Leveraging Health Literacy and Patient Preferences to Reduce Hypoglycemic Events in Patients with Type 2 Diabetes
Learning Objectives

• Describe the prevalence of hypoglycemic events among patients with type 2 diabetes mellitus and risk factors leading to an event

• Introduce methods of assessing health literacy and numeracy of patients and caregivers

• Review effective ways to incorporate patient preferences into care plans and differentiate A1C target values for individuals

• List the action steps to reduce the likelihood of a hypoglycemic event for a high risk patient
What Is Hypoglycemia?

- Hypoglycemia, or low blood sugar, occurs when the level of glucose in the blood drops below normal
  - For many people with diabetes, that means a level of 70 milligrams per deciliter (mg / dL) or less
- Can be a side effect of both insulin and some other hypoglycemic prone anti-hyperglycemic medications
Symptoms of Hypoglycemia

- Dizziness
- Blurred Vision
- Headache
- Sweating
- Difficulty Concentrating
- Fast Heartbeat
- Palpitations
- Hunger
- Shakiness
- Tiredness
- Anxiety
Risk Factors for Hypoglycemia

• Intensive glucose control / A1C targets too low
• Advanced age and cognitive decline
• Low health literacy and numeracy
• Social determinants including food insecurity
• Insulin and / or sulfonylurea medication therapy
• Low economic status
• Prior hypoglycemic episode
• Hypoglycemia unawareness
• Liver / kidney disease
Prevalence of Hypoglycemia

• In 2015, a population-based meta-analysis estimated that, among patients with type 2 diabetes taking insulin,\(^2\)
  – Prevalence of mild / moderate hypoglycemia was 52%
  – Prevalence of severe hypoglycemia was 21%
  – Incidence of mild / moderate hypoglycemia was 23 events per person-year
  – Incidence of severe hypoglycemia was 1 event per person-year

• In 2011, about 282,000 ED visits for adults \(\geq\)18 yrs. had hypoglycemia as the first-listed diagnosis and diabetes as another diagnosis\(^1\)

Prevalence of Hypoglycemia

- The National Electronic Injury Surveillance System-Cooperative Adverse Drug Event Surveillance (NEISS-CADES) analyzed the frequency and rates of hospitalization after ED visits in older adults:
  - 94% of hospitalizations from endocrine agents were for hypoglycemia\(^1\)
  - About 2/3 of these hospitalizations involved neurologic symptoms (loss of consciousness, seizures, changes in mental status)\(^1\)

Risk of Hypoglycemia in Older Veterans with Dementia and Cognitive Impairment

With Permission: Feil, D.G.; Rajan, M.; Soroka, O.; Tseng, C.L.; Miller, D.R.; Pogach, L.M.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Frequency of Hypoglycemia</th>
<th>Patients on Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dementia</td>
<td>14.1%</td>
<td>30%</td>
</tr>
<tr>
<td>Cognitive Impairment</td>
<td>10.4%</td>
<td>30%</td>
</tr>
<tr>
<td>Neither</td>
<td>6.3%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Knowledge Check

Symptoms of hypoglycemia include:

a) Headache, blurred vision
b) Seizures
c) Confusion
d) All of the above
e) None of the above
Knowledge Check

Symptoms of hypoglycemia include:

a) Headache, blurred vision
b) Seizures
c) Confusion
d) All of the above
e) None of the above
Heart Disease Rates in Diabetes Patients

- Three landmark trials compared the rates of heart disease in patients receiving:
  - Intensive diabetes treatment
  - Conventional diabetes treatment
- The trials demonstrated that intensive blood glucose lowering to near normal levels resulted in more hypoglycemia requiring medical assistance
ACCORD, ADVANCE, and VADT

• Action to Control Cardiovascular Risk in Diabetes (ACCORD) study

• Action in Diabetes and Vascular Disease (ADVANCE) trial

• Veterans Affairs Diabetes Trial (VADT)
Outpatient Intensive Glucose Control

With Permission: Frier, B.M.; Schernthaner, G.; Heller, S.R.

Benefits of Intensive Glucose Control

ACCORD  ADVANCE  VADT

NO clear benefit of intensive blood glucose control on heart disease risk

https://diatribe.org/issues/10/learning-curve

2017 U.S. Food & Drug Administration
A1C Variabilities

• The A1C test reflects average blood glucose levels over the past 2-3 months

• Results can vary by as much as 2-6% depending on the lab where the test was performed
  – This means an A1C measured as 7.0% could indicate a true A1C anywhere in the range from ~6.6-7.4%

ACCORD Trial – Root Cause of Hypoglycemic Events

1) use of diabetes medications
2) inadequate Caloric intake and food insecurity
3) exercise
4) errors with use of medications
5) current illnesses
Food Insecurity

- Screening question:
  - "In the past month, was there any day when you or anyone in your family went hungry because you did not have enough money for food?"

- 1 in 7 U.S. households do not have adequate access to food

Food Insecurity

Risk for hypoglycemia admission ↑ 27% in the last week of the month vs. first week in low-income population

Factors Increasing Hypoglycemic Events—Patient Controlled

• Insufficient carbohydrate intake
• Skipping or delaying meals
• Increasing physical activity
• Drinking too much alcohol without enough food
• Taking medications incorrectly
• Inadequate nutrition during illness
Factors Increasing Hypoglycemic Events—Provider Controlled

- Lack of shared decision making and individualized A1C target setting
- Aggressive hyperglycemic medication prescribing
- Not addressing patient knowledge gaps
- Failure to address food insecurity
Knowledge Check

On average, A1C test results can differ by as much as:

a) 10%
b) 8% to 12%
c) 2% to 6%
d) 0.5% to 1%
e) None of the above
Knowledge Check

On average, A1C test results can differ by as much as:

a) 10%
b) 8% to 12%
c) 2% to 6%
d) 0.5% to 1%
e) None of the above
What Is Health Literacy?

• “The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.”

• Deficits are not always obvious, so if these skills are not specifically assessed, they may go unrecognized.


2017 U.S. Food & Drug Administration
Health Literacy Issues

• **77 million** U.S. adults have basic or below basic health literacy. ¹

• Only **12%** of U.S. adults had proficient health literacy. ¹

• Evidence supports an association between limited health literacy and numeracy and poor diabetes outcomes. ²

Health Literacy Domains

Cultural and conceptual knowledge

Numeracy

Writing and reading skills

Speaking and listening skills


2017 U.S. Food & Drug Administration
Diabetes-Specific Numeracy

• Numeracy is the ability to understand and work with numbers
• Interpreting dietary information requires high numeracy skills
• Examples include A1C target, blood glucose readings, and carbohydrate calculations

https://en.oxforddictionaries.com/definition/numeracy
Methods of Assessing Health Literacy / Health Numeracy

• Spoken Knowledge in Low Literacy in Diabetes (SKILLD) Scale

• Diabetes Knowledge Test (DKT2)

• Diabetes Numeracy Test (DNT15)

• Single-Item Literacy Screener (SILS)
Spoken Knowledge in Low Literacy in Diabetes (SKILLLD) Scale

- Developed to screen patients with diabetes and low literacy for deficits in self-care knowledge.
- 10-item, open-answer test
- Questions about behaviors patients should have to best manage their diabetes

## Spoken Knowledge in Low Literacy in Diabetes (SKILLD) Scale Sample Questions

**With Permission**: Rothman, R.; Malone, R.; Bryant, B.; Wolfe, C.; Padgett, P.; DeWalt, D; Weinberger, M.; Pignone, M.

<table>
<thead>
<tr>
<th>Item no.</th>
<th>SKILLD items in English</th>
<th>Escala De Conocimiento Oral En Pacientes Diabéticos Con Bajo Nivel de Lectoescritura</th>
<th>Correct responses (Revisions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What are the signs and symptoms of high blood sugar? (Name at least 2)</td>
<td>¿Cuáles son los signos y síntomas del azúcar alto en la sangre? (al menos dos)</td>
<td>Answer must contain 2 of any of the following: extreme thirst, frequent urination, drinking or eating, blurred vision, drowsiness, fatigue.</td>
</tr>
<tr>
<td></td>
<td><strong>Probe:</strong> How do you feel when your blood sugar is high or when you are diagnosed?</td>
<td><strong>Exploración:</strong> ¿Cómo se siente cuando tiene alto su nivel de azúcar o cuando le diagnosticaron que lo tiene alto?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>What are the signs and symptoms of low blood sugar? (Name at least 2)</td>
<td>¿Cuáles son los signos o síntomas del azúcar bajo en la sangre? (al menos dos)</td>
<td>Answer must contain 2 of any of the following: hunger, nervousness, jiteriness, mood swings, irritability, confusion, sweatiness, fast heart rate, dizziness, light-headedness, weakness.</td>
</tr>
<tr>
<td></td>
<td><strong>Probe:</strong> How do you feel when your blood sugar is too low?</td>
<td><strong>Exploración:</strong> ¿Cómo se siente cuando tiene muy bajo su nivel de azúcar?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>How do you treat low blood sugar?</td>
<td>¿Cómo trata el nivel bajo de azúcar?</td>
<td>Answer must be clear about action: drink juice, eat candy, drink milk, eat sugar or sweets, drink sugared soft drink, or at least 15 grams of carbohydrates.</td>
</tr>
<tr>
<td></td>
<td><strong>Probe:</strong> What should you do if your sugar is too low? How can you bring your blood sugar up if it’s too low?</td>
<td><strong>Exploración:</strong> ¿Qué debería hacer si tiene bajo su nivel de azúcar? ¿Cómo puede usted subir su nivel de azúcar si está muy bajo?</td>
<td></td>
</tr>
</tbody>
</table>


2017 U.S. Food & Drug Administration
Diabetes Knowledge Test (DKT2)

- Quick and low-cost method of assessing a patient’s or a population’s general knowledge of diabetes and diabetes self-care
- 2 components: 14-item general test and 9-item insulin use subscale
- Translated into several languages

Diabetes Knowledge Test (DKT2) Sample Questions

1. Which of the following is highest in carbohydrate?
   a. Baked chicken
   b. Swiss cheese
   c. Baked potato
   d. Peanut butter

2. For a person in good control, what effect does exercise have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect

3. What effect will an infection likely have on blood glucose?
   a. Lowers it
   b. Raises it
   c. Has no effect

4. If you have taken rapid-acting insulin, you are most likely to have a low blood glucose reaction in:
   a. Less than 2 hours
   b. 3 - 5 hours
   c. 6 - 12 hours
   d. More than 13 hours


2017 U.S. Food & Drug Administration
Diabetes Numeracy Test (DNT)

- A valid and reliable assessment of diabetes-specific numeracy
- DNT15 is a shortened version that can be used by clinicians or diabetes educators to help target education or guide therapy
- Touches on 5 diabetes self-care areas
  - 3 items on nutrition
  - 1 item on exercise
  - 3 items on blood glucose monitoring
  - 1 on oral medications
  - 7 on insulin administration

Diabetes Numeracy Test (DNT) Sample Questions

With Permission: Cavanaugh, K.L.

A. You ate one and a half cups from the food labeled below. How many grams of carbohydrate did you eat?

Nutrition facts
Serving size: 1/2 cup
Servings per container: 10

Amount per serving
Calories: 150
Total fat: 7 g
Total carbohydrates: 18 g
Dietary fiber: 3 g
Sugars: 3 g
Total protein: 3 g

Answer: 36 g

B. You test your blood sugar three times a day. You purchase a prescription of 50 strips on 5 March. Of the dates below, by when will you need to buy new strips?

- 21 March
- 21 April
- 21 May
- 21 June

Answer: 21 March

C. You are given the following instructions: “take one unit of insulin for every 7 g of carbohydrate you eat.” How much insulin do you take:

— when you eat 98 g at supper?

Answer: 14 units

Single-Item Literacy Screener (SILS)

• One question: “How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?”

• Responses range from 1 (never) to 5 (always)

• A response of 2 is the identifying cut-off point as to who may be in need of assistance

Adult Carb Quiz

• Validated method of assessing patients’ knowledge of carbohydrate counting
• 43 item quiz that takes ~15 minutes to complete
• 6 domains:
  – Carbohydrate food recognition
  – Carbohydrate food content
  – Nutrition label reading
  – Glycemic targets
  – Hypoglycemia prevention and treatment
  – Calculating carbohydrate composition in a mixed meal


2017 U.S. Food & Drug Administration
Adult Carb Quiz Sample Questions

1. A good blood sugar reading just before a meal would be...

2. You are going to mow the grass, which takes about 30 minutes of solid work. By how many points do you expect your blood sugar to go down?
Knowledge Check

A U.S. Department of Health and Human Services brief said that 77 million Americans were identified as having basic or below basic health literacy.

True

False
Knowledge Check

A U.S. Department of Health and Human Services brief said that 77 million Americans were identified as having basic or below basic health literacy.

True

False
Knowledge Check

Evidence supports an association between limited health literacy and poor diabetes outcomes.

True

False
Knowledge Check

Evidence supports an association between limited health literacy and poor diabetes outcomes.

True

False
Translation into Practice

• Appropriately tailor interventions and provide health education

• Communicate using simple language
  – Use the “Two syllable rule” when creating written and spoken educational materials
  – Limit information to no more than three topics


“Teach Back” or “Show Me” Method

- Ask them to explain in their own words
- Use plain language
- Ask open-ended questions
- Use non-shaming language and tone
- Use comfortable body language and eye contact
- If needed, re-explain and check again
Apply the Ask Me 3

1. What is my main problem?

2. What do I need to do?

3. Why is it important to do this?
Knowledge Check

Which of the following tests or methods have been identified as effective health literacy tools? (Choose all that apply)

a) SKILLD  
b) DKT2  
c) SILS  
d) TNT  
e) All of the above
Knowledge Check

Which of the following tests or methods have been identified as effective health literacy tools? (Choose all that apply)

a) SKILLD  
b) DKT2  
c) SILS  
d) TNT  
e) All of the above
Knowledge Check

The easiest way to ensure your message complies with universal literacy comprehension is to limit your patient discussion to words that are two syllables or less whenever possible.

True

False
Knowledge Check

The easiest way to ensure your message complies with universal literacy comprehension is to limit your patient discussion to words that are two syllables or less whenever possible.

True

False
Key Elements of Shared Decision Making (SDM)

- Ask
- Prioritize
- Assess
- Advise
- Acknowledge
- Assist
- Make Decision
- Evaluate
Shared Decision-Making Algorithm

Adult with diabetes Type 2 AND hypertension, or dyslipidemia, or BMI >25kg/m or other recognized risk for serious cardiovascular event facing decision regarding intensive treatment option

Is condition urgent / emergent?
- Ask - Listen
- Prioritize problems (focus)
- Assess patient readiness to make decision (capacity)
- Is patient ready to proceed in decision-making process?
  - Re-address at next visit

Exit SDM process; treat as indicated

Educate patient & family: information transfer
- Agree on criteria for making the decision
- Present options
- Weigh benefit and risk, like and dislike, pros and cons
- Make choice (decision)
- Evaluate the process (experience & expectations)

Step 1: Assess Health Literacy Status and Assume Some Level of Health Literacy Deficit

• Utilize one or more health literacy assessment tools

• Apply universal precautions by assuming some level of health literacy deficit

• Adjust communication style based on level of health literacy
Step 2: Identify Critical Factors

**Major Comorbidity**
- Significant cardiovascular disease
- Severe CKD
- Severe COPD
- Severe chronic liver disease
- Life threatening cancer
- Recent stroke

**Physiologic Age with Life Expectancy**
- >10 years
- 5-10 years
- <5 years

**Microvascular Disease**

**Absent or Mild**
- Early retinopathy
- Microalbuminuria (<30mg / dL)
- Mild nephropathy

**Moderate**
- Pre-proliferative retinopathy
- Sensory loss
- Macroalbuminuria (fixed proteinuria (>300 mg / dL)]

**Advanced**
- Retinopathy with hemorrhage
- Proliferative retinopathy
- Creatinine >2.0
- Insensate extremities
- Autonomic neuropathy

Step 3: Recommend Target Based on “7-8-9” A1C Goal Ranges

<table>
<thead>
<tr>
<th>Major Comorbidity or Physiologic Age</th>
<th>Absent or Mild Microvascular Complications</th>
<th>Moderate Microvascular Complications</th>
<th>Advanced Microvascular Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absent</strong></td>
<td>&lt;7%</td>
<td>&lt;8%</td>
<td>8-9%</td>
</tr>
<tr>
<td>&gt;10 years of life expectancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Present</strong></td>
<td>&lt;8%</td>
<td>&lt;8%</td>
<td>8-9%</td>
</tr>
<tr>
<td>5-10 years of life expectancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marked</strong></td>
<td>8-9%</td>
<td>8-9%</td>
<td>8-9%</td>
</tr>
<tr>
<td>&lt;5 years of life expectancy</td>
<td></td>
<td></td>
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</tbody>
</table>

Step 4: Discuss Recommended A1C Target and Ask Patient About Factors Specific to Them

Patient Factors to Consider

- Motivation
- Adherence
- Ability to care for themselves
- Support system
- Risk / fear of hypoglycemia
- Economic factors
Step 5: Use Framework and Patient Preferences to Collaborate with Patient / Family for Best Management Option

Framework to assist in determining glycemic treatment targets in patients with type 2 diabetes.

More Intense Treatment

Less Intense Treatment

Psychosocioeconomic Considerations

Highly motivated, adherent, knowledgeable, excellent self-care capacities, and comprehensive support systems

Less motivated, nonadherent, limited insight, poor self-care capacities, and weak support system

Hypoglycemia risk

Low

Moderate

High

Patient age, y

40

45

50

55

60

65

70

75

Disease duration, y

5

10

15

20

Other comorbid conditions

None

Few or mild

Multiple or severe

Established vascular complications

None

None

Cardiovascular disease

Early microvascular

Advanced microvascular

Step 6: Agree on Action Plan and Set Goals

- Patients and caregivers may accept your recommendations OR choose a less / more intensive strategy.

- The objective of SDM is to partner with the patient for safe and effective care, always allowing them to change their goals.
## Medication Selection

<table>
<thead>
<tr>
<th>High Hypoglycemic Risk</th>
<th>Moderate Hypoglycemic Risk</th>
<th>Low Hypoglycemic Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulin</strong></td>
<td><strong>Meglitinides</strong></td>
<td><strong>Biguanides</strong></td>
</tr>
<tr>
<td><strong>Sulfonylureas</strong></td>
<td>(nateglinide, repaglinide)</td>
<td>(metformin)</td>
</tr>
<tr>
<td>(glyburide, glipizide,</td>
<td></td>
<td><strong>DPP-4 Inhibitors</strong></td>
</tr>
<tr>
<td>glimepiride, tolamazide,</td>
<td></td>
<td>(sitagliptin,</td>
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<tr>
<td>tolbutamide, chlorpropamide)</td>
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<td>saxagliptin,</td>
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<td>linaglaptin,</td>
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<td>alogliptin)</td>
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<tr>
<td></td>
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<td><strong>GLP-1 analogs</strong></td>
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<tr>
<td></td>
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<td>(exenatide,</td>
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<td>albiglutide, dulaaglutide,</td>
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<td></td>
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<td>liraglutide)</td>
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<td></td>
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<td><strong>SGLT-2 inhibitors</strong></td>
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<td></td>
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<td>(canagliflozin, empagliflozin,</td>
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<td></td>
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<td>dapagliflozin)</td>
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<td><strong>Thiazolidinediones</strong></td>
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<td></td>
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<td>(rosiglitazone, pioglitazone)</td>
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<td><strong>Alpha-glucosidase inhibitors</strong></td>
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<td>(miglitol, acarbose)</td>
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</table>
## Medication Management

<table>
<thead>
<tr>
<th>Icon</th>
<th>Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>🍽️🍴</td>
<td>Advise patients to avoid skipping meals to reduce need for medication adjustment and risk of hypoglycemic events</td>
</tr>
<tr>
<td>🏋️‍♂️</td>
<td>Inform patients that exercising during the peak effect of a rapid-acting insulin dose increases the risk of severe hypoglycemia</td>
</tr>
<tr>
<td>🍭</td>
<td>Always carry glucose tablets / gels or hard candy if at risk for hypoglycemia</td>
</tr>
<tr>
<td>🌴💊</td>
<td>Teach patients to take medications correctly, e.g., insulin and sulfonylurea timing with meals</td>
</tr>
</tbody>
</table>
Knowledge Check

Which drug class has the LOWEST risk of hypoglycemia?

A. FalseInsulin (long-acting)
B. Sulfonylureas (glyburide)
C. Meglitinides (repaglinide)
D. Biguanides (metformin)
Knowledge Check

Which drug class has the LOWEST risk of hypoglycemia?

A. False Insulin (long-acting)
B. Sulfonylureas (glyburide)
C. Meglitinides (repaglinide)
D. Biguanides (metformin)
Knowledge Check

Each step of the shared decision-making process should be used for every patient.

True
False
Knowledge Check

Each step of the shared decision-making process should be used for every patient.

True

False
Case Study

GT is a 72 year old man with an A1C of 7.2% and history of cardiovascular disease, including a myocardial infarction (MI) two years ago. For his diabetes, he is currently taking metformin 500mg BID, glipizide 5mg BID, and Lantus 20 units at bedtime. GT has a fixed income with limited access to food, and his wife recently passed away.

List action steps that you would take to minimize the risk of a hypoglycemic event for this patient.
Action Steps to Minimize Risk for Hypoglycemic Event

1. Determine health literacy and numeracy gaps.
   Identify critical factors.

2. Recommend an A1C target based on “7-8-9” ranges.
   Discuss recommended A1C target and ask the patient about factors specific to them.
   Use framework and patient preferences to collaborate with patient and family.

3. Agree on an action plan and set goals.
1. **Determine any health literacy and numeracy gaps.** It was observed that the patient incorrectly measured units of insulin.

2. **Identify critical factors.** The patient had a myocardial infarction two years ago, and has cardiovascular disease.

3. **Recommend an A1C target based on “7-8-9” ranges.** Due to the patient’s age, co-morbid disease states, and the fact that he lives alone and has limited access to food, an A1C target range of 8-9% was set.

4. **Discuss recommended A1C target and ask the patient about factors specific to them.** This patient lived alone, is on a fixed income, and has limited access to food. This increases his risk for hypoglycemia and puts him at risk for severe consequences.

5. **Use framework and patient preferences to collaborate with patient / family.** Partnership with the patient occurred throughout the whole process.

6. **Agree on an action plan and set goals.** The patient’s bedtime Lantus dose was decreased. Patient was given contact information of a local resource to access food, and shown the correct technique to measure insulin. The patient was scheduled to return for a follow-up appointment, and was also referred to a registered dietitian nutritionist for assistance with food insufficiency.
Summary

Hypoglycemia is considerably prevalent among people with type 2 diabetes, particularly those on insulin.

• Assume some level of health literacy and numeracy deficit in patients
• Communicate using simple language
• Personalize each A1C target depending on patient risk factors, using shared decision making to enhance safe and effective care
• Create safe and effective care plans using patient specific social determinants of health to reduce the risk of a hypoglycemic event
Conclusion

You should now be able to:

• Describe the prevalence of hypoglycemic events among patients with type 2 diabetes mellitus and identify risk factors leading to an event.

• Introduce methods of assessing health literacy and numeracy of patients and caregivers.

• Review effective ways to incorporate patient preferences into care plans and differentiate A1C target values for individuals.

• List the action steps to reduce the likelihood of a hypoglycemic event for a high-risk patient.