Making Health Care Better Together

About Alliant Health Solutions
Tanya Vadala, Pharm.D.

MEDICATION SAFETY PHARMACIST

Tanya is an IPRO pharmacist with 20 years of clinical pharmacy, community pharmacy, academia, quality improvement and medication safety experience. Before joining IPRO, she worked at various community pharmacies and taught at Albany College of Pharmacy and Health Sciences in Albany, N.Y. She specializes in Medication Therapy Management (MTM), medication reconciliation, opioids, immunizations, and patient self-care. Her formal teaching experience includes courses in pharmacy practice and clinical experiential teaching.

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Katharine Abbot, Pharm.D.

PGY-2 ENDOCRINOLOGY PHARMACY RESIDENT

Katharine is a Pharmacy Resident at Albany College of Pharmacy and Health Sciences. Her current practice site is Albany Medical Center Division of Community Endocrinology/The Endocrine Group in Albany, NY where she practices under Dr. Michael Kane, PharmD, FCCP, BCPS, BCACP.

Katharine completed her Bachelor of Science in Biochemistry from SUNY Stony Brook University in Stony Brook, NY. She graduated in 2022 from Albany College of Pharmacy and Health Sciences in Albany, NY and completed her PGY-1 Pharmacy Residency in 2023 at Centra Lynchburg General Hospital in Lynchburg, VA.

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Objectives

Recognize signs and symptoms of hyperglycemia and hypoglycemia

Identify common adverse drug reactions for diabetes medications

Discuss measures to prevent medication related adverse reactions
Prevalence

- CDC 2022 Report
  - About 37.1 million (14.7%) American adults have DM with 23% of them unaware
  - 38% of US adults have pre-DM with 81% of them unaware
- Frequency of adults with DM increases with age
- Most common in American Indians/Alaskan Natives (14.5%) and non-Hispanic African Americans (12.1%)

Diabetes and the Elderly

- Over 25% of people over the age of 65 years have diabetes
- One-half of older adults have prediabetes
- Older adults with diabetes have higher rates of premature death, functional disability, accelerated muscle loss, and coexisting illnesses, such as hypertension, coronary heart disease, and stroke, compared to those without diabetes
- Older adults with diabetes are at greater risk than other older adults for several common geriatric syndromes, such as polypharmacy, cognitive impairment, depression, urinary incontinence, injurious falls, persistent pain, and frailty

Older Adults ADA Recommendations

Episodes of hypoglycemia should be ascertained and addressed at routine visits

For older adults with type 1 diabetes, continuous glucose monitoring is recommended to reduce hypoglycemia

For older adults with type 2 diabetes on multiple daily doses of insulin, continuous glucose monitoring should be considered

For older adults with type 1 diabetes, consider the use of automated insulin delivery systems and other advanced insulin delivery devices such as connected pens

Glycemic goals for some older adults might reasonably be relaxed as part of individualized care, but hyperglycemia leading to symptoms or risk of acute hyperglycemia complications should be avoided in all people with diabetes

Screening for diabetes complications should be individualized in older adults
Outpatient Glycemic Goals

- **Before meals**: 80-130 mg/dL
- **After meals**: <180 mg/dL at 1-2 hours after start of meal

**Individualization is key**
- Tighter targets (6.0%-6.5%)
  - Younger, healthier
- Looser targets (7.5%-8.0%)
  - Older, comorbidities, hypoglycemia risk

**Individualize goals based on:**
- Diabetes duration, age, life expectancy, comorbidities
- CVD or advanced micro-vascular complications
- Hypoglycemia risk or unawareness
Glycemic Goals: Avoiding Overtreatment

- Very complex/poor health
  - **Who:** LTC, end-stage chronic illness, moderate to severe cognitive impairment, or 2+ ADL dependencies
  - **Why:** limited life expectancy vs time to benefit

- **Goals:** avoid hypoglycemia and symptomatic hyperglycemia
  - No A1C goal
  - Premeal glucose: 100-180 mg/dL
  - Bedtime glucose: 110-200 mg/dL

- Simplify, simplify, simplify
- Decrease pill burden
- Choose medications with low risk of hypoglycemia, low glucose monitoring burden, and low pill burden


## ADA Recommendations

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Rationale</th>
<th>Reasonable A1C Goal</th>
<th>Fasting/Preprandial Glucose</th>
<th>Bedtime Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy (few coexisting chronic illnesses, intact cognitive function and functional status)</td>
<td>Longer life expectancy</td>
<td>&lt;7.0% to 7.5%</td>
<td>80-130 mg/dL</td>
<td>80-180 mg/dL</td>
</tr>
<tr>
<td>Complex/intermediate (multiple coexisting chronic illnesses or 2+ instrumental ADL impairments or mild to moderate cognitive impairment)</td>
<td>Intermediate life expectancy, high treatment burden, hypoglycemia vulnerability, fall risk</td>
<td>&lt;8.0%</td>
<td>90-150 mg/dL</td>
<td>100-180 mg/dL</td>
</tr>
<tr>
<td>Very complex/poor health (LTC or end-stage chronic illness or moderate to severe cognitive impairment or 2+ ADL impairments)</td>
<td>Limited life expectancy</td>
<td>Avoid reliance on A1C; avoid hypoglycemia and symptomatic hyperglycemia</td>
<td>100-180 mg/dL</td>
<td>110-200 mg/dL</td>
</tr>
<tr>
<td>Medication Summary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WEIGHT</strong></td>
<td><strong>MET</strong></td>
<td><strong>GLP-1 RA</strong></td>
<td><strong>DUAL GIP/GLP-1 RA</strong></td>
<td><strong>SGLT2i</strong></td>
</tr>
<tr>
<td>Slight loss</td>
<td>Loss</td>
<td>Loss</td>
<td>Loss</td>
<td>Gain⁶</td>
</tr>
</tbody>
</table>

**HYPOGLYCEMIA RISK¹⁴**

| **CKD** | **RENAL ADJUSTMENT** | **MET** | **GLP-1 RA** | **DUAL GIP/GLP-1 RA** | **SGLT2i** | **TZD** | **INSULIN** (basal & basal bolus) | **DPP-4i** | **SU** | **GLN** | **AGI** | **COLSVL** | **BRC** | **PRAML** |
| Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Moderate to Severe | Neutral | Moderate to Severe | Mild | Neutral | Neutral | Neutral | Neutral | Neutral |

| **RENOVASCULAR DISEASE** | **MET** | **GLP-1 RA** | **DUAL GIP/GLP-1 RA** | **SGLT2i** | **TZD** | **INSULIN** (basal & basal bolus) | **DPP-4i** | **SU** | **GLN** | **AGI** | **COLSVL** | **BRC** | **PRAML** |
| Not with CKD eGFR <30⁶ | Benefit⁷ | Benefit⁷ | Insufficient Evidence | Check medication-specific eGFR thresholds⁸ | Neutral | Increased hypoglycemia risk with impaired renal function | Neutral | Increased hypoglycemia risk with impaired renal function | Not recommended SCR >2 mg/dL or CrCl <35 |
| Exenatide not recommended eGFR <45 | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral |

| **ASCVD** | **MACE** | **CHF** | **SAFE** | **REDUCTION** | **DIP** | **HIGH RISK** | **LOW RISK** | **MODERATE RISK** | **LOW RISK** | **MODERATE RISK** | **LOW RISK** | **MODERATE RISK** | **LOW RISK** | **MODERATE RISK** |
| Neutral | Benefit¹³ | Unclear | Safe | Benefit¹² | Neutral³ | Neutral | Neutral | Neutral | Possible Increased Risk | Neutral | Insufficient Evidence | Neutral³ | Safe | Insufficient Evidence |

| **STROKE** | **MET** | **GLP-1 RA** | **DUAL GIP/GLP-1 RA** | **SGLT2i** | **TZD** | **INSULIN** (basal & basal bolus) | **DPP-4i** | **SU** | **GLN** | **AGI** | **COLSVL** | **BRC** | **PRAML** |
| Benefit⁵ | Possible Benefit⁴ | Benefit | Neutral⁴ | Benefit | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Moderate | Mild | Moderate | Moderate |

| **GI ADVERSE SYMPTOMS** | **MET** | **GLP-1 RA** | **DUAL GIP/GLP-1 RA** | **SGLT2i** | **TZD** | **INSULIN** (basal & basal bolus) | **DPP-4i** | **SU** | **GLN** | **AGI** | **COLSVL** | **BRC** | **PRAML** |
| Mild to Moderate | Moderate¹⁰ | Moderate¹⁰ | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Moderate | Mild | Moderate | Moderate |

| **OTHER CONSIDERATIONS** | **MET** | **GLP-1 RA** | **DUAL GIP/GLP-1 RA** | **SGLT2i** | **TZD** | **INSULIN** (basal & basal bolus) | **DPP-4i** | **SU** | **GLN** | **AGI** | **COLSVL** | **BRC** | **PRAML** |
| Medullary Thyroid Carcinoma/ MEN2 | Medullary Thyroid Carcinoma/ MEN2 | GU infections DKA¹¹ Fracture Risk¹² | Fracture Risk | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias | Rare Arthralgias/ Myalgias |

*Possible benefits | Use with caution | Likelihood of adverse events | Neutral, not studied, insufficient evidence*
Common Adverse Drug Reactions

Metformin
- GI discomfort: nausea, vomiting, diarrhea, abdominal pain
- Vitamin B12 deficiency
- Lactic acidosis

GLP-1 RA and Dual GIP/GLP-1 RA
- GI: nausea, vomiting, diarrhea, abdominal pain, constipation

SGLT2i
- Genitourinary tract infection
  - Genital mycotic infections
  - Urinary tract infections
- Frequent urination → risk of hypotension and hypovolemia
- Euglycemic ketoacidosis (primarily in T1DM)

TZDs
- Fluid retention/edema → CHF worsening
- Weight gain
- Fracture risk

Insulin
- Hypoglycemia
- Weight gain

SU
- Hypoglycemia
- Weight gain
Common Adverse Drug Reactions

- **DPP4i**
  - Skin reactions (rare), arthralgia

- **Meglitinides**
  - Hypoglycemia
  - Weight gain

- **Alpha-glucosidase inhibitors**
  - GI discomfort: flatulence, bloating, diarrhea, abdominal pain

- **Bromocriptine**
  - GI: nausea, constipation
  - Headache, dizziness

- **Colesevelam**
  - GI: constipation, bloating, dyspepsia

- **Amylin analogue**
  - Hypoglycemia in combination
  - Nausea, vomiting
  - Headache
Hypoglycemic Medications

High Risk

- Insulin
- Sulfonylureas
- Meglitinides

Low Risk

- Metformin
- GLP-1 agonists
- SGLT2 inhibitors
- DPP-4 inhibitors
- Thiazolidinediones

<table>
<thead>
<tr>
<th>Level</th>
<th>Glycemic criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoglycemia alert value (level 1)</td>
<td>Glucose ≤70 mg/dl (3.9 mmol/L) and glucose ≥54 mg/dl (3.0 mmol/L)</td>
<td>Sufficiently low for treatment with fast-acting carbohydrate and dose adjustment of glucose-lowering therapy</td>
</tr>
<tr>
<td>Clinically significant hypoglycemia (level 2)</td>
<td>Glucose &lt;54 mg/dl (3.0 mmol/L)</td>
<td>Sufficiently low to indicate serious, clinically important hypoglycemia</td>
</tr>
<tr>
<td>Severe hypoglycemia (level 3)</td>
<td>No specific glucose threshold</td>
<td>Sufficiently low associated with severe cognitive impairment and/or physical status requiring external assistance for recovery with possible progression to loss of consciousness, seizure, coma, or death</td>
</tr>
</tbody>
</table>

Symptoms of Hypoglycemia

- Shaking or trembling
- Faster heart rate
- Extreme hunger
- Sweating
- Confusion/difficulty concentrating
- Dizziness
### Hypoglycemia Treatment

**For unconscious patient**

- Glucagon Kit - 1 mg IM, SQ, or IV
- Gvoke (ready to use glucagon injection) – 1 mg SQ
- Baqsimi (glucagon nasal powder) - 3 mg intranasal
- Zegalogue (dasiglucagon) – 0.6 mg SQ auto injector
- May repeat any of above after 15 minutes

**For conscious patient**

- 15 grams of CHO
- Glucose preferred (avoid fat)
- Recheck BG in 15 min
  - Still low: Additional 15 grams of CHO
- Once normal, consider meal/snack to prevent recurrence
- Treatment options
  - 3 glucose tabs
  - 4 oz. (1/2 cup) OJ
  - 4-6 oz. regular soda

- When in doubt, treat for hypoglycemia
- Medic Alert bracelet
- Prevent future occurrences
# Hypoglycemia Treatment

<table>
<thead>
<tr>
<th>Intranasal glucagon (Baqsimi)</th>
<th>Liquid stable glucagon (Gvoke prefilled syringe and autoinjector)</th>
<th>Dasiglucagon (Zegalogue prefilled syringe and autoinjector)</th>
<th>Lyophilized glucagon powder injection (glucagon emergency kit)</th>
<th>Lyophilized glucagon powder injection (GlucaGen)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Available doses</strong></td>
<td>3 mg</td>
<td>0.5 mg, 1 mg</td>
<td>0.6 mg</td>
<td>0.5 mg, 1 mg</td>
</tr>
<tr>
<td><strong>Route of administration</strong></td>
<td>Nasal</td>
<td>SC</td>
<td>SC</td>
<td>SC, IM, IV</td>
</tr>
<tr>
<td><strong>Location of administration</strong></td>
<td>Nose</td>
<td>Lower abdomen, outer thigh, or outer upper arm</td>
<td>Lower abdomen, outer thigh, buttocks, or outer upper arm</td>
<td>Upper arms, thighs, or buttocks</td>
</tr>
<tr>
<td><strong>Dosage</strong></td>
<td>3 mg</td>
<td>1 mg</td>
<td>0.6 mg</td>
<td>1 mg</td>
</tr>
<tr>
<td><strong>Requires reconstitution prior to use?</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Shelf-life stability</strong></td>
<td>24 months</td>
<td>24 months</td>
<td>36 months (refrigeration) 12 months (room temperature)</td>
<td>24 months If reconstituted, must use immediately</td>
</tr>
</tbody>
</table>

Hyperglycemia Signs and Symptoms

- Hyperglycemia is defined as glucose >125mg/dL while fasting or >180mg/dL 2 hours after a meal

- Ketoacidosis symptoms
  - Nausea and vomiting
  - Dehydration
  - Abdominal pain
  - Fruity-smelling breath
  - Deep labored breathing or hyperventilation (Kussmaul breathing)
  - Rapid heartbeat
  - Confusion and disorientation
  - Loss of consciousness

Symptoms of Hyperglycemia

- Increased thirst.
- Frequent urination.
- Extreme hunger.
- Blurred vision.
- Slow-healing cuts and sores.
- Fatigue.

Cleveland Clinic. Hyperglycemia Signs, Treatment & Prevention | Cleveland Clinic. Cleveland Clinic. Published February 11, 2020. https://my.clevelandclinic.org/health/diseases/9815-hyperglycemia-high-blood-sugar
Uncontrolled Diabetes Complications

# Diabetes Management Challenges

<table>
<thead>
<tr>
<th>Patient related</th>
<th>Facility related</th>
<th>Diabetes management related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular eating habits</td>
<td>Staff turnover</td>
<td>Sole use of sliding scale insulin</td>
</tr>
<tr>
<td>Altered cognition, anxiety and depression</td>
<td>Lack of nutritional individualization</td>
<td>Mismatch insulin administration timing in relation to feeding time</td>
</tr>
<tr>
<td>Impaired mobility</td>
<td>Lack of or insufficient glucose monitoring</td>
<td>Inappropriate hypoglycemia management</td>
</tr>
<tr>
<td>Polypharmacy and medication reconciliation errors</td>
<td>Limited staff diabetes-specific knowledge and training</td>
<td>Limited knowledge of advanced technologies (continuous glucose monitoring)</td>
</tr>
<tr>
<td>Variable levels of social support</td>
<td>Lack of pharmacist and dietitian support</td>
<td>Lack of comprehensive transitional diabetes management protocol</td>
</tr>
<tr>
<td>Variable nutritional needs</td>
<td>Lack of comprehensive notification system</td>
<td>Lack of diabetes management protocols</td>
</tr>
<tr>
<td>Persistent pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral health, skin and vision problems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Strategies to Replace Sliding Scale Insulin

<table>
<thead>
<tr>
<th>Suggested steps</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSI is the sole mode of insulin treatment</strong></td>
</tr>
<tr>
<td>• Review average daily insulin requirement over prior 5–7 days</td>
</tr>
<tr>
<td>• Give 50–75% of the average daily insulin requirement as basal insulin</td>
</tr>
<tr>
<td>• Stop SSI, use noninsulin agents or fixed-dose mealtime insulin</td>
</tr>
<tr>
<td>• Consider giving basal insulin in the morning to impact postprandial</td>
</tr>
<tr>
<td>hyperglycemia and reduce risk of early-morning hypoglycemia</td>
</tr>
<tr>
<td><strong>SSI is being used in addition to scheduled basal insulin</strong></td>
</tr>
<tr>
<td>• Add 50–75% of the average insulin requirement used as SSI to the existing</td>
</tr>
<tr>
<td>dose of basal insulin</td>
</tr>
<tr>
<td>• Use noninsulin agents or fixed-dose mealtime insulin for postprandial</td>
</tr>
<tr>
<td>hyperglycemia</td>
</tr>
<tr>
<td><strong>SSI is being used in addition to basal and scheduled mealtime insulin</strong></td>
</tr>
<tr>
<td>• If correction dose is required frequently, add the average correction dose</td>
</tr>
<tr>
<td>before a meal to the scheduled mealtime insulin dose at the <strong>preceding</strong></td>
</tr>
<tr>
<td>meal.</td>
</tr>
<tr>
<td><strong>SSI is used in short term due to irregular dietary intake or acute illness</strong></td>
</tr>
<tr>
<td>• Short-term use may be needed for acute illness and irregular dietary intake</td>
</tr>
<tr>
<td>• As health and glucose levels stabilize, stop SSI and return to previous</td>
</tr>
<tr>
<td>regimen as tolerated</td>
</tr>
<tr>
<td>**Wide fluctuations in glucose levels with cognitive decline and/or irregular</td>
</tr>
<tr>
<td>dietary intake**</td>
</tr>
<tr>
<td>• Use scheduled basal and mealtime insulin based on individual needs with the</td>
</tr>
<tr>
<td>goal of avoiding hypoglycemia</td>
</tr>
<tr>
<td>• Keep patients hydrated, especially when glucose levels are high</td>
</tr>
</tbody>
</table>

### Specific Situations Needing Attention

#### Recommendations for LTC staff for diabetes management

| BG reading <70 mg/dL and unresponsive | • Treat hypoglycemia per protocol without any delay |
| Consecutive glucose meter readings <70 mg/dL | • Call practitioner  
• Confirm low glucose value by laboratory test  
• Evaluate nutritional intake  
• Consider an increase in frequency of glucose monitoring for 24 h  
• Adjust diabetes regimen as needed |
| BG readings >250 mg/dL two or more times within 24-h period accompanied by a new or change in medical or functional status | • Call practitioner  
• Increase frequency of glucose monitoring |
| BG readings >300 mg/dL during all or part of 2 consecutive days | • Confirm high glucose value by laboratory test  
• Evaluate nutritional intake |
| Any glucose reading too high to measure by glucose meter | • Adjust diabetes regimen as needed  
• If glucose levels are persistently high after changes to the diabetes regimen, consider medical evaluation for other causes (i.e., infection) |
| Patient not eating, vomiting, or unable to take oral glucose-lowering medications | • Call practitioner **as soon as possible**  
• Consider insulin therapy and adjust dose accordingly based on nutritional status |

Tips to Prevent Adverse Events

Try to minimize the use of sliding scale insulins

Use CGMs whenever possible

Consider administering insulin after meals to ensure the dose is appropriate for the amount of carbohydrates consumed

Confirm medication expiration date prior to administration

Measure blood glucose prior to administering an agent with a risk of hypoglycemia
References

Questions?
Nursing Home and Partnership for Community Health: CMS 12th SOW GOALS

**OPIOID UTILIZATION AND MISUSE**
- Promote opioid best practices
- Reduce opioid adverse drug events in all settings

**PATIENT SAFETY**
- Reduce hospitalizations due to c. diff
- Reduce adverse drug events
- Reduce facility acquired infections

**CHRONIC DISEASE SELF-MANAGEMENT**
- Increase instances of adequately diagnosed and controlled hypertension
- Increase use of cardiac rehabilitation programs
- Reduce instances of uncontrolled diabetes
- Identify patients at high-risk for kidney disease and improve outcomes

**CARE COORDINATION**
- Convene community coalitions
- Reduce avoidable readmissions, admissions to hospitals and preventable emergency department visits
- Identify and promote optimal care for super utilizers

**COVID-19**
- Support nursing homes by establishing a safe visitor policy and cohort plan
- Provide virtual events to support infection control and prevention
- Support nursing homes and community coalitions with emergency preparedness plans

**IMMUNIZATION**
- Increase influenza, pneumococcal, and COVID-19 vaccination rates

**TRAINING**
- Encourage completion of infection control and prevention trainings by front line clinical and management staff
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