# Diabetes Mellitus

**AGS Geriatrics Evaluation and Management Tools (Geriatrics E&M Tools)** support clinicians and systems that are caring for older adults with common geriatric conditions.

## Test (confirm with repeat testing)

<table>
<thead>
<tr>
<th>Test</th>
<th>Diabetes mellitus (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>≥6.5%</td>
</tr>
<tr>
<td>Random plasma glucose concentration</td>
<td>≥200 mg/dL (11.1 mmol/L) plus symptoms (polyuria, polydipsia, weight loss)</td>
</tr>
<tr>
<td>Fasting plasma glucose concentration (8-hour fast)</td>
<td>≥126 mg/dL (7 mmol/L)</td>
</tr>
<tr>
<td>Plasma glucose concentration 2 hours after ingestion of 75 mg of glucose in 300 mL of water administered after overnight fast</td>
<td>≥200 mg/dL (11.1 mmol/L)</td>
</tr>
</tbody>
</table>

## Prevention
- Lifestyle changes (diet, exercise, weight loss) can delay/prevent DM in those with impaired glucose tolerance more effectively than metformin, valsartan, and acarbose

## History of Present Illness
- Symptoms of DM (polyuria, polydipsia, weight loss)
- Symptoms of hypoglycemia if on medication therapy

## Past Medical History/Review of Symptoms
Inquire about medical problems that are common in older adults with DM:
- Medical eye disease (eg, retinopathy)
- Cerebrovascular disease
- Coronary artery disease
- Chronic kidney disease
- Urinary incontinence
- Peripheral vascular disease
- Neuropathy and foot problems
- Falls
- Functional impairment
- Pain
- Depression
- Cognitive impairment

## Social History
Ask about alcohol and tobacco use, ability to afford medications, and social support for medication management if needed.

## Physical Examination
Perform comprehensive geriatric examination (may be done over several visits).
- Blood pressure at each visit
- BMI
- Ophthalmologist evaluation at diagnosis and yearly if retinopathy or every 2 years if not.
- Annual foot examination, including inspection, monofilament testing at 4 plantar sites plus any one of tuning fork, pinprick sensation, ankle reflexes, or vibration threshold; insensate feet should be inspected every 3–6 months. Refer those with sensory and structural abnormalities to foot care specialists.
- Check pedal pulses to assess for peripheral vascular disease.

## Medications
Medications such as diuretics, sympathomimetics, glucocorticoids, antipsychotics, and niacin can increase glucose concentrations.

## Nonpharmacologic Management
- Smoking cessation: Reduces mortality more than blood pressure or lipid control.
- Nutrition changes: Diet plus exercise are more effective than diet alone.
  - Decrease carbohydrates and total and saturated fat.
  - Limit alcohol to <1 drink/day in women, <2 drinks/day in men.
  - High-fiber diet (25 g insoluble and 25 g soluble/day).
  - Limit protein intake to ≤0.8 g/kg/day if any chronic kidney disease.
- Weight loss
  - Target 7% weight loss if overweight or obese.
  - Consider bariatric surgery for healthier older adults with uncontrolled DM type 2 and BMI >35 kg/m².
- Physical activity
  - ≥150 min/week of moderate activity (walking); resistance training 3x/week if no contraindication.
- Education
  - Yearly management training (by DM educator) covered under Medicare Part B.
**Management of Comorbid Conditions**

- Blood pressure: Gradual titration to prevent adverse reaction to therapy.
- If orthostatic hypotension develops, blood pressure target may need to be relaxed.
- Begin with ACE inhibitor or angiotensin II receptor blocker (ARB).
- If patient is black, calcium channel blocker or diuretic is preferred as initial treatment.
- Albuminuria: Measure albumin:Cr ratio at diagnosis and annually.
- No need to continue screening for albuminuria if taking an ACE inhibitor or angiotensin II receptor blocker.
- CV protection: Aspirin 75–162 mg/d if heart disease; if allergic, clopidogrel 75 mg/d.
- Unclear if aspirin should be used for primary prevention of CV disease in DM.
- Consider if 10-year CV risk >10% (http://hp2010.nhlbihin.net/atpiii/calculator).
- Vaccinations: Recommend influenza and pneumococcal; consider hepatitis B vaccination.
- Lipids: Conflicting data whether hyperlipidemia primary prevention decreases cardiovascular (CV) events in patients with diabetes.

### 2013 ACC/AHA Indications for Statin Treatment to Reduce CV Risk:

<table>
<thead>
<tr>
<th>Age</th>
<th>Risk factors</th>
<th>Statin Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-75</td>
<td>CVD* or LDL ≥ 190 mg/dL</td>
<td>High intensity statin</td>
</tr>
<tr>
<td>40-75</td>
<td>Diabetes AND LDL 70-189 AND 10-year CV risk ≥7.5%**</td>
<td>High intensity statin</td>
</tr>
<tr>
<td>40-75</td>
<td>Diabetes AND LDL 70-189 AND 10-year CV risk &lt;7.5%**</td>
<td>Moderate intensity statin</td>
</tr>
<tr>
<td>&gt;75</td>
<td>CVD*</td>
<td>Moderate intensity statin</td>
</tr>
<tr>
<td>&gt;75</td>
<td>Diabetes but no CVD*</td>
<td>There are no data for those without CVD*. Continuation of statins beyond age 75 may be warranted. It is unclear whether starting statins for primary prevention is beneficial for those over 75. Consider potential risk/benefit of primary prevention based on individual CVD*, risk, comorbidities, and goals of care.</td>
</tr>
</tbody>
</table>

*CVD (prior MI, angina, ACS, coronary revascularization, stroke, TIA, or PAD)

**Risk calculator at my.americanheart.org/cvriskcalculator. Some experts are concerned that the risk calculator designates many more older adults as being eligible for primary prevention with statin treatment than previous guidelines. For example the calculator assesses a 10 year CVD* risk of ≥7.5% in all men 63–75 and all women 71–75 years old with optimal values for other risk factors.

### Treatment Goals

- Goals of DM management should be individualized according to:
  - Patient goals and preferences
  - Functional status
  - Patient health and expected prognosis
  - Quality of life
  - Evaluation and treatment of DM complications
  - Control of hyperglycemia and its symptoms
  - Avoiding hypoglycemia.
- Glycemic control: If HbA₁c not at goal in 6 months with diet/exercise, consider medication.
  - Monitor blood glucose 3 x day if multiple daily insulin injections or insulin pump; may be unnecessary with medications that do not cause hypoglycemia.
  - Check HbA₁c every 6 months with stable glycemic control; quarterly if poor control.

### Goals of Treatment for Older Adults with Diabetes Mellitus

<table>
<thead>
<tr>
<th>Patient Health</th>
<th>HbA₁c Goal</th>
<th>FPG or PPG (mg/dL)</th>
<th>Bedtime Glucose (mg/dL)</th>
<th>Blood Pressure Goal (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>7%–7.5%</td>
<td>90–130</td>
<td>90–150</td>
<td>&lt;140/80</td>
</tr>
<tr>
<td>Complex/intermediate</td>
<td>7.5%–8.5%</td>
<td>90–150</td>
<td>100–180</td>
<td>&lt;140/80</td>
</tr>
<tr>
<td>Very complex/poor health</td>
<td>8.5%–9%</td>
<td>100–180</td>
<td>110–200</td>
<td>&lt;150/90</td>
</tr>
</tbody>
</table>

FPG=fasting plasma glucose, PPG=postprandial glucose

*a ≥3 comorbid chronic illnesses, ≥2 IADL impairments, or mild-to-moderate cognitive impairment

*b Long-term care, end-stage chronic illness, moderate-to-severe cognitive impairment, or ≥2 ADL dependencies
<table>
<thead>
<tr>
<th>Oral Agents</th>
<th>Comments/Adverse Effects</th>
</tr>
</thead>
</table>
| **Biguanide (K)**     | Decreases hepatic glucose production.  
| Metformin* (first choice) | 1%–2% HbA₁c reduction.  
|                       | Does not cause hypoglycemia, may cause weight loss.  
|                       | Avoid if eGFR <30 mL/1.73 m², heart failure, COPD, ↑ liver function tests.  
|                       | Hold before contrast radiologic studies.  
|                       | Start 500 mg q12h or q24h; may titrate q5–7d to max 2,550 mg/d divided (long-acting: max 2,000 mg/d).                                                                                                                   |
| **Second-Generation Sulfonylureas** | Increases insulin secretion.  
| Glipizide* (L, K) | 1%–2% HbA₁c reduction.  
|                       | Can cause hypoglycemia and weight gain.  
|                       | Glipizide 2.5–40 mg q12–24h (max dose = 40 mg/d)  
|                       | Other sulfonylureas: glimepiride has numerous drug interactions and is long acting; glyburide not recommended in older adults because of hypoglycemia risk.                                                                                       |
| **α-Glucosidase Inhibitor** | Delays glucose absorption.  
| Acarbose (gut, K) | Can cause hypoglycemia and weight gain.  
| Miglitol (L, K) | GI adverse events common.  
|                       | Avoid if Cr >2 mg/dL.  
|                       | Acarbose: start with 25 mg tid; max 50–100 mg tid.  
|                       | Monitor liver enzymes.  
|                       | Take with first bite of meal.  
|                       | Miglitol: start with 25 mg tid; max 25–100 mg tid.                                                                                                                                  |
| **DPP-4 Enzyme Inhibitors** | Protect and enhance incretin hormones.  
| Alogliptin (K) | Do not cause hypoglycemia; weight neutral.  
| Saxagliptin (K) | Alogliptin: 25 mg; 12.5 mg if CrCl 30–59 mL/min; 6.25 mg if CrCl 15–29 mL/min  
| Sitagliptin (K) | Saxagliptin 5 mg; 2.5 mg if CrCl <50 mL/min  
| Linagliptin (L) | Sitagliptin: 100 mg; 50 mg/d if CrCl <31–50 mL/min; 25 mg/d if CrCl <30 mL/min  
|                       | Linagliptin: 5 mg, no dose adjustment for renal or liver impairment                                                                                                          |
| **Meglitinides**      | Increases insulin secretion.  
| Nateglinide(K, L) | 1%–2% HbA₁c reduction.  
| Repaglinide (L) | Nateglinide: 60–120 mg tid with meals.  
|                       | Can cause hypoglycemia and weight gain.  
|                       | Regaglinide: 0.5–4 mg tid with meals. Adjust dose weekly, potential for drug interactions, caution in renal or hepatic insufficiency. Avoid if CrCl <20 mL/min.                                                                            |
| **Thiazolidinediones** | Insulin resistance reduction.  
| Pioglitazone (L, K) | 0.5%–1.5% HbA₁c reduction.  
| Rosiglitazone (L, K) | Risk of CHF, avoid if NYHA Class III or IV. Stop if decline in cardiac status.  
|                       | Pioglitazone: 15–45 mg/d. Max dose 30 mg/d if used in combination therapy.  
|                       | Can cause weight gain; may increase fracture risk in women.  
|                       | Rosiglitazone: 4–8 mg/d.  
|                       | Check liver function tests at start, every 2 months during first year, then periodically.  
|                       | Avoid if clinical evidence of liver disease or if serum ALT levels >2.5 times upper limit of normal.                                                                                                                   |
| **SGLT2 Inhibitors** | Decreases glucose reabsorption from kidney.  
| Canagliflozin (L) | 0.5%–1.5% HbA₁c reduction.  
| Dapagliflozin (L) | Risk of urinary tract infections and ketoacidosis (can occur with blood glucose levels lower than those typically seen with diabetic ketoacidosis). Possible risk of dehydration, increased cholesterol, and yeast infections.  
| Empagliflozin (L) | Canagliflozin: 100 mg/d, avoid if CrCl ≤45 mL/min.  
|                       | Dapagliflozin: 5–10 mg/d, avoid if CrCl <60 mL/min.  
|                       | Empagliflozin: 10–25 mg/d, avoid if CrCl <45 mL/min.                                                                                                                  |
## Injectable Agents

<table>
<thead>
<tr>
<th>Injectable Agents</th>
<th>Comments/Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albiglutide (L)</td>
<td>Glucagon-like peptide-1 receptor agonists.</td>
</tr>
<tr>
<td>Dulaglutide (L)</td>
<td>0.7%–1% HbA1c reduction</td>
</tr>
<tr>
<td>Exenatide* (K)</td>
<td>Hypoglycemia common if used with sulfonylurea or insulin; less likely to cause hypoglycemia than insulin or sulfonylurea. Can cause weight loss. Avoid if CrCl &lt;30 mL/min. Risk of acute pancreatitis and possibly medullary thyroid cancer.</td>
</tr>
<tr>
<td>Liraglutide (L)</td>
<td>0.6–1.8 mg SC once daily</td>
</tr>
<tr>
<td>Pramlintide (K)</td>
<td>Amylin analogue. 0.4%–0.7% HbA1c reduction</td>
</tr>
</tbody>
</table>

Nausea common; reduce pre-meal dose of short-acting insulin by 50%. Type 1 DM: 15 mcg before each major meal; may increase to 30–60 mcg. Type 2 DM: 60 mcg before each major meal; may increase to 120 mcg.

(K) = renal elimination; (L) = hepatic elimination * Available as short- or long-acting forms

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## Basal insulin (intermediate at bedtime or long-acting at bedtime or morning).
- Stop sulfonylureas and meglinitides when starting insulin.
- Start with 10 units (U) or 0.2 U/kg, can increase by 2–4 U every 3 days depending on fasting blood glucose (FBG).
- When FBG at goal, recheck HbA1c in 2–3 months. If above target HbA1c, add rapid or intermediate-acting insulin.
- If hypoglycemia or FBG <70 mg/dL, reduce dose by 4 U or 10%, whichever is greater.
- Do not use sliding scale insulin chronically as a solo insulin therapy in long-term care.

### Insulin Preparations

<table>
<thead>
<tr>
<th>Insulin Preparations</th>
<th>Onset (hours)</th>
<th>Peak (hours)</th>
<th>Duration (hours)</th>
<th>Doses/day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid-acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin glulisine (Apidra)</td>
<td>20 min</td>
<td>0.5–1.5</td>
<td>3–4</td>
<td>3</td>
</tr>
<tr>
<td>Insulin lispro (Humalog)</td>
<td>15 min</td>
<td>0.5–1.5</td>
<td>3–4</td>
<td>3</td>
</tr>
<tr>
<td>Insulin aspart (NovoLog)</td>
<td>30 min</td>
<td>1–3</td>
<td>3–5</td>
<td>3</td>
</tr>
<tr>
<td>Inhaled (Afrezza)</td>
<td>15 min</td>
<td>1</td>
<td>3–4</td>
<td>3</td>
</tr>
<tr>
<td>Regular (eg, Humulin, Novolin)</td>
<td>0.5–1 h</td>
<td>2–3</td>
<td>5–8</td>
<td>1–3</td>
</tr>
<tr>
<td><strong>Intermediate or long-acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPH (neutral protamine hagedorn) insulin (eg, Humulin N, Novolin N)</td>
<td>1–1.5 h</td>
<td>4–12</td>
<td>24</td>
<td>1–2</td>
</tr>
<tr>
<td>Insulin detemir (Levemir)</td>
<td>3–4 h</td>
<td>6–8</td>
<td>6–24 (dose dependent)</td>
<td>1–2</td>
</tr>
<tr>
<td>Insulin glargine* (Lantus)*</td>
<td>2–4 h</td>
<td>—</td>
<td>24</td>
<td>1</td>
</tr>
</tbody>
</table>

### Combinations

- Isophane insulin and regular insulin, premixed (Novolin 70/30)
- Insulin lispro protamine and insulin lispro (Humalog Mix 50/50; 75/25)

*a To convert from NPH dosing, give same number of units once a day. For patients taking NPH q12h, decrease the total daily units by 20% and titrate on basis of response.

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## CHOOSING WISELY

- Avoid using medications other than metformin to achieve hemoglobin A1c <7.5% in most older adults; moderate control is generally better.