidities
    - In adults with prediabetes or diabetes who are not taking statins or other lipid-lowering therapy, consider measuring lipid levels at the time of diabetes diagnosis, at the initial medical evaluation, and annually thereafter, or more frequently if indicated.
    - Evaluate for the presence of clinically significant liver fibrosis (defined as moderate fibrosis to cirrhosis) in patients with type 2 diabetes or prediabetes, particularly those with obesity, cardiometabolic risk factors, or established cardiovascular disease, even if liver enzymes are normal. Use a calculated fibrosis-4 index (FIB-4) for screening.
    - At least annually, assess urinary albumin (such as spot urinary albumin-to-creatinine ratio) and estimated glomerular filtration rate (GFR) in all patients with type 2 diabetes regardless of treatment.
    - Perform a dilated and comprehensive eye examination at the time of diabetes diagnosis.
    - Test for distal symmetric polyneuropathy and the loss of a protective sensation with a **10-g monofilament** and ≥ 1 of the following tests at the time of diagnosis and annually to identify feet at risk of ulceration and amputation:


- Temperature discrimination or pinprick sensation (for small-fiber function)
- Vibration sensation using a 128 hertz (Hz) tuning fork (for large-fiber function).
- Light touch perception with 10-g monofilament testing to identify risk of ulceration and amputation

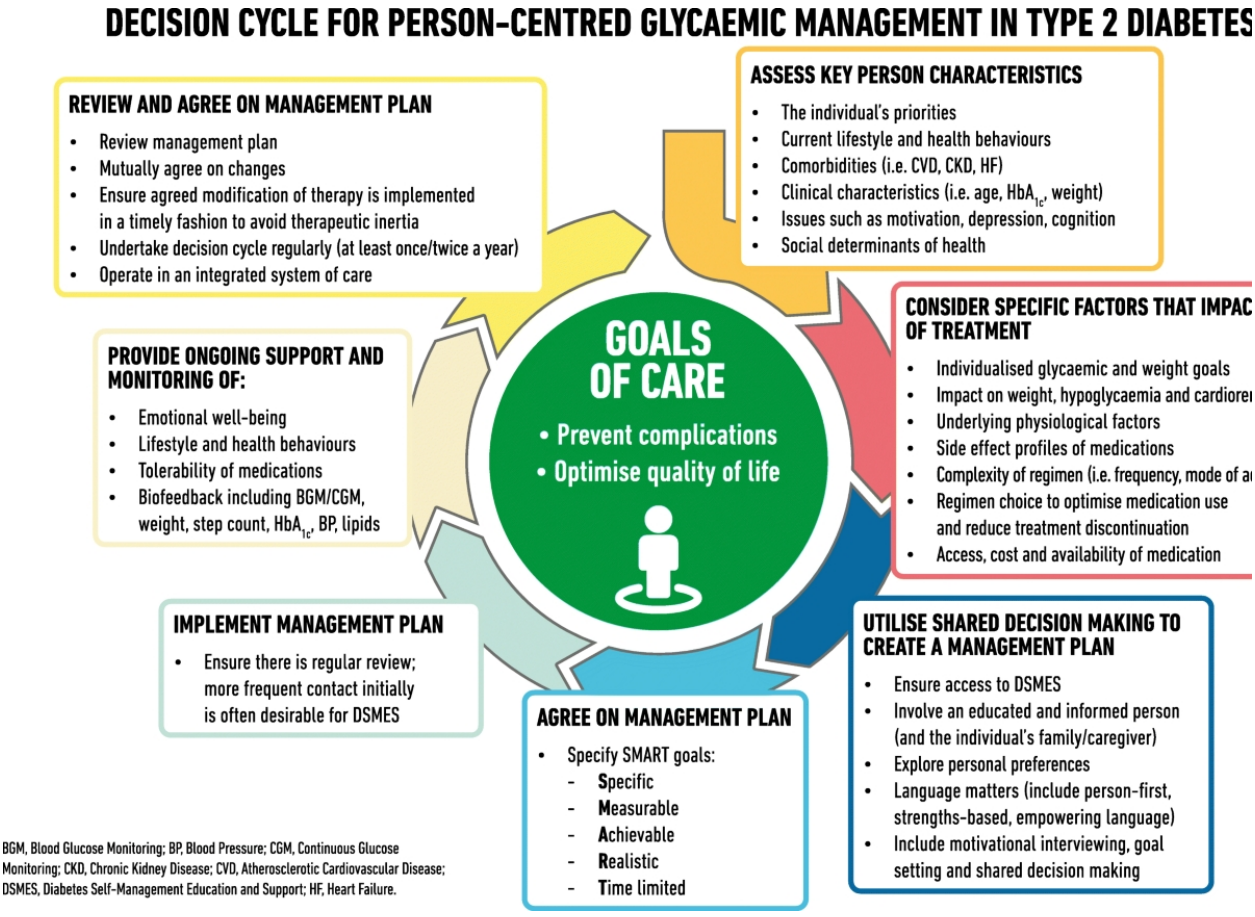
***Neuropathic diabetic ulcers***



| | | Initial Visit | Every Follow-Up Visit | Annual Visit |
|---|---|---|---|---|
| PAST MEDICAL AND FAMILY HISTORY | DIABETES HISTORY | | | |
| | • Characteristics at onset (e.g., age, symptoms) | ✓ | | |
| | • Review of previous treatment plans and response | ✓ | | |
| | • Assess frequency/cause/severity of past hospitalizations | ✓ | | |
| | FAMILY HISTORY | | | |
| | • Family history of diabetes in a first-degree relative | ✓ | | |
| | • Family history of autoimmune disorder | ✓ | | |
| | PERSONAL HISTORY OF COMPLICATIONS AND COMMON COMORBIDITIES | | | |
| | • Common comorbidities (e.g., obesity, OSA, NAFLD) | ✓ | | |
| | • High blood pressure or abnormal lipids | ✓ | | ✓ |
| | • Macrovascular and microvascular complications | ✓ | | ✓ |
| | • Hypoglycemia: awareness/frequency/causes/timing of episodes | ✓ | ✓ | ✓ |
| | • Presence of hemoglobinopathies or anemias | ✓ | | ✓ |
| | • Last dental visit | ✓ | | ✓ |
| | • Last dilated eye exam | | | ✓ |
| | • Visits to specialists | | | ✓ |
| | • Disability assessment and use of assistive devices (e.g., physical, cognitive, vision and auditory, history of fractures, podiatry) | ✓ | ✓ | ✓ |
| | • Personal history of autoimmune disease | ✓ | | |
| | INTERVAL HISTORY | | | |
| | • Changes in medical/family history since last visit | | ✓ | ✓ |
| BEHAVIORAL FACTORS | • Eating patterns and weight history | ✓ | ✓ | ✓ |
| | • Assess familiarity with carbohydrate counting (e.g., type 1 diabetes, type 2 diabetes treated with intensive insulin therapy) | ✓ | | ✓ |
| | • Physical activity and sleep behaviors, screen for obstructive sleep apnea | ✓ | ✓ | ✓ |
| | • Tobacco, alcohol, and substance use | ✓ | | ✓ |
| MEDICATIONS AND VACCINATIONS | • Current medication plan | ✓ | ✓ | ✓ |
| | • Medication-taking behavior, including rationing of medications and/or medical equipment | ✓ | ✓ | ✓ |
| | • Medication intolerance or side effects | ✓ | ✓ | ✓ |
| | • Complementary and alternative medicine use | ✓ | ✓ | ✓ |
| | • Vaccination history and needs | ✓ | | ✓ |
| TECHNOLOGY USE | • Assess use of health apps, online education, patient portals, etc. | ✓ | | ✓ |
| | • Glucose monitoring (meter/CGM): results and data use | ✓ | ✓ | ✓ |
| | • Review insulin pump settings and use, connected pen and glucose data | ✓ | ✓ | ✓ |

| | | Initial Visit | Every Follow-Up Visit | Annual Visit |
|---|---|---|---|---|
| SOCIAL LIFE ASSESSMENT | SOCIAL NETWORK | | | |
| | • Identify existing social supports | ✓ | | ✓ |
| | • Identify surrogate decision maker, advanced care plan | ✓ | | ✓ |
| | • Identify social determinants of health (e.g., food security, housing stability & homelessness, transportation access, financial security, community safety) | ✓ | | ✓ |
| | • Assess daily routine and environment, including school/work schedules and ability to engage in diabetes self-management | ✓ | ✓ | ✓ |
| PHYSICAL EXAMINATION | • Height, weight, and BMI; growth/pubertal development in children and adolescents | ✓ | ✓ | ✓ |
| | • Blood pressure determination | ✓ | ✓ | ✓ |
| | • Orthostatic blood pressure measures (when indicated) | ✓ | | |
| | • Fundoscopic examination (refer to eye specialist) | ✓ | | ✓ |
| | • Thyroid palpation | ✓ | | ✓ |
| | • Skin examination (e.g., acanthosis nigricans, insulin injection or insertion sites, lipodystrophy) | ✓ | ✓ | ✓ |
| | • Comprehensive foot examination | ✓ | | ✓ |
| | » Visual inspection (e.g., skin integrity, callous formation, foot deformity or ulcer, toenails) ** | ✓ | ✓ | ✓ |
| | » Screen for PAD (pedal pulses—refer for ABI if diminished) | ✓ | | ✓ |
| | » Determination of temperature, vibration or pinprick sensation, and 10-g monofilament exam | ✓ | | ✓ |
| | • Screen for depression, anxiety, diabetes distress, fear of hypoglycemia, and disordered eating | ✓ | | ✓ |
| | • Consider assessment for cognitive performance* | ✓ | | ✓ |
| | • Consider assessment for functional performance* | ✓ | | ✓ |
| | • Consider assessment for bone pain | ✓ | | ✓ |
| LABORATORY EVALUATION | • A1C, if the results are not available within the past 3 months | ✓ | ✓ | ✓ |
| | • If not performed/available within the past year | ✓ | | ✓ |
| | » Lipid profile, including total, LDL, and HDL cholesterol and triglycerides# | ✓ | | ✓^ |
| | » Liver function tests# | ✓ | | ✓ |
| | » Spot urinary albumin-to-creatinine ratio | ✓ | | ✓ |
| | » Serum creatinine and estimated glomerular filtration rate+ | ✓ | | ✓ |
| | » Thyroid-stimulating hormone in people with type 1 diabetes# | ✓ | | ✓ |
| | » Vitamin B12 if on metformin | ✓ | | ✓ |
| | » Complete Blood Count (CBC) with platelets | ✓ | | ✓ |
| | » Serum potassium levels in people with diabetes on ACE inhibitors, ARBs, or diuretics+ | ✓ | | ✓ |
| | » Calcium, vitamin D, phosphorus for appropriate patients | ✓ | | ✓ |

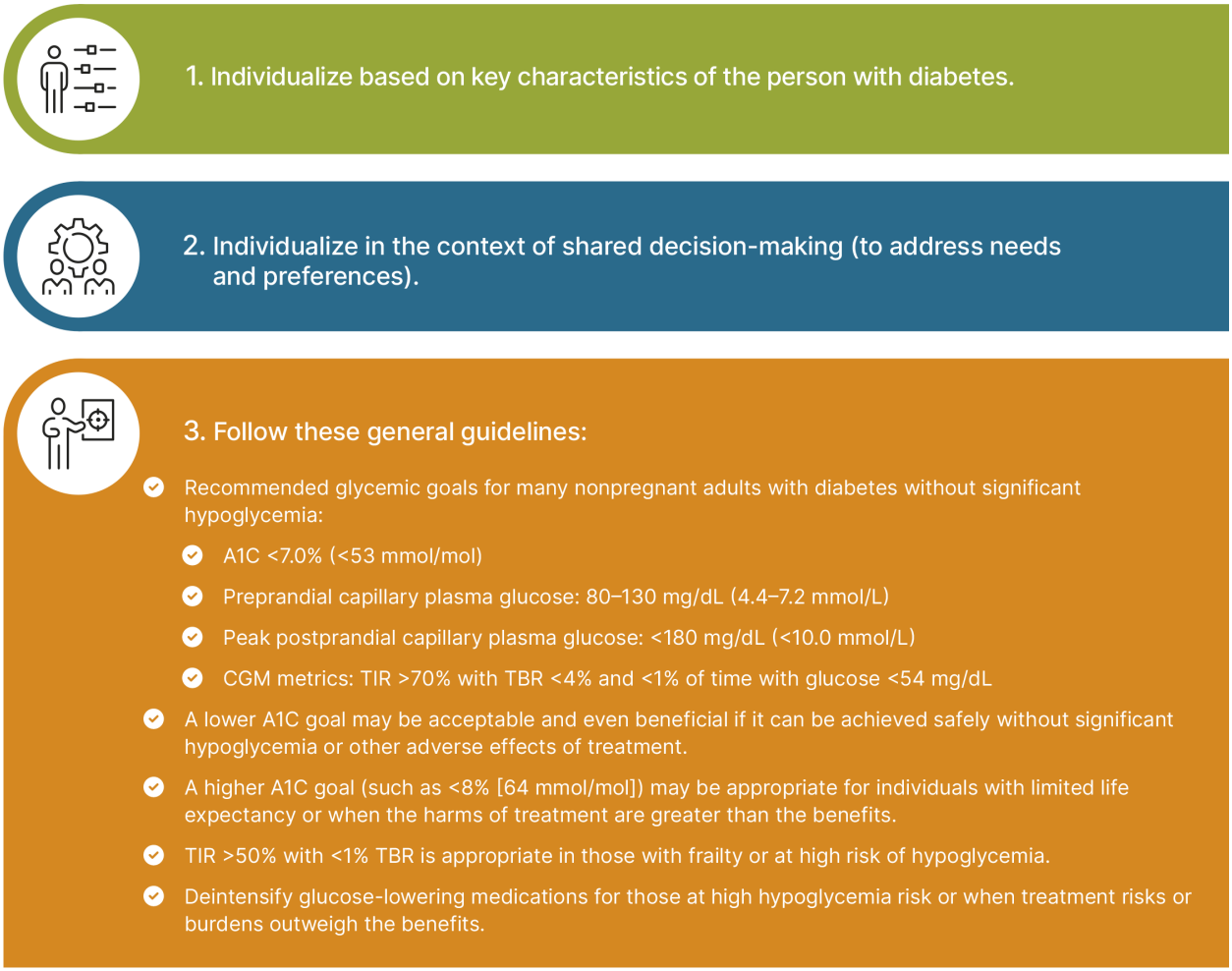
## Management




### *Glycemic Goals*

- Individualize glycemic goals.
    - **HbA1c < 7%** (53 mmol/mol) is a reasonable goal for many nonpregnant adults without significant hypoglycemia.
    - **A more stringent target, such as HbA1c < 6.5%** (48 mmol/mol), may be reasonable if it can be achieved without significant hypoglycemia or other adverse effects of treatment. Candidates for more stringent targets may include those with:
        - Short duration of diabetes
        - Long life expectancy
        - No significant cardiovascular disease

- **A less stringent target, such as HbA1c < 8%** (64 mmol/mol), may be appropriate for patients with any of the following:
  - Limited life expectancy
  - Harms of treatment likely to outweigh the benefits
  - History of severe hypoglycemia




***Lifestyle Modification***

- Individualized **medical nutrition** therapy provided by a registered dietitian (preferably a registered dietitian familiar with diabetes care) is recommended to achieve treatment goals in patients with type 2 diabetes.
- Encourage patients with diabetes to regularly engage in **aerobic and resistance physical activity** with physical activity targets customized to the patient's age and physical activity level; counsel most adults type 2 diabetes to engage in 150 min or more of

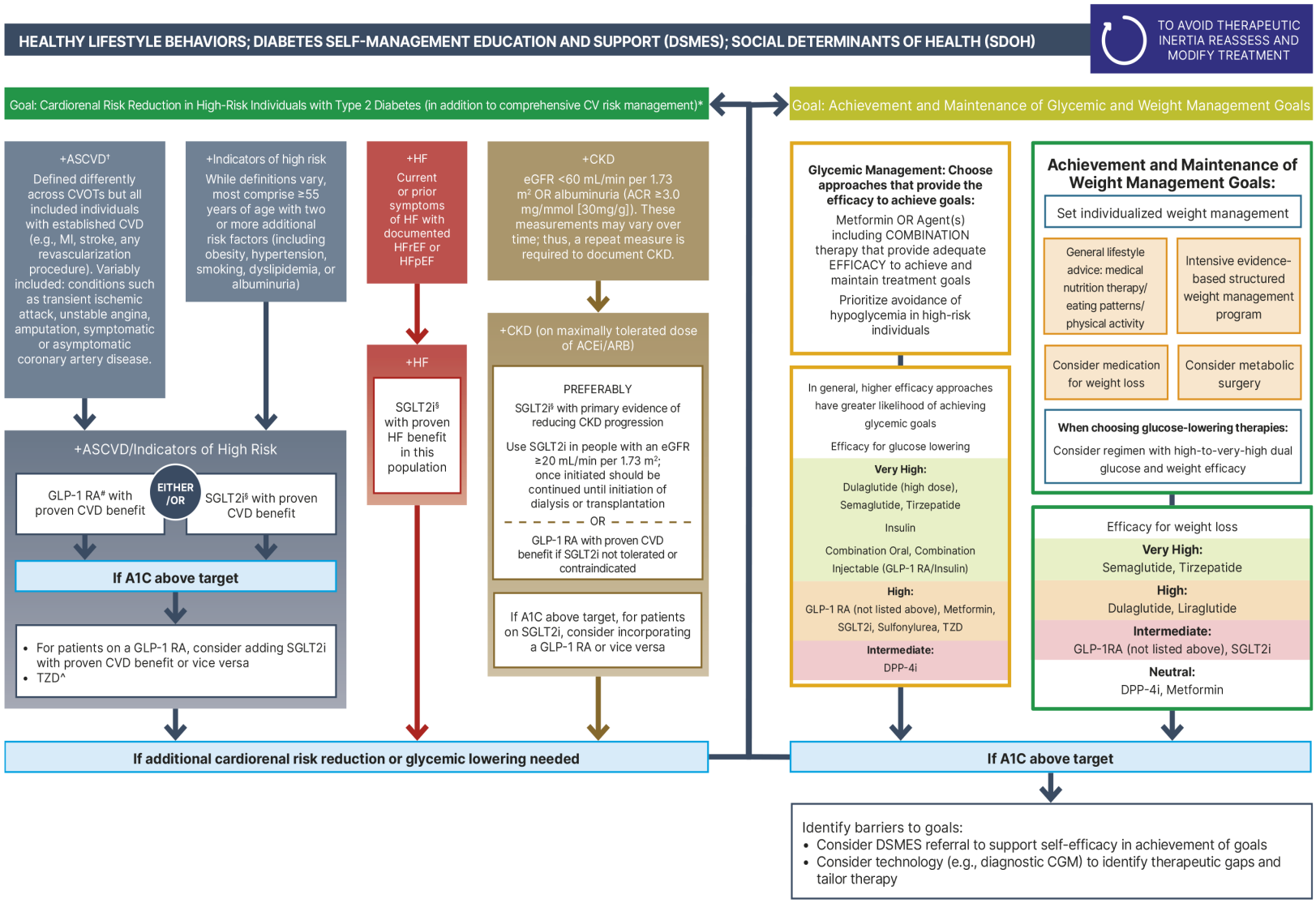
moderate- to vigorous-intensity aerobic activity per week, spread over at least 3 days/week, with no more than 2 consecutive days without activity, and to engage in 2–3 sessions/week of resistance exercise on nonconsecutive days.

- Counsel people with diabetes to practice **sleep-promoting routines and habits**.
- For many individuals with overweight or obesity alongside type 2 diabetes, **at least 5% weight loss** is needed to achieve beneficial outcomes in glycemic management, lipids, and blood pressure.
- **Alcohol and smoking cessation**.

***Glucose-Lowering Medications***

- Use a **patient-centered approach** to guide the choice of pharmacologic agents for type 2 diabetes, considering factors such as **cardiovascular and kidney comorbidities, hypoglycemia risk, effect on weight, cost and access, risk for adverse events, and patient preferences.**
- The choice of first-line therapy depends on patient comorbidities, patient-centered treatment factors, and management needs. Other management factors to consider in patients with type 2 diabetes include healthy lifestyle behaviors, education and support for diabetes self-management, avoidance of clinical inertia, and social determinants of health.
    - **Metformin is the traditional first-line** pharmacologic agent for adults with type 2 diabetes and is one of the most cost-effective agents. However, other agents may be used first or in addition to metformin to reduce blood glucose while also addressing specific comorbidities, such as atherosclerotic cardiovascular disease, heart failure, obesity, and/or chronic kidney disease.
    - The initial choice of pharmacologic therapy needs to take into account patient comorbidities and patient-centered treatment factors.
        - In patients with or at **high risk for atherosclerotic cardiovascular disease**, options include GLP-1 receptor agonists or SGLT2 inhibitors with demonstrated benefit in this population.
        - For adults with **heart failure** with either preserved or reduced ejection fraction, use an SGLT2 inhibitor for glycemic management and to prevent heart failure hospitalizations.
        - For adults with **chronic kidney disease** (estimated glomerular filtration rate [GFR] > 20-30 mL/minute per 1.73 $m^2$), SGLT2 inhibitors are preferred.

- In the absence of any of the above considerations, use metformin as the first-line pharmacologic therapy.
- Metformin may be used in combination with medication that addresses specific comorbid conditions if needed for adequate glycemic control.
- If **insulin therapy** is necessary, continue most glucose-lowering agents upon initiation of insulin therapy for ongoing glycemic and metabolic benefit unless contraindicated or not tolerated. Sulfonylureas and DPP-4 inhibitors are often weaned or discontinued.




- Many patients with type 2 diabetes and HbA1c ≥ 1.5% above glycemic target will require combination therapy (≥ 2 agents) to achieve glycemic control.

- In adults with type 2 diabetes and HbA1c ≥ 1.5%-2% above the glycemic target, consider early combination therapy at treatment initiation to prolong the time to treatment failure.
- For patients who require greater glucose lowering than can be achieved with oral agents alone, GLP-1 receptor agonists are preferred over insulin when possible due to their favorable effects on weight and hypoglycemia risk.
- Consider **early introduction of insulin** (as the first injectable therapy) in patients with:
    - Weight loss or other evidence of ongoing catabolism.
    - Symptomatic hyperglycemia (such as polyuria or polydipsia).
    - HbA1c > 10% (86 mmol/mol) or blood glucose levels ≥ 300 mg/dL (16.7 mmol/L) until glucotoxicity resolves, at which time it is often possible to simplify the regimen.

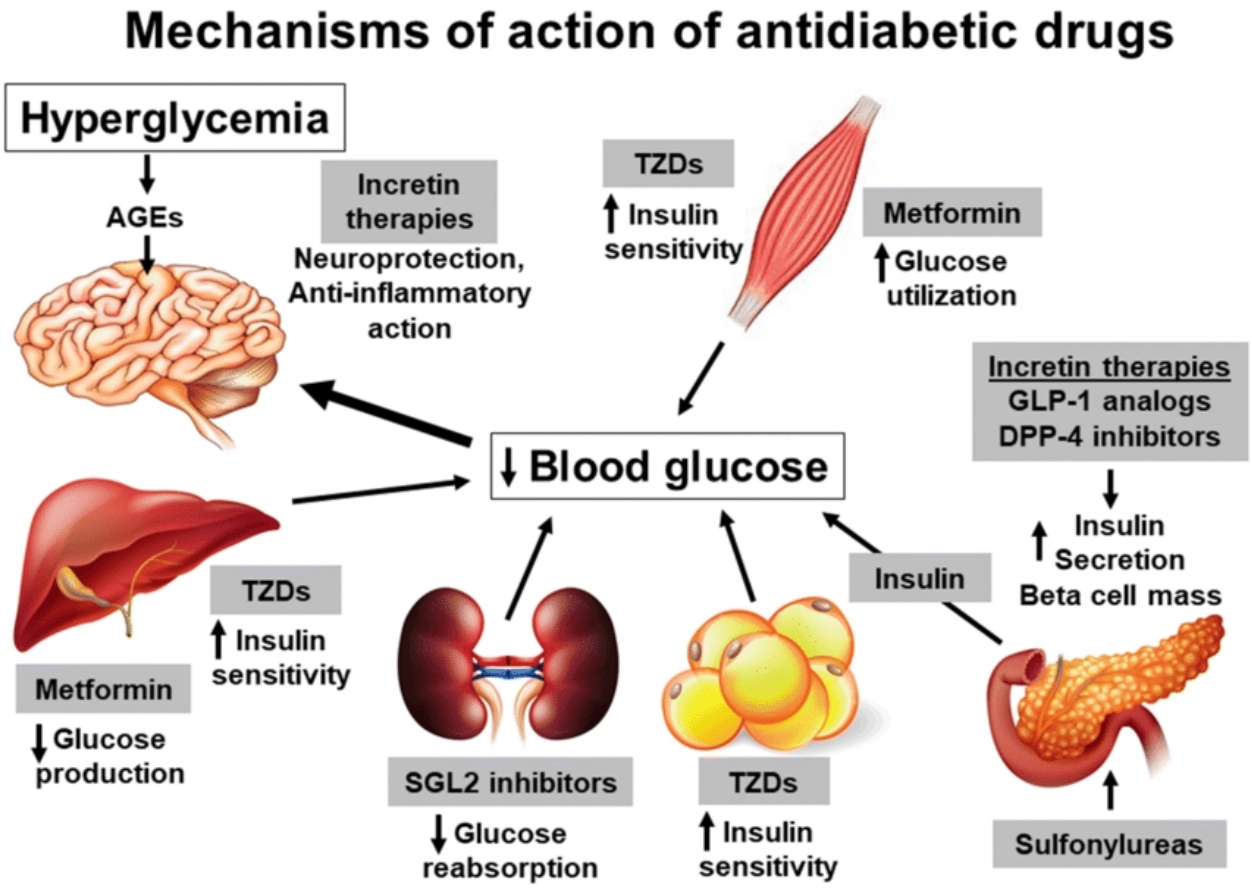
- Considerations in older adults (≥ 65 years old):
    - Metformin is the preferred initial pharmacologic agent for older adults with type 2 diabetes.
    - For older adults with diabetes, assess and address episodes of hypoglycemia at routine office visits.
    - Older adults who are cognitively and functionally intact and have few existing chronic illnesses should have an HbA1c goal < 7%-7.5% (53-58 mmol/mol)
    - Less stringent glycemic goals, such as HbA1c < 8% (64 mmol/mol) should be used for adults with multiple coexisting chronic illnesses, cognitive impairment, or functional dependence.
    - Treatment goals must consider the patient's capability for glucose monitoring and insulin dose adjustment when diabetes-related complications and comorbidities occur. Consider medication classes with a low risk of hypoglycemia in those at an increased risk for hypoglycemia.
    - Glycemic goals for older adults with very complex or poor health may be relaxed as part of individualized care, but avoid hyperglycemia leading to symptoms and risk of acute hyperglycemia complications.

| | Efficacy[1] | Hypoglycemia | Weight change[2] | CV effects | | Renal effects | | Oral/SQ | Cost |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Effect on MACE | HF | Progression of DKD | Dosing/use considerations* | | |
| **Metformin** | High | No | Neutral (potential for modest loss) | Potential benefit | Neutral | Neutral | • Contraindicated with eGFR <30 mL/min per 1.73 $m^2$ | Oral | Low |
| **SGLT2 inhibitors** | Intermediate to high | No | Loss (intermediate) | Benefit: canagliflozin, empagliflozin | Benefit: canagliflozin, dapagliflozin, empagliflozin, ertugliflozin | Benefit: canagliflozin, dapagliflozin, empagliflozin | • See labels for renal dose considerations of individual agents<br>• Glucose-lowering effect is lower for SGLT2 inhibitors at lower eGFR | Oral | High |
| **GLP-1 RAs** | High to very high | No | Loss (intermediate to very high) | Benefit: dulaglutide, liraglutide, semaglutide (SQ)<br>Neutral: exenatide once weekly, lixisenatide | Neutral | Benefit for renal endpoints in CVOTs, driven by albuminuria outcomes: dulaglutide, liraglutide, semaglutide (SQ) | • See labels for renal dose considerations of individual agents<br>• No dose adjustment for dulaglutide, liraglutide, semaglutide<br>• Monitor renal function when initiating or escalating doses in patients with renal impairment reporting severe adverse GI reactions | SQ; oral (semaglutide) | High |

| | Clinical considerations |
|---|---|
| **Metformin** | • GI side effects common; to mitigate GI side effects, consider slow dose titration, extended release formulations, and administration with food<br>• Potential for vitamin B12 deficiency; monitor at regular intervals |
| **SGLT2 inhibitors** | • DKA risk, rare in T2DM: discontinue, evaluate, and treat promptly if suspected; be aware of predisposing risk factors and clinical presentation (including euglycemic DKA); discontinue before scheduled surgery (e.g., 3–4 days), during critical illness, or during prolonged fasting to mitigate potential risk<br>• Increased risk of genital mycotic infections<br>• Necrotizing fasciitis of the perineum (Fournier gangrene), rare reports: institute prompt treatment if suspected<br>• Attention to volume status, blood pressure; adjust other volume-contracting agents as applicable |
| **GLP-1 RAs** | • Risk of thyroid C-cell tumors in rodents; human relevance not determined (liraglutide, dulaglutide, exenatide extended release, semaglutide)<br>• Counsel patients on potential for GI side effects and their typically temporary nature; provide guidance on dietary modifications to mitigate GI side effects (reduction in meal size, mindful eating practices [e.g., stop eating once full], decreasing intake of high-fat or spicy food); consider slower dose titration for patients experiencing GI challenges<br>• Counsel patients about potential for ileus<br>• Pancreatitis has been reported in clinical trials but causality has not been established. Discontinue if pancreatitis is suspected<br>• Evaluate for gallbladder disease if cholelithiasis or cholecystitis is suspected |

| | | Efficacy[1] | Hypoglycemia | Weight change[2] | CV effects | | Renal effects | | Oral/SQ | Cost |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Effect on MACE | HF | Progression of DKD | Dosing/use considerations* | | |
| **DPP-4 inhibitors** | | Intermediate | No | Neutral | Neutral | Neutral (potential risk, saxagliptin) | Neutral | • Renal dose adjustment required (sitagliptin, saxagliptin, alogliptin); can be used in renal impairment<br>• No dose adjustment required for linagliptin | Oral | High |
| **Thiazolidinediones** | | High | No | Gain | Potential benefit: pioglitazone | Increased risk | Neutral | • No dose adjustment required<br>• Generally not recommended in renal impairment due to potential for fluid retention | Oral | Low |
| **Sulfonylureas (2nd generation)** | | High | Yes | Gain | Neutral | Neutral | Neutral | • Glyburide: generally not recommended in chronic kidney disease<br>• Glipizide and glimepiride: initiate conservatively to avoid hypoglycemia | Oral | Low |
| **Insulin** | **Human** | High to very high | Yes | Gain | Neutral | Neutral | Neutral | • Lower insulin doses required with a decrease in eGFR; titrate per clinical response | SQ; inhaled | Low (SQ) |
| | **Analogs** | | | | | | | | SQ | High |

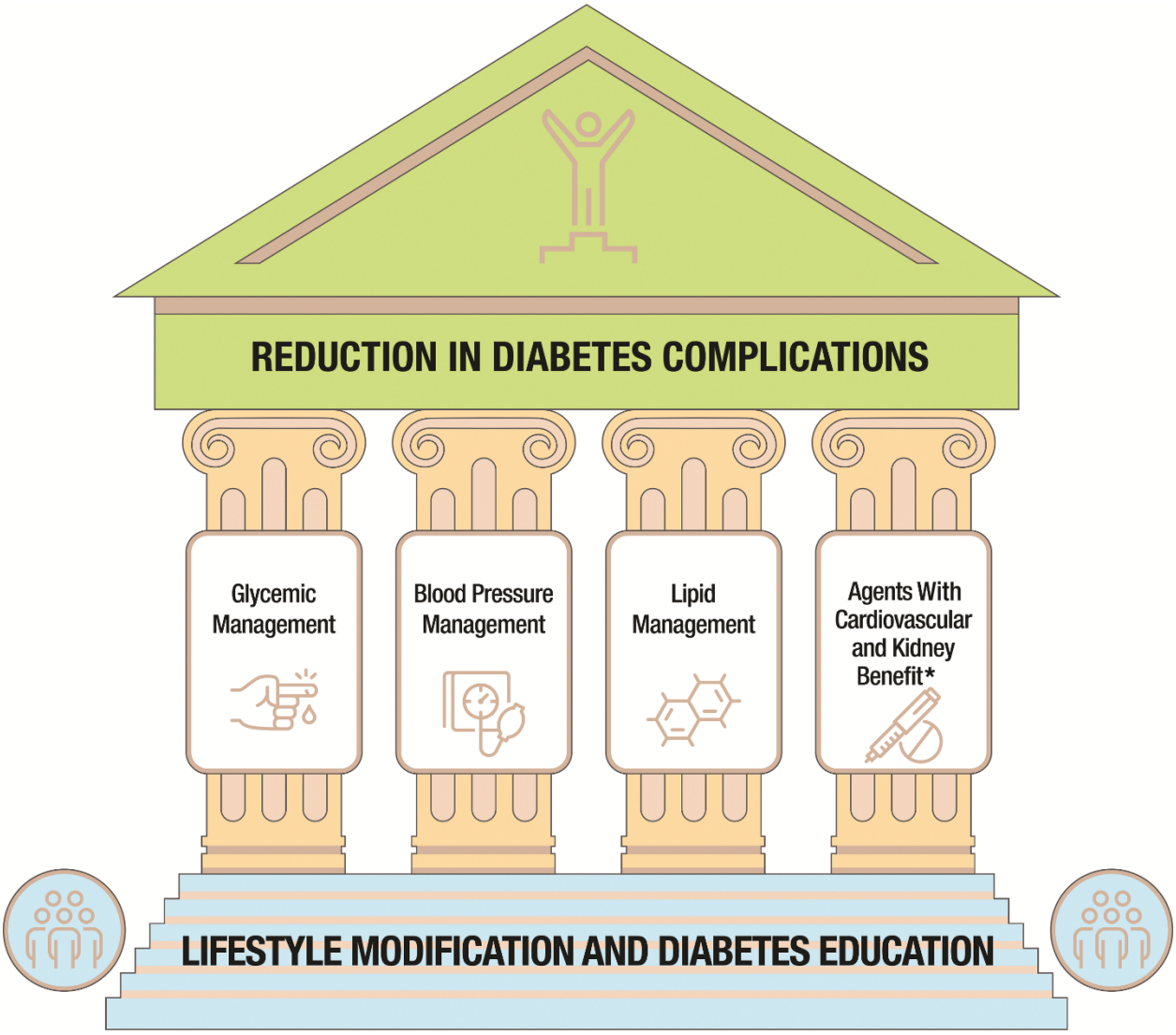
| | | Clinical considerations |
|---|---|---|
| **Dual GIP and GLP-1 RA** | | • Risk of thyroid C-cell tumors in rodents; human relevance not determined<br>• Counsel patients on potential for GI side effects and their typically temporary nature; provide guidance on dietary modifications to mitigate GI side effects (reduction in meal size, mindful eating practices [e.g., stop eating once full], decreasing intake of high-fat or spicy food); consider slower dose titration for patients experiencing GI challenges<br>• Not recommended for individuals with history of gastroparesis<br>• Pancreatitis has been reported in clinical trials but causality has not been established. Discontinue if pancreatitis is suspected<br>• Evaluate for gallbladder disease if cholelithiasis or cholecystitis is suspected |
| **DPP-4 inhibitors** | | • Pancreatitis has been reported in clinical trials but causality has not been established. Discontinue if pancreatitis is suspected<br>• Joint pain<br>• Bullous pemphigoid (postmarketing): discontinue if suspected |
| **Thiazolidinediones** | | • Congestive HF (pioglitazone, rosiglitazone)<br>• Fluid retention (edema; heart failure)<br>• Benefit in NASH<br>• Risk of bone fractures<br>• Weight gain: consider lower doses to mitigate weight gain and edema |
| **Sulfonylureas (2nd generation)** | | • FDA Special Warning on increased risk of CV mortality based on studies of an older sulfonylurea (tolbutamide); glimepiride shown to be CV safe (see text)<br>• Use with caution in persons at risk for hypoglycemia |
| **Insulin** | **Human** | • Injection site reactions<br>• Higher risk of hypoglycemia with human insulin (NPH or premixed formulations) vs. analogs |
| | **Analogs** | |




## Management of Comorbidities

- **Statins** are recommended as the preferred medication for lowering low-density lipoprotein cholesterol.
    - Prescribe a moderate-intensity statin (in addition to lifestyle therapy) for most adults aged 40-75 years with diabetes and without cardiovascular risk factors.
    - Consider prescribing a statin (in addition to lifestyle therapy) in patients aged 20-39 years with cardiovascular risk factors.
    - Consider high-intensity statin therapy to reduce LDL cholesterol by ≥ 50% of baseline with a target LDL goal of < 70 mg/dL in patients aged 40-75 years at increased cardiovascular risk (including patients with ≥ 1 cardiovascular risk factor).

- Preventative **angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs)**:
    - For nonpregnant patients with diabetes and hypertension:
        - Either an ACE inhibitor or an ARB is recommended for those with modestly elevated urinary albumin-to-creatinine ratio (30–299 mg/g creatinine).
        - Either an ACE inhibitor or an ARB is strongly recommended for those with urinary albumin-to-creatinine ratio ≥ 300 mg/g creatinine and/or estimated GFR < 60 mL/minute/1.73 $m^2$.
    - ACE inhibitors or ARBs are not recommended for the primary prevention of chronic kidney disease in patients with diabetes who have:
        - Normal blood pressure
        - Normal urinary albumin-to-creatinine ratio (< 30 mg/g creatinine)
        - Normal estimated GFR
- Consider aspirin 75-162 mg/day in patients with diabetes and increased cardiovascular risk, such as most patients ≥ 50 years old with no increased risk of bleeding and with ≥ 1 additional major risk factor.
- Metabolic (bariatric) surgery should be considered in adults with diabetes and BMI ≥ 30 kg/$m^2$ (27.5 kg/$m^2$ in Asian American patients) who are good surgical candidates.
- Highly recommended vaccinations for adults with diabetes include:
    - COVID-19 (initial vaccination and boosters)
    - Hepatitis B for all adults < 60 years old
    - Influenza annually for all adults (trivalent influenza vaccine preferred over attenuated influenza vaccine in persons with diabetes)
    - Respiratory syncytial virus (RSV) for all adults ≥ 60 years old
    - Tetanus, diphtheria, pertussis (TDAP) for all adults with booster once every 10 years (pregnant women should have an extra dose)
    - Zoster for all adults ≥ 50 years old (provide 2-dose Shingrix, even if previously vaccinated)
    - Pneumococcal vaccine.


REDUCTION IN DIABETES COMPLICATIONS
Glycemic Management
Blood Pressure Management
Lipid Management
Agents With Cardiovascular and Kidney Benefit*
LIFESTYLE MODIFICATION AND DIABETES EDUCATION

## Complications

### *Chronic Kidney Disease*

Screening

**Who?**

- Everyone with type 2 diabetes
- Everyone with type 1 diabetes for ≥5 years

**How?**

- Urinary albumin-to-creatinine ratio (UACR)
- Estimated glomerular filtration rate (eGFR)

**How often?**

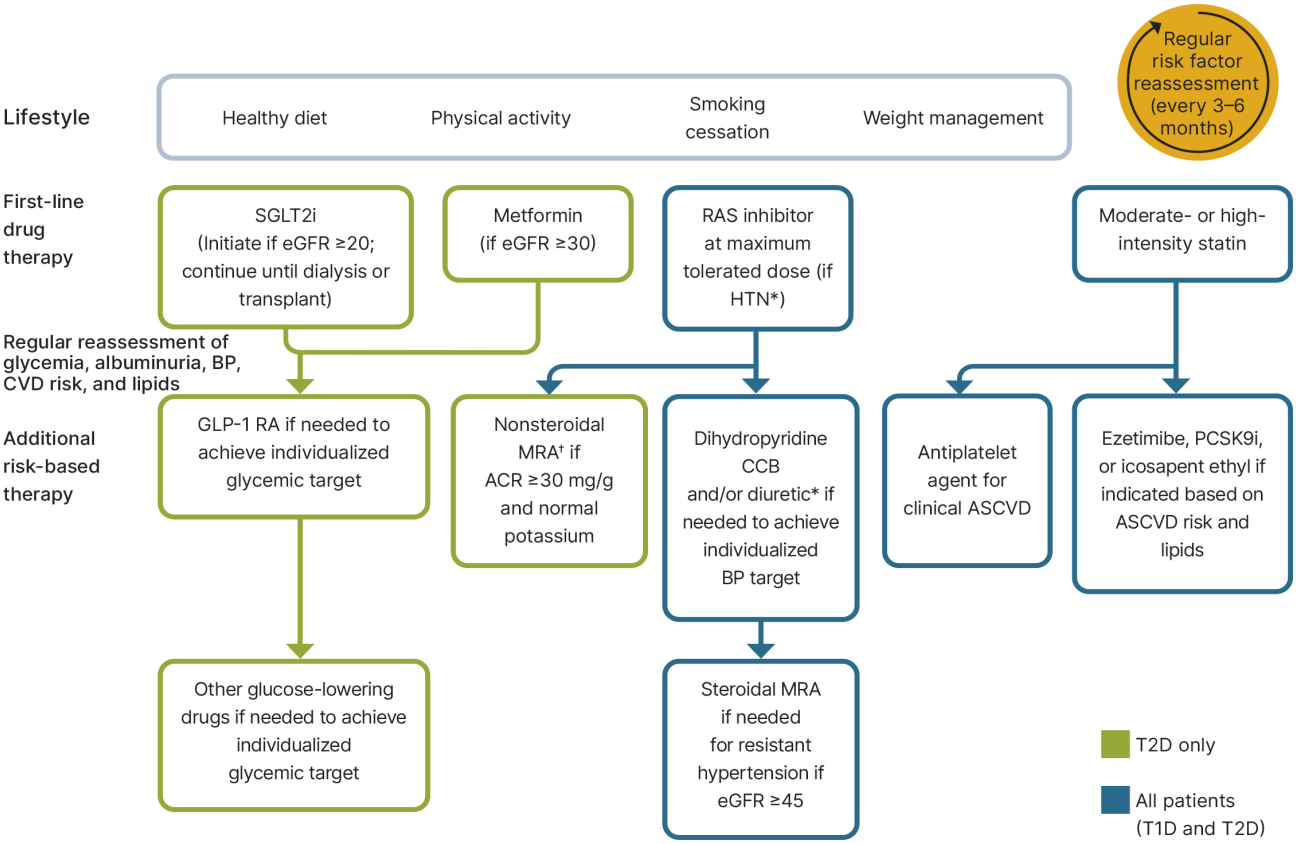
Annually

**Monitoring Established CKD**

**How?** UACR and eGFR. Use the CKD Epidemiology Collaboration's CKD-EPI Refit equation, which eliminates race as a variable, for all individuals.

**How often?** One to four times per year, depending on the stage of the disease

## Holistic Approach to Improving Outcomes in People With Diabetes and CKD




**ACEi or ARB (at maximal tolerated doses) should be first-line therapy for hypertension when albuminuria is present. Otherwise, dihydropyridine CCB or diuretic can also be considered; all three classes are often needed to attain BP targets. †Finerenone is currently the only nonsteroidal MRA with proven clinical kidney and cardiovascular benefits.*

### Clinical Tips

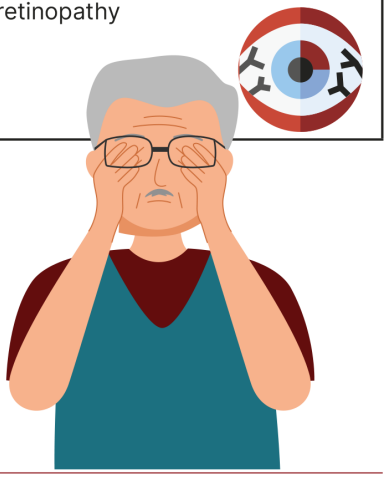
- Periodically check serum creatinine and potassium levels when ACE inhibitor, angiotensin receptor blocker (ARB), or nonsteroidal mineralcorticoid receptor antagonist is used.
- Do not discontinue ACE inhibitor or ARB therapy for increases ≤30% increases in serum creatinine in the absence of volume depletion.
- Aim for a urinary albumin reduction ≥30% in people with CKD and urinary albumin ≥300 mg/g to slow CKD progression.

## *Diabetic Retinopathy (DR)*

### Screening

| How? | When? | Follow-Up Eye Exam Schedule |
|---|---|---|
| Dilated comprehensive eye exam<br>Retinal photography* | For people with type 1 diabetes: within 5 years after the onset of diabetes<br>For people with type 2 diabetes: at the time of diabetes diagnosis | • At least annually for people with any level of retinopathy<br>• Every 1–2 years for those with no retinopathy for one or more annual exams and well-managed glycemia<br>• More frequently for those with progressing or sight-threatening retinopathy |

*Retinal photography with remote reading or use of an authorized artificial intelligence tool can expand access to screening where qualified eye care professionals are not available. When abnormalities are detected, in-person exams will be needed.



**Treatment**

Promptly refer to an ophthalmologist who is knowledgeable and experienced in managing DR any individuals with:

- Any level of diabetic macular edema
- Moderate or worse nonproliferative DR (a precursor of proliferative DR)
- Any proliferative DR

## *Neuropathy*

### Screening

All people with diabetes should be assessed for **diabetic peripheral neuropathy (DPN); (hotness, numbness, and burning sensation in stocking and glove distribution)**:

- Starting at the diagnosis of type 2 diabetes
- 5 years after the diagnosis of type 1 diabetes
- At least annually thereafter


Symptoms and signs of **autonomic neuropathy**; **(sexual dysfunction, gastroparesis, bladder dysfunction, orthostatic hypotension)** should be assessed:

- Starting at the diagnosis of type 2 diabetes
- 5 years after the diagnosis of type 1 diabetes
- At least annually thereafter

- With evidence of other microvascular complications, particularly kidney disease and DPN

Treatment

- Various drugs may reduce pain from DPN, and both drug and non-drug strategies may ease symptoms of DPN and autonomic neuropathy.
- The safest and most evidence-based pharmacologic options for DPN include gabapentinoids, serotonin- norepinephrine reuptake inhibitors, tricyclic antidepressants, and sodium channel blockers.
- Consider b12 deficiency if the patient is on metformin as a cause of DPN.
- Refer to a neurologist or pain specialist when pain control is not achieved within the scope of practice of the treating clinician.

***Foot Care***

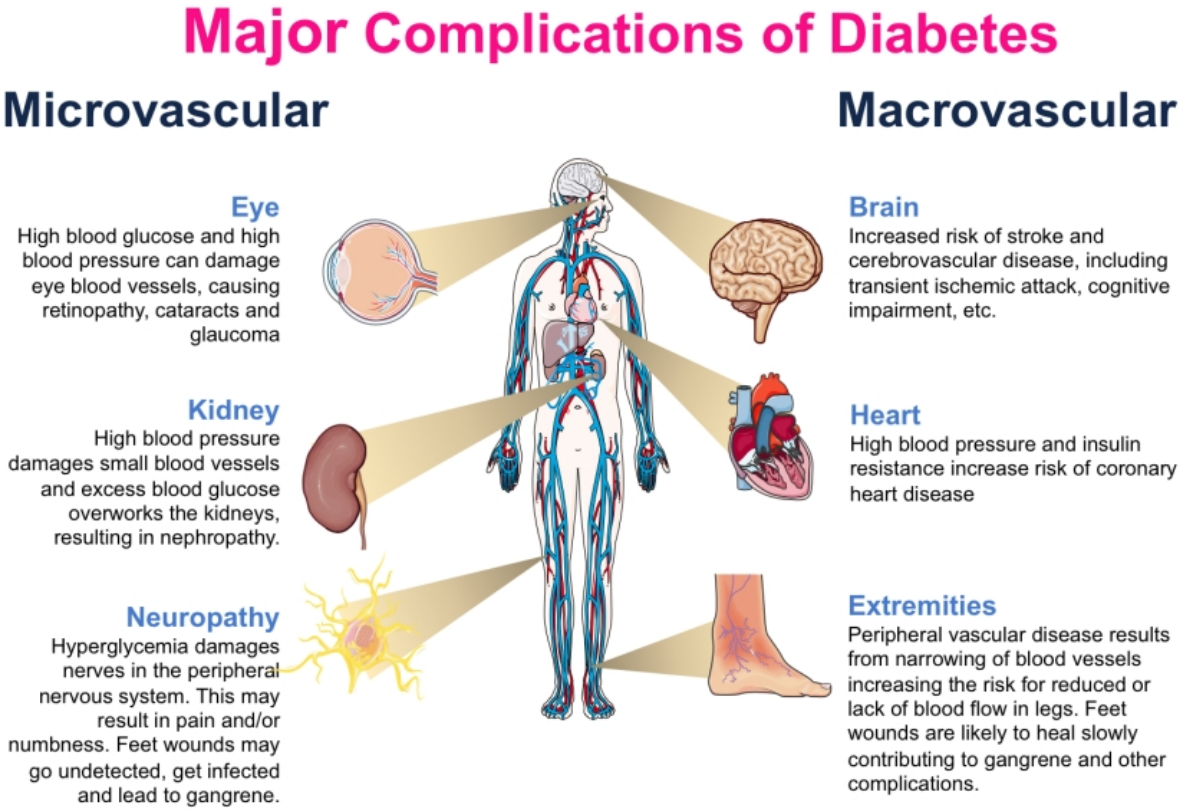
Initial treatment recommendations should include:

- Daily foot inspection
- Use of moisturizers for dry, scaly skin and avoidance of self-care of ingrown nails and calluses
- Well-fitted athletic or walking shoes with customized pressure-relieving orthoses for people with increased plantar pressures (e.g., with plantar calluses).

Risk Stratification and Screening Frequency

| Category | Ulcer Risk | Characteristics | Examination Frequency |
|---|---|---|---|
| 0 | Very low | No LOPS and no PAD | Annually |
| 1 | Low | LOPS or PAD | Every 6–12 months |
| 2 | Moderate | LOPS + PAD, or LOPS/PAD + foot deformity | Every 3–6 months |
| 3 | High | LOPS or PAD and one or more of the following:<br>• History of foot ulcer<br>• Amputation (minor or major)<br>• End-stage renal disease | Every 1–3 months |

LOPS, loss of protective sensation. PAD, peripheral artery disease




## References

1. ADA guidelines 2024

2. Dynamed.com