MANAGING DIABETES IN THE ELDERLY

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Diabetes in the elderly...
Objectives - Participants will gain:

- A greater appreciation the geriatric population has impacting healthcare, relative to the entire population.
- A greater knowledge of the discrepancy that exists in medical studies regarding the elderly group.
- A review of the current guidelines regarding management of the multiple comorbidities that affect the elderly diabetic population.

Obligatory statistics

- “Elderly”
  - Defined by many as 65 years of age and older
  - The U.S. population of elderly is now the largest it has ever been, in terms of size and percent of the population, compared with any previous census

According to the 2010 Census, there were 40.3 million people 65 and older in 2010 - an increase of 5.3 million - since the 2000 Census when this population numbered 35.0 million.

(Total US population: in 2010 – 308,745,538)
Population of 65+

People age 65 and older now make up 13% of the total population, compared with 12.4% in 2000 and 4.1% in 1900.
In 2008, the U.S. Census Bureau projected future censuses as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Projection</th>
<th>Actual Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>310,232,863</td>
<td>308,745,538</td>
</tr>
<tr>
<td>2020</td>
<td>333,896,000</td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>358,471,000</td>
<td></td>
</tr>
<tr>
<td>2040</td>
<td>380,016,000</td>
<td></td>
</tr>
<tr>
<td>2050</td>
<td>399,803,000</td>
<td></td>
</tr>
</tbody>
</table>
65 and Older Population Grew Faster than Total Population

- Between 2000 and 2010, the population 65 and older grew 15.1%, while the total U.S. population grew only 9.7%.

The opposite happened between 1990 - 2000 when the growth of the older population was slower than the growth of the total population with growth rates of 12% and 13.2 %, respectively.

Other highlights

- In the 2010 Census, there were 53,364 centenarians, an increase of 5.8% since 2000.

- The number of people 65 and older more than doubled in 21 counties in the United States.

- Approximately 1.3 million people 65 and older - or 3.1% of this population - lived in skilled-nursing facilities in 2010.
Of U.S. adults aged 65 and older, 25% have diabetes, a number expected to grow rapidly in the coming decades.

This population accounts for 40% of all those with type 2 diabetes.
Diabetes in older people: new insights and remaining challenges
- The Lancet
- Nov 2014

A population at risk

Compared to those without, older individuals with diabetes have higher rates of:

- Functional disability
- Coexisting illnesses such as:
  - HTN
  - CAD
  - Stroke
  - Premature death
A population at risk

Compared to those without, older individuals with diabetes have greater risk of:

- Polypharmacy
- Cognitive impairment
- Urinary incontinence
- Injurious falls
- Persistent pain

Common Comorbidities Associated With Diabetes

Assess & address comorbidities that may complicate diabetes management:

- Cancers: liver, pancreas, bladder, endometrium, breast, colon*
- Cognitive impairment
- Depression
- Dyslipidemia
- Fatty liver disease
- Fractures
- Hearing impairment
- Heart failure
- Hypertension
- Low testosterone (men)
- Obesity
- Obstructive sleep apnea
- Periodontal disease

*Possibly only associated with type 2 diabetes

How do we manage this complicated disease in this challenging population?

American Association of Clinical Endocrinologists and American College of Endocrinology Clinical Practice Guidelines for Developing a Diabetes Mellitus Comprehensive Care Plan

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This Guideline

• An update of the 2011 American Association of Clinical Endocrinologists (AACE) and Medical Guidelines for Clinical Practice for Developing a Diabetes Mellitus Comprehensive Care Plan.

• Mandate for this Clinical Practice Guideline is to provide a practical guide for comprehensive care that incorporates an integrated consideration of micro- and macrovascular risk (including cardiovascular risk factors such as lipids, HTN, and coagulation) rather than an isolated approach focusing merely on glycemic control.
This Guideline

- Clinical practice guideline (CPG), created under strict adherence with AACE Protocol, with over 670 cited resources.

AACE DM CPG Objectives and Structure

- This CPG aims to provide the following:
  - An evidence-based education resource for the development of a diabetes comprehensive care plan
  - Easy-to-follow structure
    - 24 diabetes management questions
    - 67 practical recommendations
  - Concise, practical format that complements existing DM textbooks
# AACE DM CPG - Evidence Ratings and Grades

<table>
<thead>
<tr>
<th>Evidence level</th>
<th>Evidence grade</th>
<th>Semantic descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Meta-analysis of randomized controlled trials (MRCT)</td>
</tr>
<tr>
<td>1</td>
<td>A</td>
<td>Randomized controlled trials (RCT)</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>Meta-analysis of nonrandomized prospective or case-controlled trials (MNRCT)</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>Nonrandomized controlled trial (NRCT)</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>Prospective cohort study (PCS)</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>Retrospective case-control study (RCCS)</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Cross-sectional study (CSS)</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Surveillance study (registries, surveys, epidemiologic study, retrospective chart review, mathematical modeling of database) (SS)</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Consecutive case series (CCS)</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Single case reports (SCR)</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>No evidence (theory, opinion, consensus, review, or preclinical study) (NE)</td>
</tr>
</tbody>
</table>

# AACE DM CPG Questions

1. How is diabetes screened and diagnosed?
2. How is prediabetes managed?
3. What are glycemic treatment goals of DM?
4. How are glycemic targets achieved for T2D?
5. How should glycemia in T1D be managed?
6. How is hypoglycemia managed?
7. How is hypertension managed in patients with diabetes?
8. How is dyslipidemia managed in patients with diabetes?
9. How is nephropathy managed in patients with diabetes?
10. How is retinopathy managed in patients with diabetes?
11. How is neuropathy diagnosed and managed in patients with diabetes?
12. How is CVD managed in patients with diabetes?
13. How is obesity managed in patients with diabetes?
AACE DM CPG Questions

14. What is the role of sleep medicine in the care of the patient with diabetes?
15. How is diabetes managed in the hospital?
16. How is a comprehensive diabetes care plan established in children and adolescents?
17. How should diabetes in pregnancy be managed?
18. When and how should glucose monitoring be used?
19. When and how should insulin pump therapy be used?

20. What is the imperative for education and team approach in DM management?
21. What vaccinations should be given to patients with diabetes?
22. How should depression be managed in the context of diabetes?
23. What is the association between diabetes and cancer?
24. Which occupations have specific diabetes management requirements?

Criteria for Screening for T2D and Prediabetes in Asymptomatic Adults

- Age ≥45 years without other risk factors
- Family history of T2D
- CVD
- Overweight
  - BMI ≥30 kg/m²
  - BMI 25-29.9 kg/m² 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
  - IGT, IFG, and/or metabolic syndrome
  - 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 disorders¹ 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

1 At-risk BMI may be lower in some ethnic groups; consider using waist circumference.
2 Obstructive sleep apnea, chronic sleep deprivation, and night shift occupations.

BMI = body mass index; BP = blood pressure; CVD = cardiovascular disease; HDL-C = high density lipoprotein cholesterol; IFG = impaired fasting glucose; IGT = impaired glucose tolerance; NAFLD = nonalcoholic fatty liver disease; PCOS = polycystic ovary syndrome; T2D = type 2 diabetes.
Q1. How is diabetes screened and diagnosed?

Diagnostic Criteria for Prediabetes and Diabetes in Nonpregnant Adults

<table>
<thead>
<tr>
<th>Normal</th>
<th>High Risk for Diabetes</th>
<th>Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPG &lt;100 mg/dL</td>
<td>IFG</td>
<td>FPG ≥126 mg/dL</td>
</tr>
<tr>
<td>2-h PG &lt;140 mg/dL</td>
<td>IGT</td>
<td>2-h PG ≥200 mg/dL</td>
</tr>
<tr>
<td>A1C &lt;5.5%</td>
<td>5.5 to 6.4%</td>
<td>≥6.5%</td>
</tr>
</tbody>
</table>

For screening of prediabetes

*Polydipsia (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.

Q1. How is diabetes screened and diagnosed?

AACE Recommendations for A1C Testing

- A1C should be considered an additional optional diagnostic criterion, not the primary criterion for diagnosis of diabetes
- When feasible, AACE/ACE suggest using traditional glucose criteria for diagnosis of diabetes
- A1C is not recommended for diagnosing type 1 diabetes
- A1C is not recommended for diagnosing gestational diabetes

AACE Recommendations for A1C Testing

- A1C levels may be misleading in several ethnic populations (for example, African Americans)
- A1C may be misleading in some clinical settings:
  - Hemoglobinopathies
  - Iron deficiency
  - Hemolytic anemias
  - Thalassemias
  - Spherocytosis
  - Severe hepatic or renal disease
- AACE/ACE endorse the use of only standardized, validated assays for A1C testing

Q1. How is diabetes screened and diagnosed?

Q2. How is prediabetes managed?

T2D Incidence in the DPP

*Goal: 7% reduction in baseline body weight through low-calorie, low-fat diet and ≥150 min/week moderate intensity exercise.

DPP, Diabetes Prevention Program; IGT, impaired glucose tolerance; T2D, type 2 diabetes.

Q2. How is prediabetes managed?

Medical and Surgical Interventions Shown to Delay or Prevent T2D

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Follow-up Period</th>
<th>Reduction in Risk of T2D (P value vs placebo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antihyperglycemic agents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metformin1</td>
<td>2.8 years</td>
<td>31% (P&lt;0.001)</td>
</tr>
<tr>
<td>Acarbose2 (glucosidase-I)</td>
<td>3.3 years</td>
<td>25% (P&lt;0.0015)</td>
</tr>
<tr>
<td>Pioglitazone3 (TZD: Actose)</td>
<td>2.4 years</td>
<td>72% (P&lt;0.001)</td>
</tr>
<tr>
<td>Rosiglitazone4 (TZD: Avandia)</td>
<td>3.0 years</td>
<td>60% (P&lt;0.0001)</td>
</tr>
<tr>
<td>Weight loss interventions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orlistat5 (Xenical/alli)</td>
<td>4 years</td>
<td>37% (P=0.0032)</td>
</tr>
<tr>
<td>Phentermine/topiramate6 (Qsymia)</td>
<td>2 years</td>
<td>79% (P&lt;0.05)</td>
</tr>
<tr>
<td>Bariatric surgery7</td>
<td>10 years</td>
<td>75% (P&lt;0.001)</td>
</tr>
</tbody>
</table>

Lifestyle modification should be used with all pharmacologic or surgical interventions.

T2D, type 2 diabetes.

**Q3. What are glycemic treatment goals of DM?**

### Outpatient Glucose Targets for Nonpregnant Adults

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C, %</td>
<td>Individualize on the basis of age, comorbidities, duration of disease, and hypoglycemia risk:</td>
</tr>
<tr>
<td></td>
<td>• In general, ≤6.5 for most*</td>
</tr>
<tr>
<td></td>
<td>• Closer to normal for healthy</td>
</tr>
<tr>
<td></td>
<td>• Less stringent for “less healthy”**</td>
</tr>
<tr>
<td>FPG, mg/dL</td>
<td>&lt;110</td>
</tr>
<tr>
<td>2-Hour PPG, mg/dL</td>
<td>&lt;140</td>
</tr>
</tbody>
</table>

*Provided target can be safely achieved.  
** See following slides.

FPG = fasting plasma glucose; PPG = postprandial glucose.

### Inpatient Glucose Targets for Nonpregnant Adults

<table>
<thead>
<tr>
<th>Hospital Unit</th>
<th>Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intensive/critical care</strong></td>
<td></td>
</tr>
<tr>
<td>Glucose range, mg/dL</td>
<td>140-180*</td>
</tr>
<tr>
<td><strong>General medicine and surgery, non-ICU</strong></td>
<td></td>
</tr>
<tr>
<td>Premeal glucose, mg/dL</td>
<td>&lt;140*</td>
</tr>
<tr>
<td>Random glucose, mg/dL</td>
<td>&lt;180*</td>
</tr>
</tbody>
</table>

*Provided target can be safely achieved.
### Therapeutic Lifestyle Changes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight loss</strong> (for overweight and obese patients)</td>
<td>Reduce by 5% to 10%</td>
</tr>
<tr>
<td><strong>Physical activity</strong></td>
<td>150 min/week of moderate-intensity exercise (eg, brisk walking) plus flexibility and strength training</td>
</tr>
<tr>
<td><strong>Diet</strong></td>
<td>• Eat regular meals and snacks; avoid fasting to lose weight</td>
</tr>
<tr>
<td></td>
<td>• Consume plant-based diet (high in fiber, low calories/glycemic index, and high in phytochemicals/antioxidants)</td>
</tr>
<tr>
<td></td>
<td>• Understand Nutrition Facts Label information</td>
</tr>
<tr>
<td></td>
<td>• Incorporate beliefs and culture into discussions</td>
</tr>
<tr>
<td></td>
<td>• Use mild cooking techniques instead of high-heat cooking</td>
</tr>
<tr>
<td></td>
<td>• Keep physician-patient discussions informal</td>
</tr>
</tbody>
</table>

### Healthful Eating Recommendations

<table>
<thead>
<tr>
<th>Carbohydrate</th>
<th>Specify healthful carbohydrates (fresh fruits and vegetables, legumes, whole grains); target 7-10 servings per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preferentially consume lower-glycemic index foods (glycemic index score &lt;55 out of 100: multigrain bread, pumpernickel bread, whole oats, legumes, apple, lentils, chickpeas, mango, yams, brown rice)</td>
</tr>
<tr>
<td>Fat</td>
<td>Specify healthful fats (low mercury/contaminant-containing nuts, avocado, certain plant oils, fish)</td>
</tr>
<tr>
<td></td>
<td>Limit saturated fats (butter, fatty red meats, tropical plant oils, fast foods) and trans fat; choose fat-free or low-fat dairy products</td>
</tr>
<tr>
<td>Protein</td>
<td>Consume protein in foods with low saturated fats (fish, egg whites, beans); there is no need to avoid animal protein</td>
</tr>
<tr>
<td></td>
<td>Avoid or limit processed meats</td>
</tr>
<tr>
<td>Micronutrients</td>
<td>Routine supplementation is not necessary; a healthful eating meal plan can generally provide sufficient micronutrients</td>
</tr>
<tr>
<td></td>
<td>Chromium; vanadium; magnesium; vitamins A, C, and E; and CoQ10 are not recommended for glycemic control</td>
</tr>
<tr>
<td></td>
<td>Vitamin supplements should be recommended to patients at risk of insufficiency or deficiency</td>
</tr>
</tbody>
</table>
### Noninsulin Agents Available for T2D

<table>
<thead>
<tr>
<th>Class</th>
<th>Primary Mechanism of Action</th>
<th>Agent(s)</th>
<th>Available as</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-Glucosidase inhibitors</td>
<td>• Delay carbohydrate absorption from intestine</td>
<td>Acarbose, Miglitol</td>
<td>Precose or generic Glyset</td>
</tr>
<tr>
<td>Amylin analogue</td>
<td>• Decrease glucagon secretion</td>
<td>Pramlintide</td>
<td>Symlin</td>
</tr>
<tr>
<td></td>
<td>• Slow gastric emptying</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increase satiety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biguanide</td>
<td>• Decrease HGP</td>
<td>Metformin</td>
<td>Glucophage or generic</td>
</tr>
<tr>
<td></td>
<td>• Increase glucose uptake in muscle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bile acid sequestrant</td>
<td>• Decrease HGP?</td>
<td>Colesevelam</td>
<td>WelChol</td>
</tr>
<tr>
<td></td>
<td>• Increase incretin levels?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPP-4 inhibitors</td>
<td>• Increase glucose-dependent insulin secretion</td>
<td>Albiglutide, Dulaglutide, Exenatide, Exenatide XR, Liraglutide</td>
<td>Tarzeum, Trulicity, Byetta, Bydureon, Victoza</td>
</tr>
<tr>
<td></td>
<td>• Decrease glucagon secretion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Slow gastric emptying</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increase satiety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dopamine-2 agonist</td>
<td>• Activates dopaminergic receptors</td>
<td>Bromocriptine</td>
<td>Cycloset</td>
</tr>
<tr>
<td>Glinides</td>
<td>• Increase insulin secretion</td>
<td>Nateglinide, Repaglinide</td>
<td>Starlix or generic Prandin</td>
</tr>
</tbody>
</table>

DPP-4 = dipeptidyl peptidase; HGP = hepatic glucose production.


Continued on next slide

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### Noninsulin Agents Available for T2D

<table>
<thead>
<tr>
<th>Class</th>
<th>Primary Mechanism of Action</th>
<th>Agent(s)</th>
<th>Available as</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLP-1 receptor agonists</td>
<td>• Increase glucose-dependent insulin secretion</td>
<td>Albilglutide, Dalaglutide, Exenatide, Exenatide XR, Liraglutide</td>
<td>Tarzeum, Trulicity, Byetta, Bydureon, Victoza</td>
</tr>
<tr>
<td></td>
<td>• Decrease glucagon secretion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Slow gastric emptying</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Increase satiety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGLT2 inhibitors</td>
<td>• Increase urinary excretion of glucose</td>
<td>Canagliflozin, Dapagliflozin, Empagliflozin</td>
<td>Invokana, Farxiga, Jardiance</td>
</tr>
<tr>
<td>Sulfonylureas</td>
<td>• Increase insulin secretion</td>
<td>Glimepiride, Glibizide, Glyburide</td>
<td>Amaryl or generic Glucotrol or generic, Diajetta, Glynase, Micronase, or generic</td>
</tr>
<tr>
<td>Thiazolidinediones</td>
<td>• Increase glucose uptake in muscle and fat</td>
<td>Pioglitazone, Rosiglitazone</td>
<td>Actos, Avandia</td>
</tr>
</tbody>
</table>

GLP-1 = glucagon-like peptide; HGP = hepatic glucose production; SGLT2 = sodium glucose cotransporter 2.


Continued from previous slide
**Q4. How are glycemic targets achieved for T2D?**

### Effects of Agents Available for T2D

<table>
<thead>
<tr>
<th>Metformin</th>
<th>Byetta, Bydureon</th>
<th>Invokana</th>
<th>Januvia</th>
<th>Trajenta</th>
<th>Actos glitazones</th>
<th>acarbose</th>
<th>Welcheol</th>
<th>Cycloset bromocriptine</th>
<th>GLP1RA</th>
<th>SU/Glinide</th>
<th>Insulin</th>
<th>Pramlinide synthins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met</td>
<td>GLP1RA</td>
<td>SGLT2I</td>
<td>DPP4i</td>
<td>TZD</td>
<td>AGI</td>
<td>Coles</td>
<td>BCR-QR</td>
<td>SU/Glinide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FPG lowering</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mod</td>
<td>Mild to mod*</td>
<td>Mod</td>
<td>Mild</td>
<td>Neutral</td>
<td>Mild</td>
<td>Neutral</td>
<td>SU/mod Glinide/mild</td>
<td>Mod to marked (basal insulin or premixed)</td>
<td>Mild</td>
<td></td>
<td></td>
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<tr>
<td><strong>PPG lowering</strong></td>
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<tr>
<td>Mild</td>
<td>Mod to marked</td>
<td>Mild</td>
<td>Mod</td>
<td>Mild</td>
<td>Mild</td>
<td>Mod</td>
<td>Mod to marked (short/rapid-acting insulin or premixed)</td>
<td>Mod to marked</td>
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</tr>
</tbody>
</table>

AGI = α-glucosidase inhibitors; BCR-QR = bromocriptine quick release; Coles = colesevelam; DPP4i = dipeptidyl peptidase 4 inhibitors; FPG = fasting plasma glucose; GLP1RA = glucagon-like peptide 1 receptor agonists; Met = metformin; PPG = postprandial glucose; SGLT2I = sodium-glucose cotransporter 2 inhibitors; SU = sulfonylureas; TZD = thiazolidinediones.

*Mild: albiglutide and exenatide; moderate: dulaglutide, exenatide extended release, and liraglutide.

Continued from previous slide

<table>
<thead>
<tr>
<th>Metformin</th>
<th>Byetta, Bydureon</th>
<th>Invokana</th>
<th>Januvia</th>
<th>Trajenta</th>
<th>Actos glitazones</th>
<th>acarbose</th>
<th>Welcheol</th>
<th>Cycloset bromocriptine</th>
<th>GLP1RA</th>
<th>SU/Glinide</th>
<th>Insulin</th>
<th>Pramlinide synthins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met</td>
<td>GLP1RA</td>
<td>SGLT2I</td>
<td>DPP4i</td>
<td>TZD</td>
<td>AGI</td>
<td>Coles</td>
<td>BCR-QR</td>
<td>SU/Glinide</td>
<td></td>
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<tr>
<td><strong>NAFLD benefit</strong></td>
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<tr>
<td>Mild</td>
<td>Mild</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Mod*</td>
<td>Neutral</td>
<td>Neutral</td>
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<td>Neutral</td>
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<tr>
<td><strong>Hypoglycemia</strong></td>
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<tr>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>SU/mod Glinide/mild to mod</td>
<td>Mod to severe*</td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slight loss</td>
<td>Loss</td>
<td>Loss</td>
<td>Neutral</td>
<td>Gain</td>
<td>Neutral</td>
<td>Gain</td>
<td>Gain</td>
<td>Loss</td>
<td></td>
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</tr>
</tbody>
</table>

AGI = α-glucosidase inhibitors; BCR-QR = bromocriptine quick release; Coles = colesevelam; DPP4i = dipeptidyl peptidase 4 inhibitors; GLP1RA = glucagon-like peptide 1 receptor agonists; Met = metformin; Mod = moderate; NAFLD, nonalcoholic fatty liver disease; SGLT2I = sodium-glucose cotransporter 2 inhibitors; SU = sulfonylureas; TZD = thiazolidinediones.

*Especially with short / rapid-acting or premixed.

Continued on next slide

#Especially with short / rapid-acting or premixed.
## Q4. How are glycemic targets achieved for T2D?

### Effects of Agents Available for T2D

<table>
<thead>
<tr>
<th>Metformin</th>
<th>Byetta, Bydureon</th>
<th>Invokana, Forxiga</th>
<th>Januvia, Trajenta</th>
<th>Actos, glitazones</th>
<th>acarbose</th>
<th>Weiethol</th>
<th>Cycloact- bromocresiptine</th>
<th>GLP1RA</th>
<th>SGLT2I</th>
<th>DPP4I</th>
<th>TZD</th>
<th>AGI</th>
<th>Coles</th>
<th>BCR-QR</th>
<th>SU/ Glinide</th>
<th>Insulin</th>
<th>Pramlintide, symlin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal impairment/ GU</td>
<td>Contra-indicated in stage 3B, 4, 5 CKD</td>
<td>Exenatide contra-indicated CCr = &lt;30 mg/mL</td>
<td>GU infection risk</td>
<td>Dose adjustment (except linaclotide)</td>
<td>May worsen fluid retention</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Increased hypoglycemia risk</td>
<td>Increased risk of hypoglycemia and fluid retention</td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GI adverse effects</td>
<td>Mod</td>
<td>Mod*</td>
<td>Neutral</td>
<td>Neutral*</td>
<td>Neutral</td>
<td>Mod*</td>
<td>Mild</td>
<td>Mod*</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Mod</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CHF</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Mod*</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVD</td>
<td>Possible benefit</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Safe</td>
<td>?</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bone</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Bone loss</td>
<td>Neutral</td>
<td>Mod bone loss*</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
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</tr>
</tbody>
</table>

AGI = α-glucosidase inhibitors; BCR-QR = bromocriptine quick release; Coles = colesevelam; CHF = congestive heart failure; CVD = cardiovascular disease; DPP4I = dipeptidyl peptidase 4 inhibitors; GI = gastrointestinal; GLP1RA = glucagon-like peptide 1 receptor agonists; GU = genitourinary; Met = metformin; Mod = moderate; SGLT2I = sodium-glucose cotransporter 2 inhibitors; SU = sulfonylureas; TZD = thiazolidinediones.

*Caution in labeling about pancreatitis.
†Caution: possibly increased CHF hospitalization risk seen in CV safety trial.

Continued from previous slide
### Q4. How are glycemic targets achieved for T2D?

**Monotherapy, Dual Therapy, and Triple Therapy for T2D**

<table>
<thead>
<tr>
<th>Monotherapy*</th>
<th>Dual therapy*</th>
<th>Triple therapy*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>Metformin (or other first-line agent) plus</td>
<td>First- and second-line agent plus</td>
</tr>
<tr>
<td>GLP1RA</td>
<td>GLP1RA</td>
<td>GLP1RA</td>
</tr>
<tr>
<td>SGLT2i</td>
<td>SGLT2i</td>
<td>SGLT2i</td>
</tr>
<tr>
<td>DPP4i</td>
<td>DPP4i</td>
<td>TZD†</td>
</tr>
<tr>
<td>AGI</td>
<td>TZD†</td>
<td>Basal insulin†</td>
</tr>
<tr>
<td>TZD†</td>
<td>Colesevelam</td>
<td>Colesevelam</td>
</tr>
<tr>
<td>SU/glinide†</td>
<td>BCR-QR</td>
<td>BCR-QR</td>
</tr>
<tr>
<td>SU/glinide†</td>
<td>AGI</td>
<td>AGI</td>
</tr>
</tbody>
</table>

AGI = α-glucosidase inhibitors; BCR-QR = bromocriptine quick release; Cole = colesevelam; DPP4i = dipeptidyl peptidase 4 inhibitors; GLP1RA = glucagon-like peptide 1 receptor agonists; Met = metformin; SGLT2i = sodium-glucose cotransporter 2 inhibitors; SU = sulfonylureas; TZD = thiazolidinediones.

*Intensify therapy whenever A1C exceeds individualized target. Boldface denotes little or no risk of hypoglycemia or weight gain, few adverse events, and/or the possibility of benefits beyond glucose-lowering.

† Use with caution.

---

### Glycemic Control Algorithm

**Lifestyle Modification**

- **Entry A1C < 7.5%**
  - **MONOTHERAPY**
    - Metformin
    - GLP1 RA
    - SGLT2i
    - DPP4i
    - AGI
    - TZD
    - SU/glinide
  - If not in goal in 3 months proceed to **Dual Therapy**

- **Entry A1C ≥ 7.5%**
  - **DUAL THERAPY**
    - GLP1 RA
    - DPP4i
    - SGLT2i
    - TZD
    - BCR-QR
    - Colesevelam
  - If not in goal in 3 months proceed to **Triple Therapy**

- **Entry A1C > 9.0%**
  - **TRIPLE THERAPY**
    - GLP1 RA
    - SGLT2i
    - TZD
    - BCR-QR
  - If not in goal in 3 months proceed to **Insulin**

**Symptoms**

- **NO**
  - **Dual Therapy** OR **Insulin & Other Agents**

**ADD OR INTENSIFY INSULIN** Refer to insulin algorithm

**Progression of Disease**

* Order of medications listedberapa is a suggested hierarchy of usage.
Q6. How should hypoglycemia be managed?

Consequences of Hypoglycemia

- Cognitive, psychological changes (e.g., confusion, irritability)
- Accidents
- Falls
- Recurrent hypoglycemia and hypoglycemia unawareness
- Refractory diabetes
- Dementia (elderly)
- CV events
  - Cardiac autonomic neuropathy
  - Cardiac ischemia
  - Angina
  - Fatal arrhythmia
Q6. How should hypoglycemia be managed?

Symptoms of Hypoglycemia

<table>
<thead>
<tr>
<th>Classification</th>
<th>Blood Glucose Level (mg/dL)</th>
<th>Typical Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild hypoglycemia</td>
<td>~50-70</td>
<td>• Neurogenic: palpitations, tremor, hunger, sweating, anxiety, paresthesia</td>
</tr>
<tr>
<td>Moderate hypoglycemia</td>
<td>~50-70</td>
<td>• Neuroglycopenic: behavioral changes, emotional lability, difficulty thinking, confusion</td>
</tr>
<tr>
<td>Severe hypoglycemia</td>
<td>&lt;50*</td>
<td>• Severe confusion, unconsciousness, seizure, coma, death</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Requires help from another individual</td>
</tr>
</tbody>
</table>

*Severe hypoglycemia symptoms should be treated regardless of blood glucose level.

Treatment of Hypoglycemia

- **Patient conscious and alert**
  - Consume glucose-containing foods (fruit juice, soft drink, crackers, milk, glucose tablets); avoid foods also containing fat
  - Repeat glucose intake if SMBG result remains low after 15 minutes
  - Consume meal or snack after SMBG has returned to normal to avoid recurrence

- **Patient severely confused or unconscious (requires help)**
  - Glucagon injection, delivered by another person
  - Patient should be taken to hospital for evaluation and treatment after any severe episode

BG = blood glucose; SMBG = self-monitoring of blood glucose.
Blood Pressure Targets

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>Individualize on the basis of age, comorbidities, and duration of disease, with general target of:</td>
</tr>
<tr>
<td>Systolic, mm Hg</td>
<td>~130</td>
</tr>
<tr>
<td>Diastolic, mm Hg</td>
<td>~80</td>
</tr>
</tbody>
</table>

- A more intensive goal (such as <120/80 mm Hg) should be considered for some patients, provided the target can be safely reached without adverse effects from medication.
- More relaxed goals may be considered for patients with complicated comorbidities or those experience adverse medication effects.

Blood Pressure Treatment

- Employ therapeutic lifestyle modification
  - DASH or other low-salt diet
  - Physical activity
- Select antihypertensive medications based on BP-lowering effects and ability to slow progression of nephropathy and retinopathy
  - ACE inhibitors
  - or
  - ARBs
- Add additional agents when needed to achieve blood pressure targets
  - Calcium channel antagonists
  - Diuretics
  - Combined $\alpha/\beta$-adrenergic blockers
  - $\beta$-adrenergic blockers
  - Do not combine ACE inhibitors with ARBs

ACE = angiotensin converting enzyme; ARB = angiotensin II receptor blocker; BP = blood pressure; DASH = Dietary Approaches to Stop Hypertension.
Q8. How should dyslipidemia be managed?

**Lipid Targets**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate risk</td>
</tr>
<tr>
<td><strong>Primary Goals</strong></td>
<td></td>
</tr>
<tr>
<td>LDL-C, mg/dL</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Non-HDL-C, mg/dL</td>
<td>&lt;130</td>
</tr>
<tr>
<td>Triglycerides, mg/dL</td>
<td>&lt;150</td>
</tr>
<tr>
<td>TC/HDL-C ratio</td>
<td>&lt;3.5</td>
</tr>
<tr>
<td><strong>Secondary Goals</strong></td>
<td></td>
</tr>
<tr>
<td>ApoB, mg/dL</td>
<td>&lt;90</td>
</tr>
<tr>
<td>LDL particles</td>
<td>&lt;1,200</td>
</tr>
</tbody>
</table>

- Moderate risk = diabetes or prediabetes with no ASCVD or major CV risk factors
- High risk = established ASCVD or ≥2 major CV risk factors
- CV risk factors
  - Hypertension
  - Family history
- Low HDL-C
- Smoking

ApoB = apolipoprotein B; ASCVD = atherosclerotic cardiovascular disease; CV = cardiovascular; HDL-C = high density lipoprotein cholesterol; LDL = low-density lipoprotein; LDL-C = low-density lipoprotein cholesterol; TC = total cholesterol.

**Lipid Management**

- Elevated LDL-C, non-HDL-C, TG, TC/HDL-C ratio, ApoB, LDL particles
  - Statin = treatment of choice
  - Add bile acid sequestrant, niacin, and/or cholesterol absorption inhibitor if target not met on maximum-tolerated dose of statin
  - Use bile acid sequestrant, niacin, or cholesterol absorption inhibitor instead of statin if contraindicated or not tolerated

- LDL-C at goal but non-HDL-C not at goal (TG ≥200 mg/dL and/or low HDL-C)
  - May use fibrate, niacin, or high-dose omega-3 fatty acid to achieve non-HDL-C goal

- TG ≥500 mg/dL
  - Use high-dose omega-3 fatty acid, fibrate, or niacin to reduce TG and risk of pancreatitis

ApoB = apolipoprotein B; HDL-C = high density lipoprotein cholesterol; LDL = low-density lipoprotein; LDL-C = low-density lipoprotein cholesterol; TC = total cholesterol; TG = triglycerides.
Q9. How is nephropathy managed in patients with diabetes?

Assessment of Diabetic Nephropathy

- Annual assessments
  - Serum creatinine to determine eGFR
  - Urine AER
- Begin annual screening
  - 5 years after diagnosis of T1D if diagnosed before age 30 years
  - At diagnosis of T2D or T1D in patients diagnosed after age 30 years

AER = albumin excretion rate; eGFR = estimated glomerular filtration rate

Management of Diabetic Nephropathy

- Optimal control of blood pressure, glucose, and lipids
- Smoking cessation
- RAAS blockade
  - ACE inhibitor, ARB, or renin inhibitor
  - Do not combine RAAS blocking agents
  - Monitor serum potassium
- Nephrologist referral
  - Atypical presentation
  - Rapid decline in eGFR or albuminuria progression
  - Stage 4 CKD

ACE = angiotensin converting enzyme; ARB = angiotensin II receptor blocker; CKD = chronic kidney disease; eGFR = estimated glomerular filtration rate; RAAS = renin angiotensin aldosterone system.
Q10. How is retinopathy managed in patients with diabetes?

Assessment of Diabetic Retinopathy

- Annual dilated eye examination by experienced ophthalmologist or optometrist
- Begin assessment
  - 5 years after diagnosis of T1D
  - At diagnosis of T2D
- More frequent examinations for:
  - Pregnant women with DM during pregnancy and 1 year postpartum
  - Patients with diagnosed retinopathy
  - Patients with macular edema receiving active therapy

DM = diabetes mellitus; T1D = type 1 diabetes; T2D = type 2 diabetes.

Management of Diabetic Retinopathy

- Slow retinopathy progression by maintaining optimal control of
  - Blood glucose
  - Blood pressure
  - Lipids
- For active retinopathy, refer to ophthalmologist as needed
  - For laser therapy
  - For vascular endothelial growth factor therapy
Assessment of Diabetic Neuropathy

- Complete neurologic examination annually
- Begin assessment
  - 5 years after diagnosis of T1D
  - At diagnosis of T2D

Diabetic Neuropathy Evaluations and Tests

<table>
<thead>
<tr>
<th>Evaluation Type</th>
<th>Tests/Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot inspection</td>
<td>Foot structure and deformities, Skin temperature and integrity, Ulcers, Vascular status, Pedal pulses, Amputations</td>
</tr>
<tr>
<td>Neurologic testing</td>
<td>Loss of sensation, using 1 and 10-g monofilament, Vibration perception using 128-Hz tuning fork, Ankle reflexes, Touch, pinprick, and warm and cold sensation</td>
</tr>
<tr>
<td>Painful neuropathy</td>
<td>May have no physical signs, Diagnosis may require skin biopsy or other surrogate measure</td>
</tr>
<tr>
<td>Cardiovascular autonomic neuropathy</td>
<td>Heart rate variability with: Deep inspiration, Valsalva maneuver, Change in position from prone to standing</td>
</tr>
</tbody>
</table>
Q11. How is neuropathy diagnosed and managed in patients with diabetes?

Diabetic Neuropathy Management

| All neuropathies       | • Prevent by controlling blood glucose to individual targets  
|                       | • No therapies proven to reverse neuropathy once it is established  
|                       | • May slow progression by maintaining optimal glucose, blood pressure, and lipid control and using other interventions that reduce oxidative stress  
| Painful neuropathy     | • Tricyclic antidepressants, anticonvulsants, serotonin reuptake inhibitors, or norepinephrine reuptake inhibitors  
| Large-fiber neuropathies | • Strength, gait, and balance training  
|                       | • Orthotics to prevent/treat foot deformities  
|                       | • Tendon lengthening for pes equinus  
|                       | • Surgical reconstruction  
|                       | • Casting  
| Small-fiber neuropathies | • Foot protection (eg, padded socks)  
|                       | • Supportive shoes with orthotics if needed  
|                       | • Regular foot inspection  
|                       | • Prevention of heat injury  
|                       | • Emollient creams

Q12. How is CVD managed in patients with diabetes?

Comprehensive Management of CV Risk

• Manage CV risk factors  
  • Weight loss  
  • Smoking cessation  
  • Optimal glucose, blood pressure, and lipid control  
• Use low-dose aspirin for secondary prevention of CV events in patients with existing CVD  
  • May consider low-dose aspirin for primary prevention of CV events in patients with 10-year CV risk >10%  
• Measure coronary artery calcification or use coronary imaging to determine whether glucose, lipid, or blood pressure control efforts should be intensified
### Q12. How is CVD managed in patients with diabetes?

#### Statin Use

- Majority of patients with T2D have a high cardiovascular risk
- People with T1D are at elevated cardiovascular risk
- LDL-C target: <70 mg/dL—for the majority of patients with diabetes who are determined to have a high risk
- Use a statin regardless of LDL-C level in patients with diabetes who meet the following criteria:
  - >40 years of age
  - ≥1 major ASCVD risk factor
  - Hypertension
  - Family history of CVD
  - Low HDL-C
  - Smoking

---

### Q13. How is obesity managed in patients with diabetes?

#### Diagnosis of Obesity and Staging of for Management

- Diagnose obesity according to body mass index (BMI)
  - Overweight: BMI 25-29.9 kg/m²
  - Obese*: BMI ≥30 kg/m²
- Consider waist circumference measurement for patients with BMI between 25 and 35 kg/m²
  - Larger waist circumference = higher risk for metabolic disease
    - Men: >102 cm (40 in)
    - Women: >88 cm (35 in)
- Evaluate patients for obesity-related complications to determine disease severity and appropriate management

---

*BMI 23-24.9 may be considered obese in certain ethnicities; perform waist circumference and use ethnicity-specific criteria in risk analysis.*
Medical Complications of Obesity

**Cardiometabolic**
- Dyslipidemia
- Hypertension
- Prediabetic states
- NAFLD
- PCOS

**Diabetes**

**Cardiovascular Disease**

**Biomechanical**
- Dismotility/disability
- GERD
- Lung function defects
- Osteoarthritis
- Sleep apnea
- Urinary incontinence

**Other**
- Androgen deficiency
- Cancer
- Gallbladder disease
- Psychological disorders

GERD, gastroesophageal reflux disease; NAFLD, nonalcoholic fatty liver disease; PCOS, polycystic ovary syndrome.


Q13. How is obesity managed in patients with diabetes?

Combinations-Centric Model for Care of the Overweight/Obese Patient

**STEP 1**

**EVALUATION FOR COMPLICATIONS AND STAGING**

<table>
<thead>
<tr>
<th>CARDIOMETABOLIC DISEASE</th>
<th>BIOMECHANICAL COMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO COMPLICATIONS</td>
<td>BMI ≥ 27 WITH COMPLICATIONS</td>
</tr>
<tr>
<td>BMI 25.6-26.9, or BMI ≥ 27</td>
<td>Stage Severity of Complications</td>
</tr>
</tbody>
</table>

**STEP 2**

**SELECT:**

- Therapeutic targets for improvement in complications
- Treatment modality
- Treatment intensity for weight loss based on staging

- Lifestyle Modification: MD/RD counselling; web/remote program; structured multidisciplinary program
- Medical Therapy: phentermine; orlistat; lorcaserin; phentermine/topiramate ER; naltrexone/bupropion; liraglutide
- Surgical Therapy (BMI ≥ 35): Lap band; gastric sleeve; gastric bypass

**STEP 3**

If therapeutic targets for improvements in complications not met, intensify lifestyle and/or medical and/or surgical treatment modalities for greater weight loss.
Q14. What is the role of sleep medicine in the care of the patient with diabetes?

Obstructive Sleep Apnea

Risk Factors
- Obesity
- Male sex
- Neck circumference >44 cm
- Age
- Narrowed airway
- Family history
- Hypertension
- Alcohol or sedatives
- Smoking

Treatment Options
- Weight loss
- Continuous positive airway pressure (CPAP)
- Additional options
  - Adjustable airway pressure devices
  - Oral appliances
  - Surgery
    - Uvulopalatopharyngoplasty (UPPP)
    - Maxillomandibular advancement
    - Tracheostomy

Q15. How is diabetes managed in the hospital?

Glucose Screening and Monitoring
- Laboratory blood glucose testing on admission, regardless of DM history
  - Known DM: assess A1C if not measured in past 3 months
  - No history of DM: assess A1C to identify undiagnosed cases
- Bedside glucose monitoring for duration of hospital stay
- Diagnosed DM
- No DM but receiving therapy associated with hyperglycemia
  - Corticosteroids
  - Enteral or parenteral nutrition
Inpatient Glucose Targets for Nonpregnant Adults

<table>
<thead>
<tr>
<th>Hospital Unit</th>
<th>Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive/critical care</td>
<td></td>
</tr>
<tr>
<td>Glucose range, mg/dL</td>
<td>140-180*</td>
</tr>
<tr>
<td>General medicine and surgery, non-ICU</td>
<td></td>
</tr>
<tr>
<td>Premeal glucose, mg/dL</td>
<td>&lt;140*</td>
</tr>
<tr>
<td>Random glucose, mg/dL</td>
<td>&lt;180*</td>
</tr>
</tbody>
</table>

*Provided target can be safely achieved.

Q15. How is diabetes managed in the hospital?

Glucose Control

**Hyperglycemia**
- Critically ill/ICU patients
  - Regular insulin by intravenous infusion
- Noncritically ill
  - Insulin analogs by scheduled subcutaneous basal, nutritional, and correctional components
  - Synchronize dosing with meals or enteral or parenteral nutrition
  - Exclusive use of sliding scale insulin is discouraged

**Hypoglycemia**
- Establish plan for treating hypoglycemia in each insulin-treated patient
- Document each episode of hypoglycemia in medical record

**Discharge Plans**
- Include appropriate provisions for glucose control in the outpatient setting
### Q18. When and how should glucose monitoring be used?

#### Self-monitoring of Blood Glucose (SMBG)

<table>
<thead>
<tr>
<th>Noninsulin Users</th>
<th>Insulin Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Introduce at diagnosis</td>
<td>• All patients using insulin should test glucose</td>
</tr>
<tr>
<td>• Personalize frequency of testing</td>
<td>• ≥2 times daily</td>
</tr>
<tr>
<td>• Use SMBG results to inform decisions about whether to target FPG or PPG for any individual patient</td>
<td>• Before any injection of insulin</td>
</tr>
<tr>
<td></td>
<td>• More frequent SMBG (after meals or in the middle of the night) may be required</td>
</tr>
<tr>
<td>Testing positively affects glycemia in T2D when the results are used to:</td>
<td>• Frequent hypoglycemia</td>
</tr>
<tr>
<td>• Modify behavior</td>
<td>• Not at A1C target</td>
</tr>
<tr>
<td>• Modify pharmacologic treatment</td>
<td></td>
</tr>
</tbody>
</table>


### Q19. When and how should insulin pump therapy be used?

#### Continuous Subcutaneous Insulin Infusion (CSII)

- Consider for
  - T1D patients
  - Insulinopenic T2D patients unable to achieve optimal glucose control with multiple daily injections of insulin
  - All patients should be motivated and well educated in DM self-management as well as CSII use
  - Prescribing physicians should have expertise in CSII
  - CSII devices with a threshold-suspend function may be considered
Q20. What is the imperative for education and team approach in DM management?

DM Comprehensive Management Team

- Endocrinologist
- PCP
- Physician assistant / Nurse practitioner
- Registered nurse
- CDE
- Dietitian
- Exercise specialist
- Mental health care professional

Q21. What vaccinations should be given to patients with diabetes?

Vaccinations for Patients with DM

<table>
<thead>
<tr>
<th>Vaccine, frequency of administration</th>
<th>Patient age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine childhood immunizations, according to standard schedule (eg, measles, mumps, rubella, varicella, polio, tetanus-diphtheria)</td>
<td>6 months to 18 years</td>
</tr>
<tr>
<td>Influenza, annually</td>
<td>≥6 months</td>
</tr>
<tr>
<td>Pneumococcal polysaccharide vaccine</td>
<td>≥22 years</td>
</tr>
<tr>
<td>PVC13, 1-2 injections</td>
<td>2-18 years</td>
</tr>
<tr>
<td>PPSV23, 1 injection</td>
<td>19-64 years</td>
</tr>
<tr>
<td>PVC13 plus PPSV23, 1 injection each, in series</td>
<td>≥65 years</td>
</tr>
<tr>
<td>Hepatitis B, 1 injection</td>
<td>≥20-59 years*</td>
</tr>
<tr>
<td>Tetanus-diphtheria booster, every 10 years in adults</td>
<td>≥59 years</td>
</tr>
<tr>
<td>Individuals not already immunized for childhood diseases and those requiring vaccines for endemic diseases should be immunized as required by individual patient needs</td>
<td>Any age</td>
</tr>
</tbody>
</table>

*Consider for patients ≥60 based on assessment of risk and likelihood of adequate immune response.
Q22. How should depression be managed in the context of diabetes?

**DM and Depression**

- Screen all adults with DM for depression
  - Untreated comorbid depression can have serious clinical implications for patients with DM
- Consider referring patients with depression to mental health professionals who are knowledgeable about DM

Q23. What is the association between diabetes and cancer?

**DM and Cancer**

- Screen obese individuals with DM more frequently and rigorously for certain cancers
  - Endometrial, breast, hepatic, bladder, pancreatic, colorectal cancers
- Increased BMI (≥25 kg/m²) also increases risk of some cancers
  - Strong associations: endometrial, gall bladder, esophageal, renal, thyroid, ovarian, breast, and colorectal cancer
  - Weaker associations: leukemia, malignant and multiple melanoma, pancreatic cancer, non-Hodgkin lymphoma
- To date, **no definitive relationship** has been established between specific hyperglycemic agents and increased risk of cancer or cancer-related mortality
  - Consider avoiding medications considered disadvantageous to specific cancers in individuals at risk for or with a history of that cancer
Q24. Which occupations have specific diabetes management requirements?

DM and Occupational Hazards

- Commercial drivers at high risk for developing T2D
  - Screen as appropriate
  - Encourage healthy lifestyle change
- Be aware of management requirements and use agents with reduced risk of hypoglycemia in patients with occupations that could put others at risk, such as (not inclusive):
  - Commercial drivers
  - Pilots
  - Anesthesiologists
  - Commercial or recreational divers

But wait, what about Diabetes in the elderly...?

- Of those 24 questions:
  - Children and adolescents
  - Pregnant diabetics
  - Diabetics in the hospital
  - Diabetics with co-morbidities
  - Obese diabetics
- But a specific teaching question did not cover the elderly.
Elderly Diabetics

- Diabetes is the most common long-term metabolic condition in older people.

Elderly are grossly underrepresented in most medical studies

- Despite the importance of DM, research is sparse on the management of older individuals with DM, who have high levels of morbidity, use multiple therapies, and have physical and mental impairments.
- Evidence of a sound individualized decision-making process is lacking.
Elderly are grossly underrepresented in most medical studies

- Of 440 trials investigating treatments for type 2 diabetes...
- 289 (65.7%) excluded individuals using an arbitrary upper age limit
- Exclusions for comorbidity was present in 338 trials (76.8%), this exclusion was poorly justified in 236 trials (53.6%)
- Exclusion for:
  - polypharmacy (29.5% of trials)
  - cognitive impairment (18.4%)
  - Short life expectancy (8.9%)
  - Only six trials (1.4%) were designed specifically to study older adults
- Most research that will be published in the near future will discriminate against older individuals

Methods

- Followed the methodology that the European Commission-funded project Increasing the Participation of the Elderly in Clinical Trials (PREDICT)
- Information regarding ongoing trials on DM was obtained from the World Health Organization International Clinical Trials Registry Platform (WHO-ICTRP)
- This database is a collection of information about all trials in registries around the world, and is the most comprehensive global public repository of information on clinical trials
• Guidelines for Improving the Care of Older Adults with Diabetes Mellitus: 2013 Update
  ➢ JAGS Nov 2013
• American Geriatrics Society Expert Panel on the Care of Older Adults with Diabetes Mellitus

• Recommends DM care that is customized and prioritized to the individual person with DM, with attention to quality of life and personal and caregiver choices related to health care
• Updates made by reviewing the existing peer-reviewed literature (2002-2012) and guidelines on each DM topic
• Draft reviewed by:
### Recommendations

1. **ASPIRIN**

1. If an older adult has DM and known CVD, daily aspirin therapy **81-325mg/d** is recommended, unless contraindicated or the patient is taking other anticoagulant therapy. (IA)

There is no evidence that a higher dose is more effective than a 75 mg/d dose, and there is **insufficient evidence** to recommend the use of aspirin for primary CVD prevention for older adults with type 2 DM. For adults aged 80 and older, aspirin should be used with caution.
2. SMOKING

1. Older adults with DM who smoke should be assessed for readiness to quit and should be offered counseling and pharmacologic interventions to assist with smoking. (IIA)

3. Hypertension

1. If an older adult has DM and requires medical therapy for HTN, then the target BP should be less than 140/90 mmHg if it is tolerated. (IA)

There is potential harm in lowering systolic BP to less than 120 mmHg in older adults with type 2DM. (IB)

Systolic BP of less than 130 mmHg is not associated with better CVD outcomes than blood pressure control between 130 and 140 mmHg.

Recent evidence comparing classes of antihypertensive medications for persons with DM indicates that many, such as diuretics, ACE inhibitors, beta-blockers, and calcium channel blockers, have comparable effectiveness in reducing cardiovascular morbidity and mortality.
Recommendations

3. Hypertension

2. Older adults with DM and HTN should be offered a therapeutic intervention to lower blood pressure within 3 months if systolic blood pressure is 140 – 160 mmHg or diastolic BP is 90-100mmHg or within 1 month if blood pressure is greater than 160/100 mmHg. (IIIB)

Older adults taking an ACE-I or ARB should have renal function and serum potassium levels monitored after approximately 1 – 2 weeks of initiation of therapy, with each dosage increase, and at least yearly. (IIIA)
Recommendations

4. Glycemic Control

1. Target goal for glycosylated hemoglobin (HbA1c) in older adults generally should be 7.5% - 8%. HbA1c between 7% and 7.5% may be appropriate if it can be safely achieved in healthy older adults with few comorbidities and good functional status. Higher HbA1c targets (8-9%) are appropriate for older adults with multiple comorbidities, poor health, and limited life expectancy. (IA evidence for HbA1c 7-8% and IIA for 8-9%)

There is potential harm in lowering HbA1c to less than 6.5% in older adults with type 2 DM. (IIA)

(Given the long time frame needed to achieve a reduction in microvascular complications (retinopathy, neuropathy, and nephropathy), glycemic goals should reflect patient goals, health status, and life expectancy.)

2. Monitoring

Older adults not at goal, HbA1c levels at least every 6 months, and more frequently as needed or indicated. If stable over years, every 12 months may be appropriate. (IIB)
Recommendations

4. Glycemic Control

3. For older adults with DM, a schedule for self-monitoring of blood glucose should be considered, depending on functional and cognitive abilities. The schedule should be based on goals of care, target HbA1c, potential for modifying therapy, and risk of hypoglycemia. (IIIB)

4. The management plan for older adults with DM with severe or frequent hypoglycemia should be evaluated; the individual should be offered referral to a DM educator, endocrinologist, or diabetologist, and more frequent contacts with the healthcare team. (IIIB)
4. Glycemic Control

Medications

5. **Metformin**, unless contraindicated, is the preferred first-line agent in combination with lifestyle therapy. (IA)

After metformin, therapy should be individualized. **Sulfonylureas** have been associated with **greater risk of hypoglycemia**, and the risk increases with age. **Glyburide** should generally **not be prescribed** to older adults because of the high risk of hypoglycemia. **Chlorpropamide** (Diabinese) has a prolonged half-life, particularly in older adults and should be avoided.

6. Use **estimated glomerular filtration rate (eGFR)** rather than serum creatinine levels to guide metformin use. Specifically, do not use metformin in patients with an eGFR of less than 30 mL/min. For individuals with an eGFR between 30 – 60 mL/min, check renal function more frequently and use lower dosages. (IIB)

Despite concern of lactic acidosis with metformin, recent data suggest that the risk is low.
Recommendations

5. Lipids

1. For older adults with DM and dyslipidemia, **efforts should be made** to correct the lipid abnormalities if feasible after overall health status is considered. (IA)

   Evidence supports the use of lipid-lowering agents, particularly **statins**, in older adults with DM who are younger than 75, but there is no clinical trial data collected over the last 10 years in people aged 80 and older with DM.

2. Pharmacological therapy with a **statin is recommended** in addition to medical nutrition therapy and increased physical activity **unless contraindicated or not tolerated.** (IB)

   **Medical nutrition therapy**, supplemented Mediterranean diet, enhanced physical activity, and weight loss have also been shown to play a role in improving cardiovascular profiles in older adults with DM.

   Optimal LDL-C targets have **not** been established.

3. Monitoring

   Older adults with DM who are newly prescribed a **statin** should have an **ALT (alanine aminotransferase) level measured before treatment** with a new medication begins and as clinically indicated thereafter. (IIIB)
## Recommendations

### 6. Eye Care

1. Older adults with new-onset DM should have an **initial screening dilated-eye exam** with funduscopy performed by an eye care specialist. (IIB)

2. Older adults with DM and who are at **high risk of eye disease** (symptoms of eye disease present; evidence of retinopathy, glaucoma, or cataracts on an initial dilated-eye examination should have a **screening dilated-eye exam performed at least annually**. Those at lower risk, at least every 2 years.

### 7. Foot Care

1. Older adults with DM should have a **careful foot exam at least annually** to check skin integrity and to determine whether there is loss of sensation or decreased perfusion and more frequently if there is evidence of any of those findings. (IIIA)
Recommendations

8. Nephropathy Screening

1. **Urine microalbumin level** should be performed in individuals at diagnosis of type 2 DM. After the initial screen, and in the absence of previously macro- or microalbuminuria, a test for the presence of microalbuminuria should be performed annually. (IIIA)

There is **little evidence supporting annual microalbuminuria screening**. This is especially so in older adults with limited life expectancy. If an individual is taking an ACE-I or an ARB, there is no need for screening.

Recommendations

9. DM Self-Management Education and Support

1. Persons with DM and, if appropriate, family members and caregivers should receive **education and support** with reassessment and reinforcement periodically as needed. (IA)

2. The **monitoring technique** of older adults with DM who self-monitor blood glucose should be routinely reviewed. (IIIB)

3. Older adults with DM and normal cognition and functional status should **perform at least 150 minutes per week of moderate-intensity aerobic physical activity**. (IA)

4. **Regular evaluation for diet and nutritional status** in older adults with DM.
Recommendations

**9. DM Self-Management Education and Support**

5. Older adults with DM who are prescribed a new medication and any caregiver should receive education about the purpose of the drug, how to take it, and the common side effects and important adverse reactions, with reassessment and reinforcement as needed. (IA)

6. Education about the risk factors for foot ulcers and amputation should be provided as well.

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**10. Depression**

1. Older adults with DM are at greater risk of major depression and should be screened for depression during the initial evaluation period (first 3 months) and if there is any unexplained decline in clinical status. (IIB)

The use of a standardized short screen is recommended.

Psychosocial problems, such as attitudes about DM, quality of life, DM-related distress, and lack of financial resources, are also important for older adults with type 2 DM.
### 10. Depression

2. **Treatment or referral within 2 weeks** of presentation, or sooner if they are a danger to themselves is normally indicated. (IIIB)

There is evidence from carefully conducted meta-analyses of RCTs that pharmacological and psychological treatment of older adults (aged>55) **is effective** in reducing depressive symptoms.

3. Evaluation of improvement in target symptoms **within 6 weeks of initiation of therapy** is indicated. (IIIB)

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### 11. Polypharmacy

1. Older adults with DM should be advised to maintain an **updated medication list** for review by clinician. (IIA)

2. The medication list of an older adult with DM **who presents with** depression, falls, cognitive impairment, or urinary incontinence should be reviewed. (IIA)

The **AGS Beers Criteria** provide clinicians with information on potentially inappropriate medications in older adults.
Recommendations

12. Cognitive Impairment

1. The use of standardized screening instrument in this population is indicated during the initial evaluation period and with any significant decline.

Studies found that dementia was more likely in persons with DM, and suggested that DM was associated with faster cognitive decline in older adults.

Simple screening tools such as The Montreal Cognitive Assessment tool are available online.

2. If there is evidence of cognitive impairment in an older adult with DM and delirium has been excluded as a cause, then an initial evaluation designed to identify reversible conditions that may cause or exacerbate cognitive impairment should be performed within the first 3 months after diagnosis and with any significant change in clinical status. (IIIa)

The American Academy of Neurology guidelines recommend screening older adults with evidence of cognitive impairment for depression, B12 deficiency, hypothyroidism; structural neuroimaging to identify lesions is also recommended for those recently diagnosed.
### Recommendations

#### 13. Urinary Incontinence

1. Evaluation for symptoms of urinary incontinence **during annual screening** should occur.

Urinary incontinence can be associated with **social isolation, depression, falls, fractures and infections**.

2. An evaluation designed to **identify treatable causes** of urinary incontinence should be pursued.

#### 14. Injurious Falls

1. Patients should be asked about falls **every 12 months or more frequently if needed**. (IIIB)

2. If and older adult presents with evidence of falls, the clinician should document a **basic falls evaluation**, including as assessment of injuries and examination of potentially reversible causes of the falls (medications, environmental factors).
Recommendations

15. Pain

Older adults with DM should be assessed during the initial evaluation period for evidence of persistent pain. (IIIA)

Neuropathic pain may occur in as many as 50% of individuals with DM, but it is often underreported and undertreated in this population.

A few current updates...
FDA Strengthens Fracture Warning for Canagliflozin
12/4/15

- The US Food and Drug Administration (FDA) has strengthened its warning for canagliflozin (Invokana, Invokamet, Johnson & Johnson/Janssen) related to the increased risk for bone fractures.
- The "Adverse Reactions" section of the product label for canagliflozin had already mentioned the risk for bone fractures. Now, based on new confirmatory information from several clinical trials, the FDA has added further warning and precaution information. In the trials, the fractures affected the upper extremities, occurred as early as 12 weeks after starting the drug, and typically arose from minor trauma such as falling from a standing height.
- The FDA has also added new information to the label about decreased bone mineral density at the hip and lower spine.

Rosiglitazone-containing Diabetes Medicines: Drug Safety Communication - FDA Eliminates the Risk Evaluation and Mitigation Strategy (REMS)

- ISSUE: FDA is eliminating the Risk Evaluation and Mitigation Strategy (REMS) for rosiglitazone-containing type 2 diabetes medicines, which are approved as Avandia, Avandamet, Avandaryl, and generics. The REMS is no longer necessary to ensure that the benefits of rosiglitazone medicines outweigh their risks.
- In 2013, FDA required removal of the prescribing and dispensing restrictions for rosiglitazone medicines after determining that data did not demonstrate an increased risk of heart attack with rosiglitazone medicines compared to the standard type 2 diabetes medicines metformin and sulfonylurea. FDA also required the drug manufacturers to provide educational training to health care professionals about the current state of knowledge regarding the heart risks of rosiglitazone medicines. Manufacturers have since fulfilled these requirements.
DKA and SGLT2 Inhibitors

- The Food and Drug Administration (FDA) has identified 20 cases of acidosis reported as DKA, ketoacidosis, or ketosis from March 2013 through June 6, 2014, in patients taking an SGLT2 inhibitor.
- 370,000 people had been prescribed an SGLT2 inhibitor during the same time period the FDA identified these cases.

References

References


Age is only a matter of perspective.

THANK YOU