

# Role of Nursing in the Continuum of Inpatient Diabetes Care



# Overview

- Hyperglycemia in the hospital setting
  - Common
  - Costly
  - Associated with poor clinical outcomes
- Glycemic targets have been modified
  - 140-180 mg/dL
- Insulin is the treatment of choice to manage hyperglycemia
- Hyperglycemia management requires multidisciplinary collaboration

**Nursing role is critical throughout hospitalization**

# Importance of Nursing Care for Improving Glycemic Control

- 24-hour coverage by nursing
- Nursing often coordinates, and is aware of, the multiple services required by patient
  - Travel off unit, (eg, physical therapy, X-ray)
  - Amount of food eaten (carbohydrates)
  - Patient's day-to-day concerns
  - Order changes (by various providers)



# Inpatient Glycemic Control Recommendations

- Identify elevated blood glucose in all hospitalized patients
- Implement structured protocols for control of blood glucose throughout the hospital
  - Glucose targets:
    - ICU: 140-180 mg/dL for most patients
    - Noncritically ill: Fasting BG <140 mg/dL; random BG <180 mg/dL
- Create educational programs for all hospital personnel caring for people with diabetes
- Plan for a smooth transition to outpatient care with appropriate diabetes management

# Factors Affecting Blood Glucose Levels in the Hospital Setting

- Increased counter-regulatory hormones
- Changing IV glucose rates
- TPN and enteral feedings
- Lack of physical activity
- Unusual timing of insulin injections
- Use of glucocorticoids
- Unpredictable or inconsistent food intake
- Fear of hypoglycemia
- Cultural acceptance of hyperglycemia

TPN, total parenteral nutrition.

Carter L. *Oklahoma Nutrition Manual*, 12<sup>th</sup> ed. Owasso, OK: Oklahoma Dietetic Association; 2006.

AACE Inpatient Glycemic Control Resource Center



# Glucose Control Deteriorates During Hospitalization

## Hyperglycemic Influences

- “Stress” hyperglycemia
- Concomitant therapy
- Decreased physical activity
- Medication omissions
- Medication errors
- Fear of hypoglycemia

## Hypoglycemic Influences

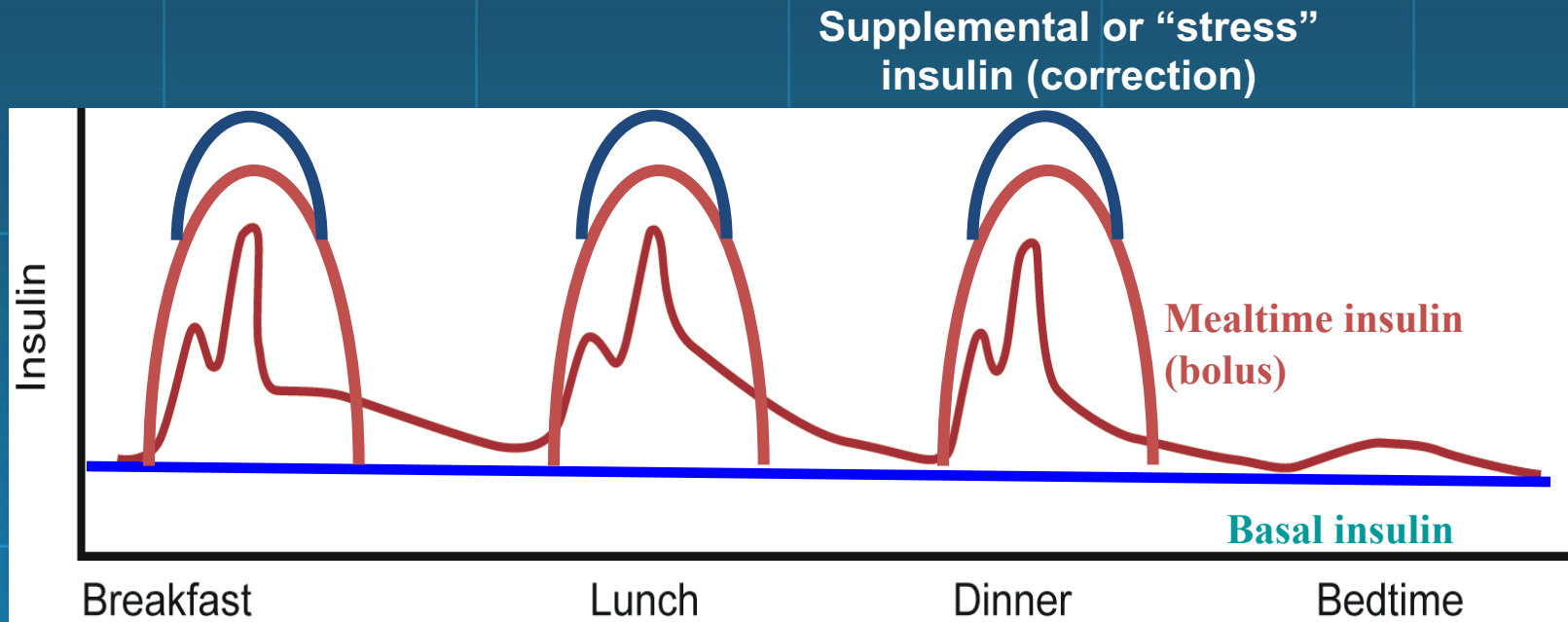
- Decreased caloric intake
- Gastrointestinal illness
- Monitored compliance
- Medication errors
- Altered cognition



# Components of Insulin Therapy

- **Basal insulin:** the amount of insulin necessary to regulate glucose levels between meals and overnight
  - Detemir (Levemir), glargine (Lantus), NPH
- **Nutritional insulin:** insulin required to cover meals, IV dextrose, enteral nutrition, total parenteral nutrition (TPN), or other nutritional supplements
  - Rapid-acting: aspart (NovoLog), glulisine (Apidra), lispro (Humalog)
  - Short-acting: regular (Humulin, Novolin)
- **Correction insulin:** supplemental doses of short- or rapid-acting insulin given to correct blood glucose elevations that occur despite use of basal and nutritional insulin
  - Usually administered before meals together with nutritional insulin

# Maintaining Physiologic Insulin Delivery in the Hospital





# Subcutaneous Basal-Bolus Insulin

*A combination of basal, nutritional (prandial), and correction (supplemental) insulin given to maintain target glucose levels*

- Nutritional/prandial bolus doses of rapid- or short-acting insulin may be titrated based on the CHO content of the meal, or fixed doses may be ordered if consistent CHO meal plans are used
- Correction bolus doses of rapid- or short-acting insulin may be added to the nutritional/prandial dose to correct hyperglycemia
- Treat hypoglycemia with oral CHO or D50 IV per hypoglycemia guidelines or protocol

**Prolonged therapy using sliding scale regular insulin is not recommended**

# Sliding Scale Insulin Is Associated With Higher Glucose Levels and Poorer Clinical Outcomes

- Patients receiving a sliding scale had mean in-hospital glucose values of 213 mg/dL vs 130 mg/dL ( $P < 0.0001$ )
- Sliding scale insulin was associated with higher odds ratios of the following outcomes:
  - Cardiovascular complications or death (OR=1.86; 95% CI 0.99-3.49)
  - Sepsis or ICU admission (OR=4.98; 95% CI 2.38-10.42)



# Insulin Time Action Profile

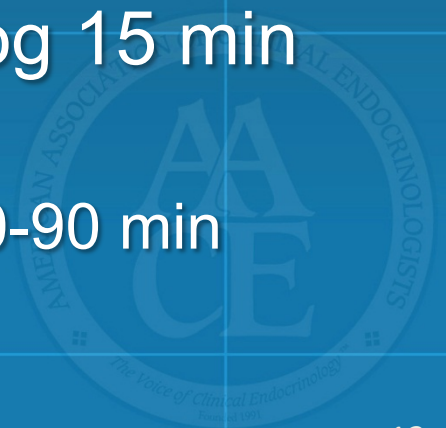
Insulin	Onset	Peak	Duration
<b>Basal</b>			
Detemir	2 hours	Relatively peakless	16-24 hours
Glargine	2-4 hours	Relatively peakless	20-24 hours
NPH	2-4 hours	4-10 hours	12-18 hours
<b>Nutritional (prandial)</b>			
Rapid-acting analog (aspart, glulisine, lispro)	5-15 min	1-2 hours	4-6 hours
Regular	30-60 min	2-3 hours	6-10 hours

Hirsch I. *N Engl J Med.* 2005;352:174-183.  
 Porcellati F, et al. *Diabetes Care.* 2007;30:2447-2552.



# Point of Care Glucose Testing and Insulin Administration

- Proper timing of glucose testing and insulin administration can reduce the risk of hypoglycemia and hyperglycemia
- Administer short-acting regular insulin 30 min before meals
  - Regular insulin peaks in 2-4 hours
- Administer rapid-acting insulin analog 15 min before meals
  - Rapid-acting insulin analogs peak in 60-90 min



# CONTROLLING HYPOGLYCEMIA



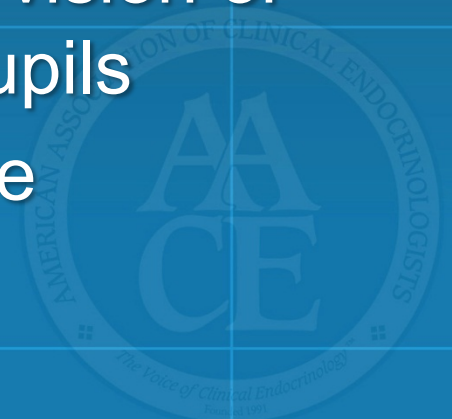
# What Is Hypoglycemia?

- Blood glucose  $<70$  mg/dL in the hospitalized patient
- Also referred to as “low blood sugar”
- Classified as mild, moderate, or severe



# Signs and Symptoms of Hypoglycemia (Blood Glucose <70 mg/dL)

- Tachycardia
- Hunger
- Restlessness
- Weakness/fatigue
- Diaphoresis
- Pallor
- Shakiness
- Irritability
- Anxiousness
- Light-headedness
- Change in mental status (eg, confusion)
- Impaired vision or dilated pupils
- Headache



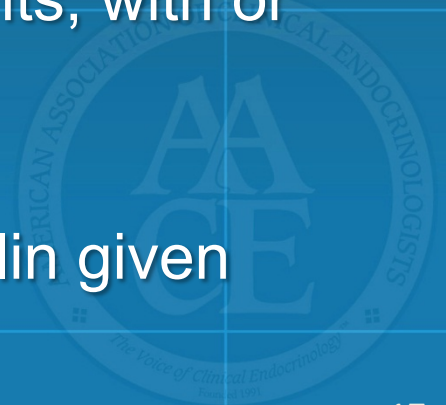
# Counter-regulatory Hormones Combating Hypoglycemia

- Glucagon
  - Produced in the alpha cells of the pancreas
- Epinephrine and norepinephrine
  - Responsible for many of the autonomic signs and symptoms of hypoglycemia
- Growth hormone
- Cortisol
- Counter-regulatory hormones increase blood glucose
  - During stress
  - In the early morning (circadian rhythm)
- Patients with type 1 diabetes have less counter-regulatory glucagon hormone reserves (within 2-5 years of diagnosis) than those with type 2 diabetes



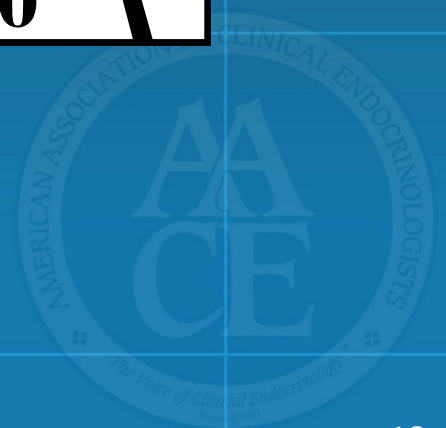
# Hypoglycemia

- Hypoglycemia can be life-threatening
- Common causes of hypoglycemia in the hospital include:
  - Too much insulin or insulin given out of sync with meals
  - Inadequate food intake, vomiting
  - Continuation of oral hypoglycemic agents, with or without insulin
  - Changes in eating status (eg, NPO)
  - Unexpected transport off unit after insulin given



# Glucose Testing and Insulin Administration

- Timing is important
- Proper timing of glucose testing and insulin administration can reduce the risk of hypoglycemia



# Blood Glucose Check—Too Early

- Patient requires regular insulin coverage
- Blood glucose checked at 0610
- Insulin is given at 0620
- Breakfast arrives at 0740
- Potential harm: hypoglycemia
- Ideally regular insulin should be given 30 min before meal
  - If necessary, regular insulin may be given with the meal
- Insulin should not be given more than 30 min before the meal

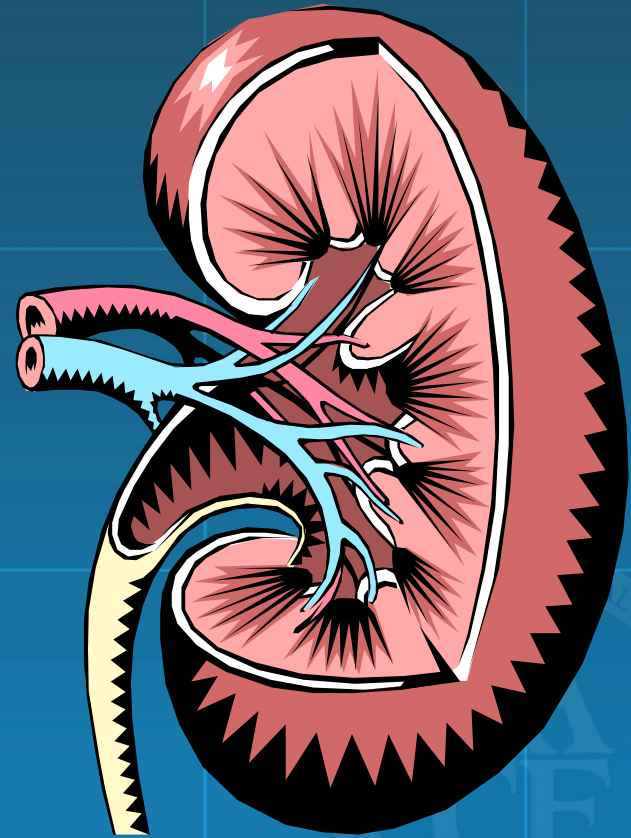
# Hypoglycemia Is Serious but Treatable

- Institute a “Hypoglycemia Order Set” or “Hypoglycemia Protocol”
- Know the peak time of the different types of insulin
- Remember that more activity (energy output) or less carbohydrate (energy intake) can cause hypoglycemia



# Hypoglycemia in Renal/Liver Disease

- Rising serum creatinine can contribute to hypoglycemia
- Liver disease can cause a depletion of glucose reserves for treatment of hypoglycemia



# Essential Part of Any Insulin Use: A Hypoglycemia Protocol

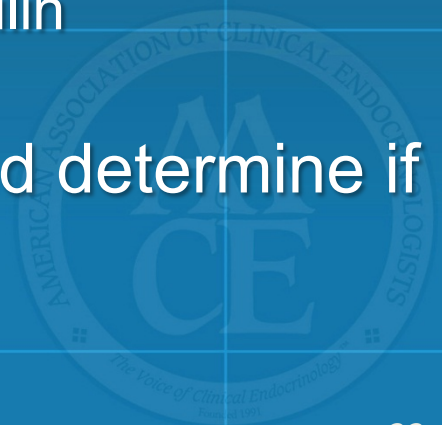
- Clear definition of hypoglycemia
  - BG <70 mg/dL
- Nursing order to treat without delay
  - Stop insulin infusion (if applicable)
  - Oral glucose (if patient is able to take oral)
  - IV dextrose or glucagon (if patient is unable to take oral)
  - Repeat BG monitoring 15 min after treatment for hypoglycemia and repeat treatment if BG not up to target
  - Directions for when and how to restart insulin
- Document the incident
- Look for the cause of hypoglycemia and determine if other treatment changes are needed

BG, blood glucose.

Moghissi ES, et al. *Endocrine Pract.* 2009;15:353-369.

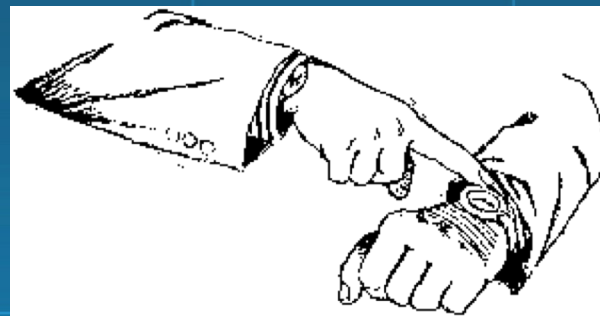
Umpierrez GE, et al. *J Clin Endocrinol Metab.* 2012;97:16-38.

AACE Inpatient Glycemic Control Resource Center

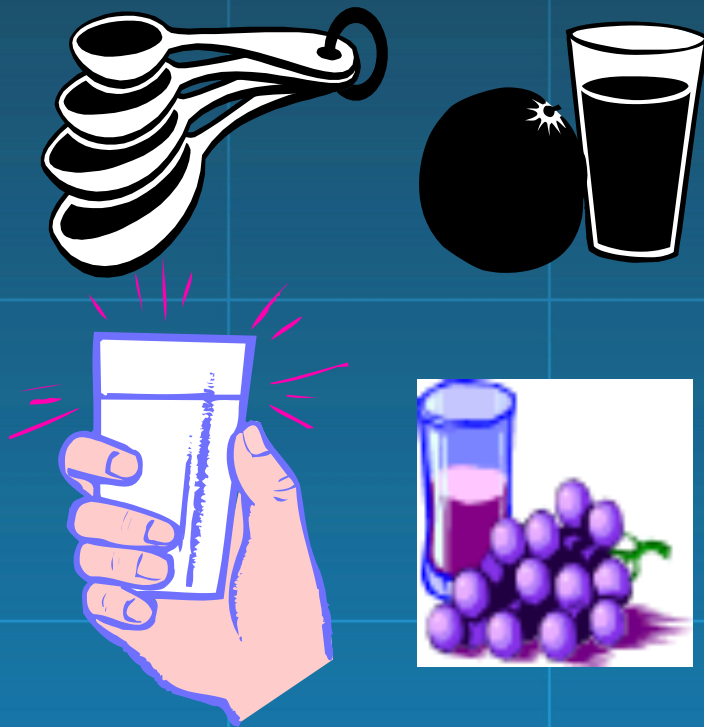


# The 15-15 Rule

- Give 15 grams of fast-acting carbohydrate and wait 15 minutes
- Recheck blood glucose and then give another 15 grams of fast-acting carbohydrate, if necessary



# 15 Grams of Carbohydrate Raises Blood Glucose by 30-50 mg/dL



- 1 tube oral glucose gel
- 3-4 glucose tablets\*
- ½ cup juice
- 1 tablespoon sugar, honey, or jelly
- 8 oz milk

\* Glucose tablets may contain 4 or 5 g of glucose



# Treating Hypoglycemia When the Patient Can Swallow

- 15-gram glucose tube or 3-4 glucose tablets\*
- 4 oz fruit juice
- 8 oz milk



\* Glucose tablets may contain 4 or 5 g of glucose

# Treatment of Hypoglycemia in an Unconscious Patient

- Use an IV site to administer dextrose  
OR
- Administer IM or SC glucagon



# HYPERGLYCEMIA



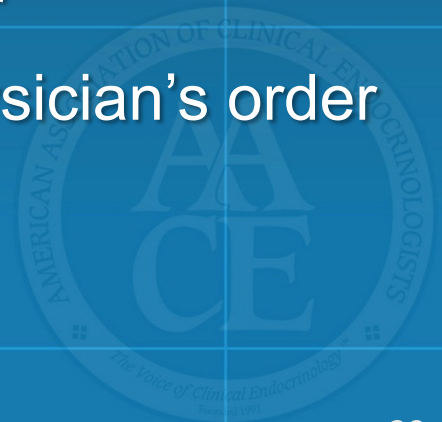
# Hyperglycemia

- What is the goal for the bedside nurse?
  - Notify the physician when blood glucose levels are out of control
  - Implement the orders and notify the physician when indicated to avoid hyperglycemia and hypoglycemia



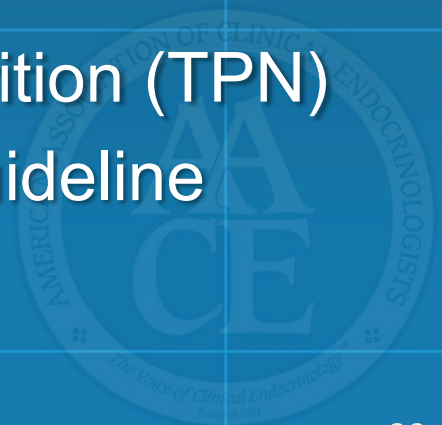
# Interventions for Hyperglycemia

- Blood glucose >200 mg/dL
  - Call the physician if:
    - Blood glucose >200 mg/dL on admission
    - First time BG  $\geq$ 200 mg/dL if not previously reported
    - Written in the physician orders: “Call if blood sugar remains out of control despite therapy or per orders”
  - Administer insulin per physician’s order
  - Hydrate the patient as indicated by physician’s order



# Nursing Role in Good Glycemic Control

- Point of care testing (POCT) for all patients with diabetes and patients who present with hyperglycemia on admission
- Special situations that cause hyperglycemia
  - Steroids
  - Immunosuppressants (eg, cyclosporin)
  - Atypical antipsychotics
- Enteral nutrition or total parenteral nutrition (TPN)
- Start POCT without an order—need guideline for care or policy



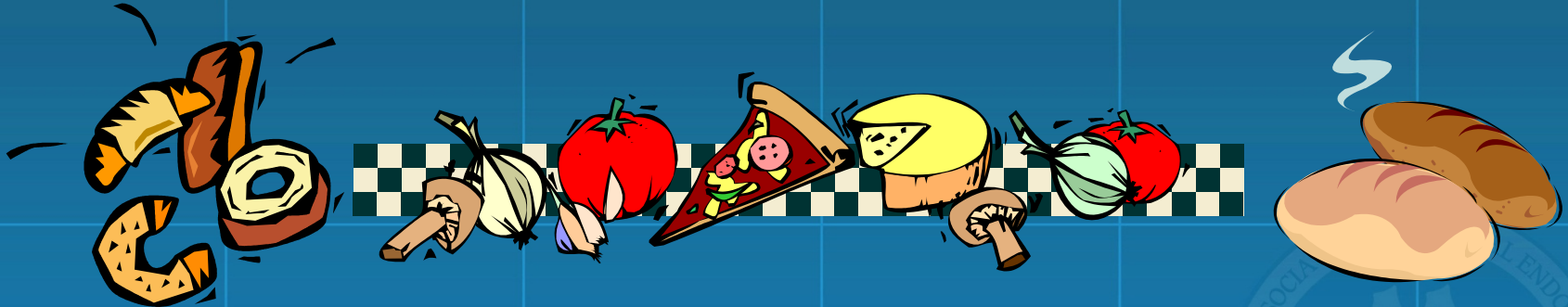
# Nursing Role in Good Glycemic Control

- Appropriate timing of point of care testing/insulin administration and meal delivery
  - Document capillary blood glucose and the time
  - Document insulin dose and the time given
  - Document percentage of the carbohydrate eaten



# Give Insulin as Directed— However, if a Patient Does Not Eat...

- Blood glucose can drop because the carbohydrates predicted did not match up to carbohydrates ingested





# How Does Infection Affect Blood Glucose Levels?

- Increased glucocorticoids from the adrenal glands, stimulating hepatic glucose production, causing hyperglycemia
- Increased epinephrine and norepinephrine (catecholamines), causing increased hepatic glycogen breakdown into glucose, leading to hyperglycemia



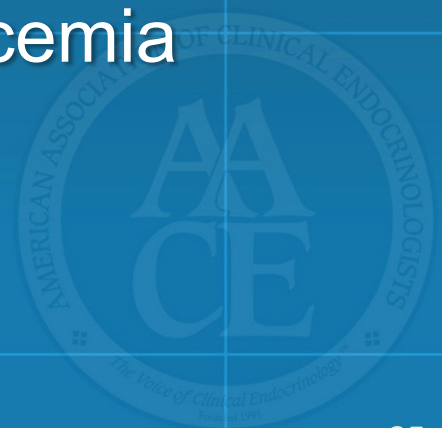
# How Do Surgery and Acute Illness Affect Blood Glucose Levels?

- Increased secretion of counter-regulatory hormones, including cortisol, catecholamines, growth hormone, and glucagon
- These hormones cause hyperglycemia by:
  - Inhibiting glucose uptake by muscle tissue
  - Suppressing insulin release
  - Increasing breakdown of glycogen by the liver
  - Increasing peripheral insulin resistance



# What Is the Impact of NPO Status on the Patient's Blood Glucose Levels?

- Ideally, patients will have surgery early in the morning to avoid a prolonged NPO period
- NPO patients need regular blood glucose monitoring (every 4-6 hours) and may need IV fluid
- NPO patients on oral diabetic medications with long duration are at risk for hypoglycemia



# NPO Patients

- Management differs for type 1 and type 2
  - Type 1 patients still need basal insulin
- Transport with insulin on board
- Advocate for early test procedures so patients do not miss too many meals
- Solution: use insulin analogs for basal/bolus



# NPO Patients

- May give half of the basal insulin dose, hold the mealtime insulin, and continue the correction dose
- Monitor BG every 6 hours and give corrective insulin as needed
- Resume the previous regimen once the patient is eating again

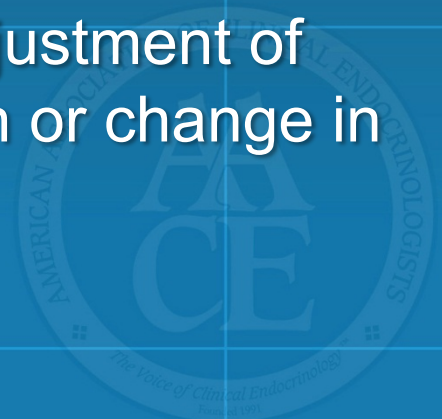


# What Is the Impact of Tube Feedings on Blood Glucose Levels?

- Patients on tube feedings will usually receive a continuous flow of carbohydrates via their feeding
- Blood glucose monitoring (usually every 4 or 6 hours) and scheduled dose of insulin plus corrections are needed
- Interruption of feeding can cause hypoglycemia
  - IV dextrose may be needed while the feeding is off
  - Notify physician for IV dextrose and adjustment of insulin orders when there is interruption or change in feeding rate

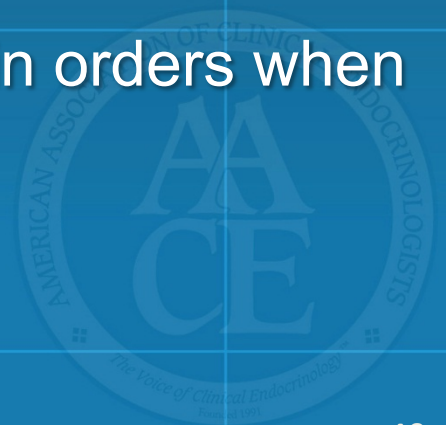
# What Is the Impact of Total Parenteral Nutrition (TPN) on Blood Glucose?

- Patients on total parenteral nutrition (TPN) may have insulin in the TPN or may be on SC insulin
- Blood glucose monitoring every 4-6 hours is needed
- Interruption of TPN can cause hypoglycemia
  - Initiation of IV dextrose may be needed
  - Notify physician for IV dextrose and adjustment of insulin orders when there is interruption or change in TPN



# Impact of Medications on Blood Glucose Levels

- Medications used for the treatment of comorbid conditions can cause hyperglycemia
  - Corticosteroids (ie, solumedrol, solucortef, prednisone, decadron) can increase glucose production by the liver and increase insulin resistance
  - Reduction or discontinuation of the steroid can cause hypoglycemia
  - Notify physician for adjustment of insulin orders when there is a change in steroid dose





# Steroids

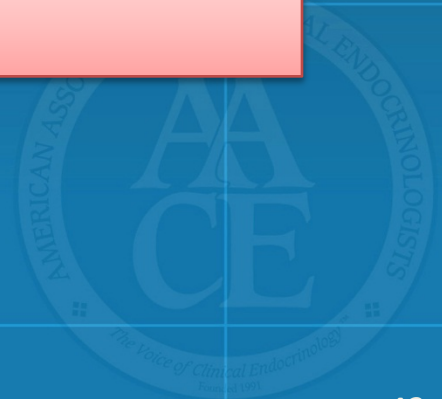
- Stimulate hepatic glucose production and inhibit peripheral glucose uptake
- Dexamethasone: half-life 48 hours
- AM prednisone:
  - Effect usually seen after meals
  - Peak effect on glycemia: 2 pm to 8 pm



# Nursing Role in Good Glycemic Control

- Appropriate timing of PCT/insulin administration and meal delivery
  - Document FS blood glucose and the time
  - Document insulin dose and the time given
  - Document percentage of the carbohydrate eaten

**Do not hold insulin just because blood glucose is under good control!**



# Nursing Role in Good Glycemic Control

- Appropriate patient handoff when transferring patient to another area of the hospital
  - Meal plan order
  - Last capillary glucose level
  - Insulin dose and last insulin given
  - Patient teaching done and patient's response
  - Identified further educational needs of patient/family
  - Transport sheet



# NURSING IS CRITICAL THROUGHOUT HOSPITALIZATION



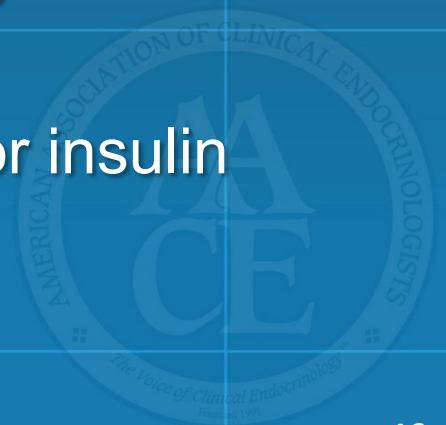
# The Standards: Supporting Patient Self-Management

- Assessing patients' self-management capabilities
- Providing support for patients in self-management activities
- Involving patients in developing the plan of care
- Educating patients in the theory and skills necessary to manage their disease(s)
- Recognizing and supporting self-management efforts

**Joint Commission standards mirror those of diabetes organizations with regard to patient self-management**

# Admission: Diabetes Assessment

- Documentation of type, duration of diabetes, and current treatment
- Assessment of patient's need for diabetes and nutrition education
- Determination of need for meter teaching
- Assessment of patient's competency
  - To perform SMBG
  - To manage diabetes medications and/or insulin



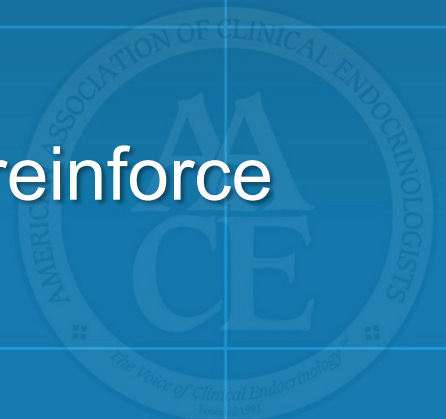
# Health Literacy

- Not the same as literacy
- More than 40% of patients with chronic illnesses are functionally illiterate
- Almost a quarter of all adult Americans read at or below a 5th-grade level, while medical information leaflets are typically written at a 10th-grade reading level or above
- An estimated 3 out of 4 patients discard the medication leaflet
- Low health literacy skills have increased our annual healthcare expenditures by \$73 billion



# Addressing Health Literacy

- Use graphics/pictures
- Use variety of media
- Use “teach back” method to assess understanding
- Focus education materials on patient action and motivation
- Check for patient understanding
- Implement follow-up phone calls to reinforce instructions





# Health Numeracy

- Difficulty adding and subtracting
- Effects in diabetes
  - Carbohydrate counting
  - Adding correction insulin to prandial insulin
  - Recommended example:
    - If your blood sugar is 80 to 150, take 10 units \_\_\_\_\_ insulin
    - If your blood sugar is 151 to 200, take 12 units \_\_\_\_\_ insulin
    - If your blood sugar is 201 to 250, take 15 units \_\_\_\_\_ insulin

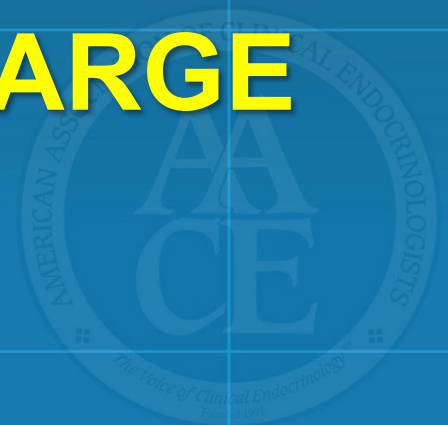


# Patient/Family Education

- Review/evaluate insulin injection technique
- New to insulin
  - Instruct ASAP
  - Give own insulin as input
  - Use handouts

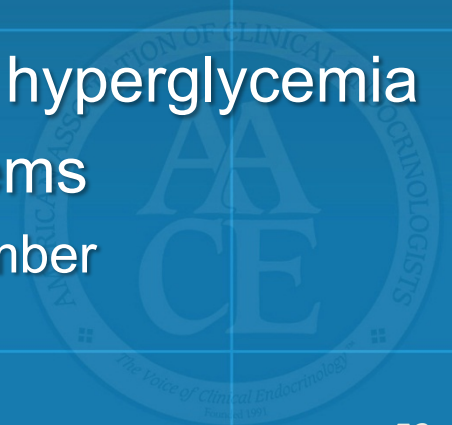


# TRANSITION TO DISCHARGE



# Ensuring Good Glycemic Control in Patients Being Discharged

- Ensure patient has survival skills—ie, diabetes self-management education (DSME)
  - Use of personal glucose monitor
  - Rudiments of meal plan (effect of CHO)
  - Medications
    - How and when to administer
    - Side effects
  - Symptoms and treatment of hypo- and hyperglycemia
  - When and whom to contact with problems
    - Be sure patient has a name and phone number
  - Additional education/resources



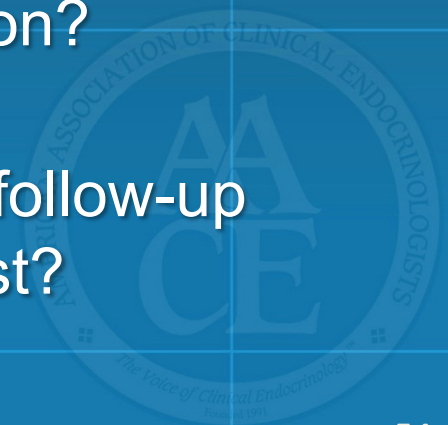
# Connecting Inpatient Care to Outpatient Support

- Multidisciplinary team: bedside nurse, clinical pharmacist, registered dietitian, case manager
- High-risk patients identified at admission
- Bedside nurse does assessment using admission database form and adds 5 questions related to diabetes
- If need identified, bedside nurse contacts appropriate team member



# Transition to Discharge

- Does patient have a glucose monitor for home use?
  - If not, call case manager/D/C planner or diabetes care center (DCC) to arrange for one
- Does patient know how to inject insulin and how to prevent and treat hypoglycemia?
- Does patient understand his/her diabetes therapy after discharge?
- Does patient need more diabetes education?
  - Refer to DCC for further education
- Does patient have appropriate outpatient follow-up appointment with primary care or specialist?

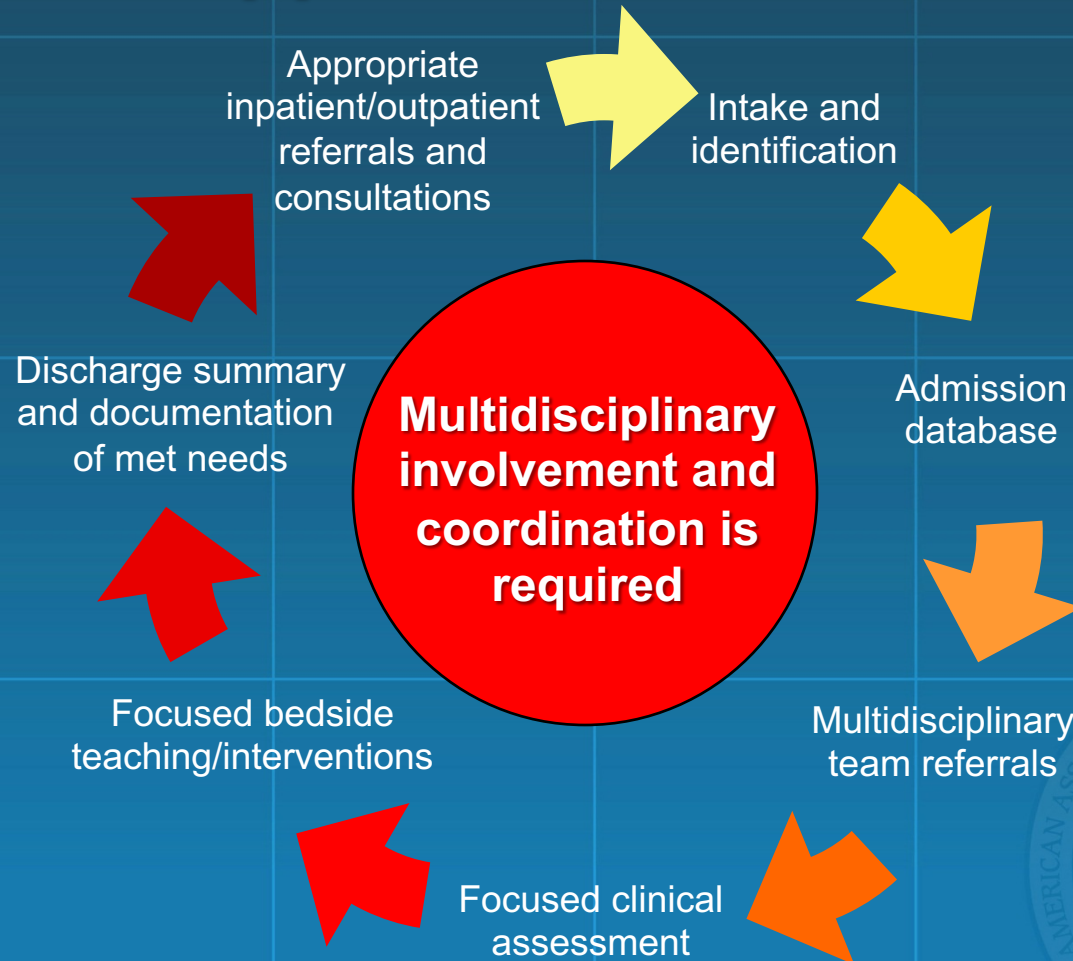


# To Enhance Nurses' Knowledge

- In-services to cover all shifts
- Web-based in-services/journal clubs
  - Can be viewed at opportune times
  - Offer CEs
- Nursing champion
- Diabetes “resource nurse” on each unit
  - Receive extra education re diabetes
  - Used as “rung” on clinical ladder



# Connecting Inpatient Care to Outpatient Support: Circle of Care





# Summary

- To effectively manage diabetes and nutrition in the hospital setting, it's important to use a multidisciplinary team approach
- Collaboration among physicians, nurses, pharmacists, laboratory staff, and dietary staff can optimize patient care and support favorable metabolic control

