# Jackson Purchase Medical Center

Cynthia Elliott, RPh,CDCES

# GLYCEMIC EXCURSIONS:

Are we harming our patients?

# OBJECTIVES

At the conclusion of this presentation, attendees will be able to:

- Understand the consequences of hypo- and hyperglycemia in the hospitalized patient.
- Review the recommendations for managing hypo- and hyperglycemia in the hospital environment.
- State the glycemic targets in the ICU and Non-ICU setting.
- Identify process improvement strategies to improve glycemic control.

# NATIONAL DIABETES STATISTICS REPORT

## ▸ Diabetes

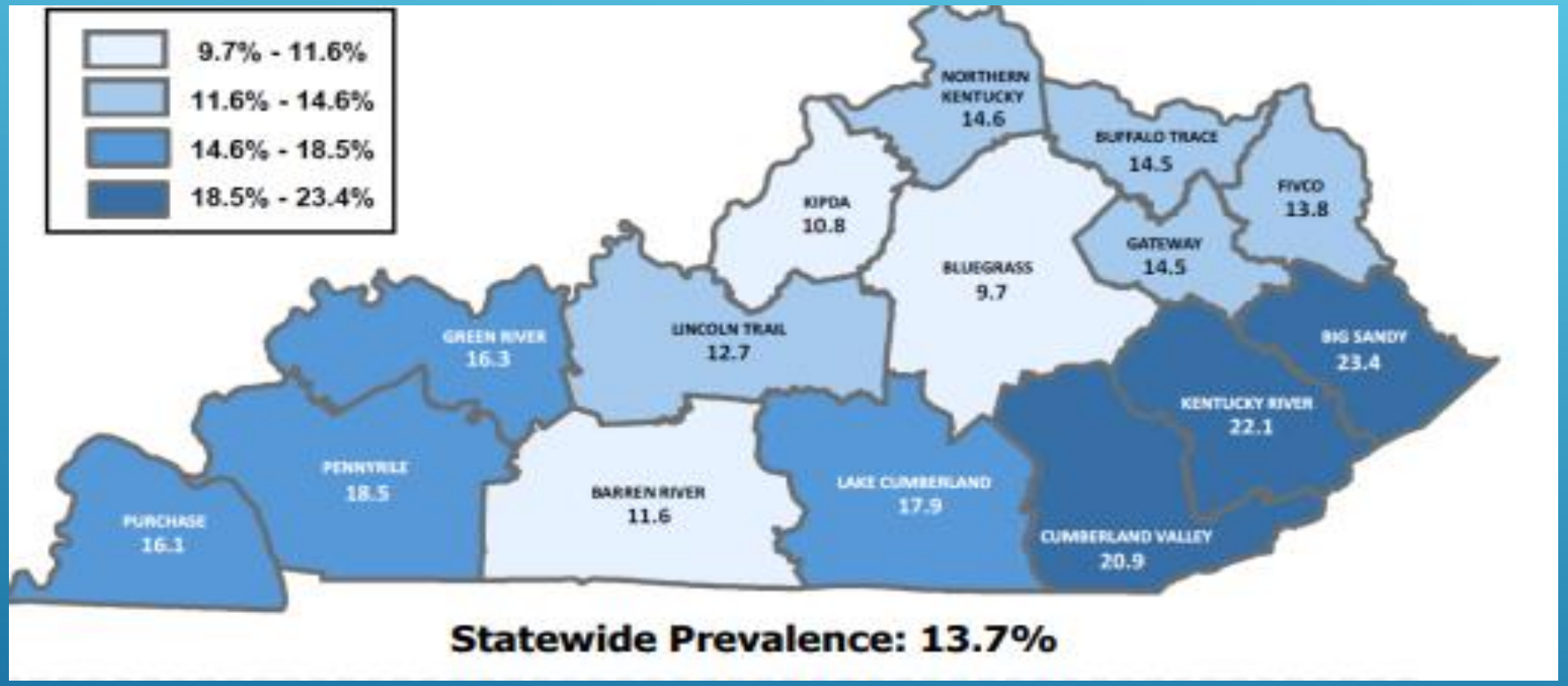
- **Total** : 37.3 million people have diabetes (11.3% of the US population)
- **Diagnosed**: 28.7 million people
- **Undiagnosed**: 8.5 million people (23.0% of adults are undiagnosed)

## ▸ Prediabetes

- **Total**: 96 million people aged 18 years or older have prediabetes (38.0% of the adult US population)
- **65 years or older**: 26.4 million people aged 65 years or older (48.8%) have prediabetes

Reference: cdc.gov/diabetes/data/statistics-report/index/html

# PREVALENCE OF DIAGNOSED DIABETES BY KENTUCKY REGIONS
## 2018 KENTUCKY BEHAVIORAL RISK FACTOR SURVEY




Reference: https://chfs.ky.gov/agencies/dph/dpqi/cdpb/dpcp/diabetesfactsheet.pdf

# DIABETES IS COSTLY

- Nationally, people with diabetes have medical expenditures 2.3 times higher than in its absence.
- Diabetes has the 3rd highest average charge for individual Kentucky hospitalizations for common chronic diseases.
- 3rd highest overall cost of several common chronic diseases in the Kentucky Medicaid population

Reference: chfs.ky.gov/agencies/dph/dpqi/cdpb/dpcp/diabetesfactsheet.pdf

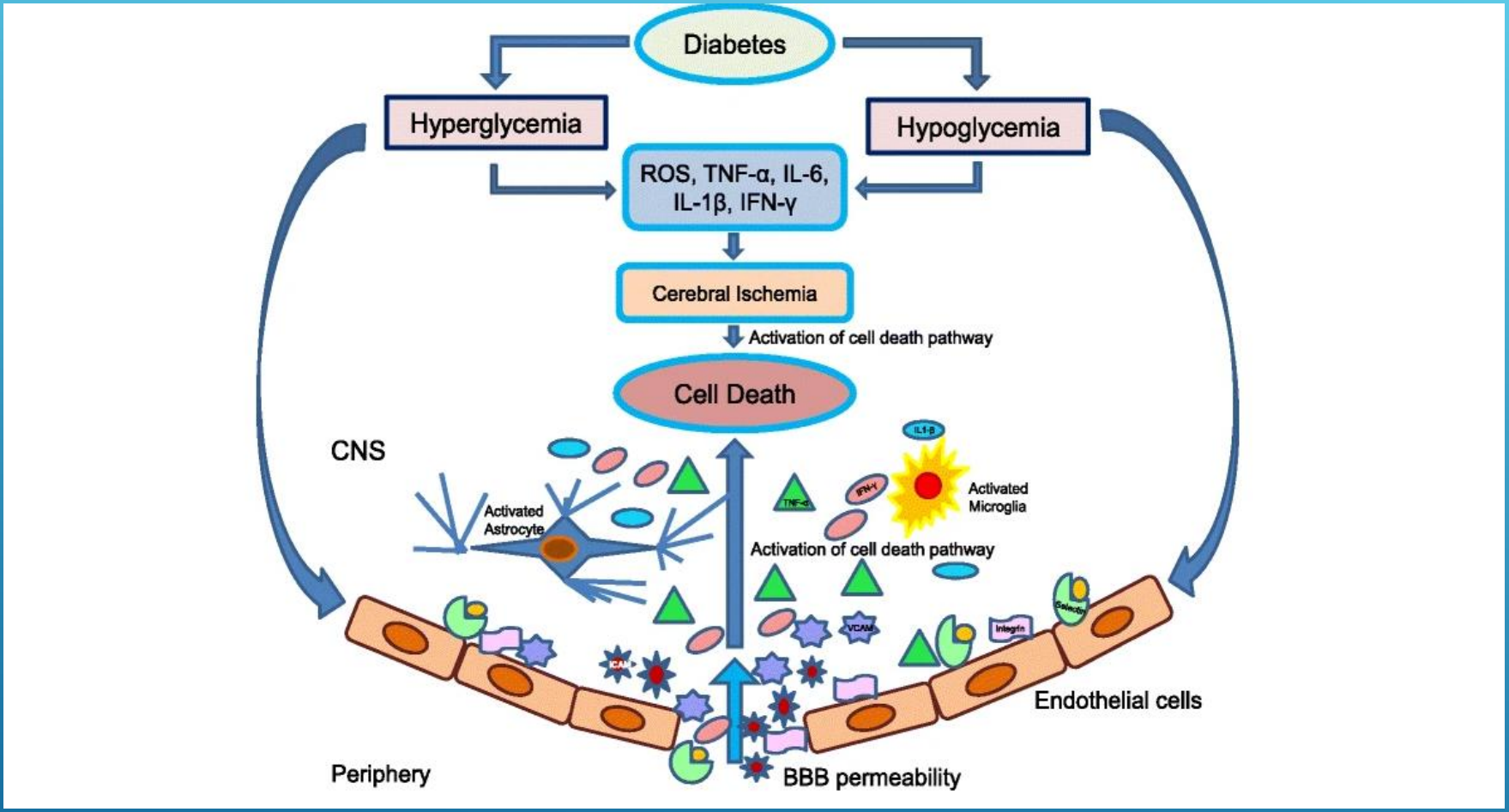
# ADVERSE OUTCOMES IN HOSPITALIZED PATIENTS WITH DIABETES MELLITUS

- Hypoglycemia
- Hyperglycemia
- Glucose variability
- Death

# CHALLENGES OF HOSPITALIZED PATIENT WITH DIABETES MELLITUS

- Changes in all of the following:
  - Diet
  - Schedule
  - Medications
  - Glucose metabolism

# CEREBRAL ISCHEMIC DAMAGE IN DIABETES




Reference: jneuroinflammation.biomedcentral.com/articles/10.1186/s12974-016-0774-5/figures/1

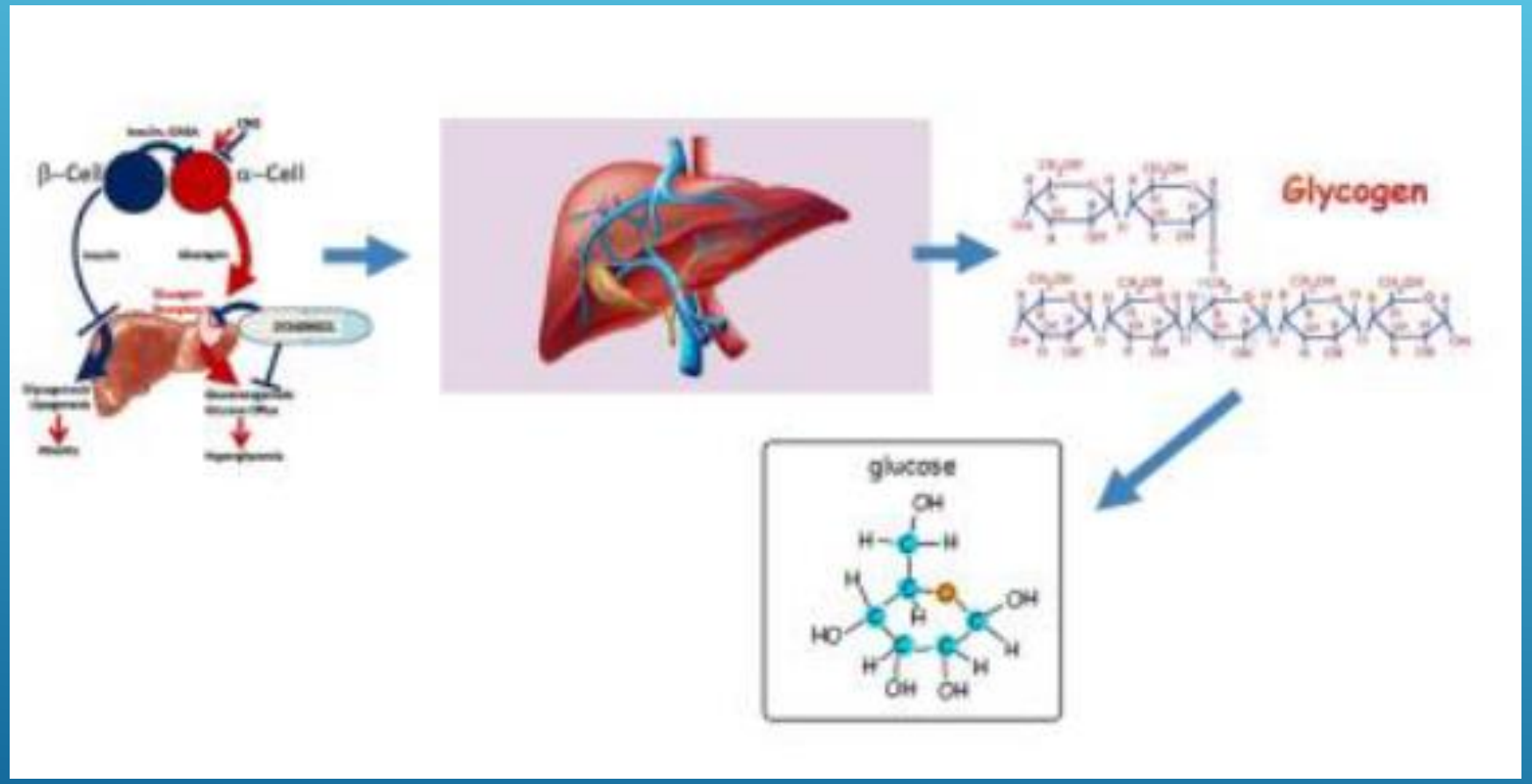
# CEREBRAL EFFECTS OF HYPOGLYCEMIA

- Cerebral intracellular “hypoxia”
- Confusion
- Death
- Hypoglycemia = Cellular Hypoxia

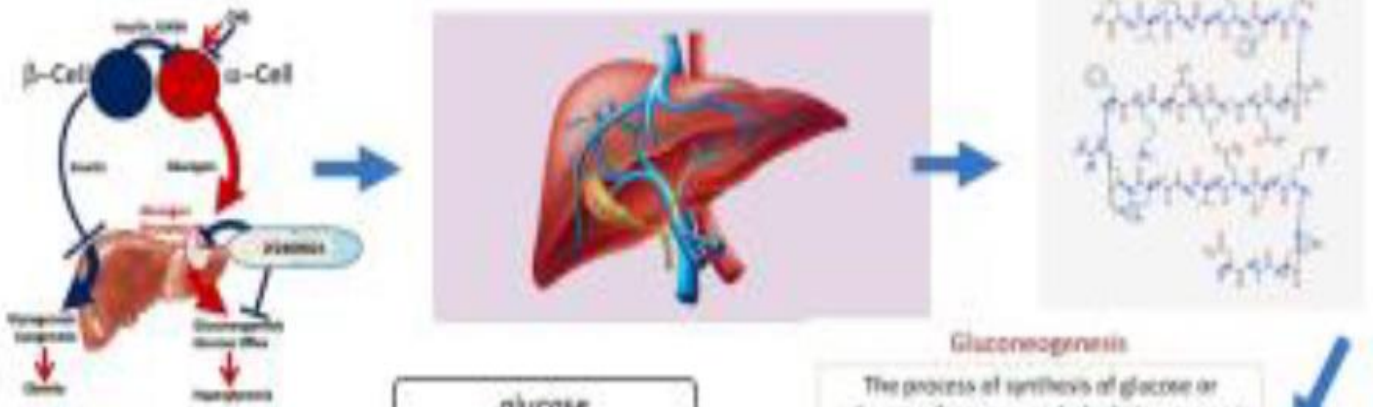
# IS A BLOOD GLUCOSE < 70 A PROBLEM?

- Hypoglycemia harms brain cells; older patients may not be able to recover.
- Tight glycemic control  in hospitalized patients increases morbidity and mortality as demonstrated in the NICE SUGAR studies in 2009.
- Target blood glucose for the hospitalized patient should be between 140-180 mg/dL.
- At a minimum, every hypoglycemic event indicates process error.

# HYPOGLYCEMIA: WHAT HAPPENS?



# NO MORE GLYCOGEN: WHAT HAPPENS NEXT?

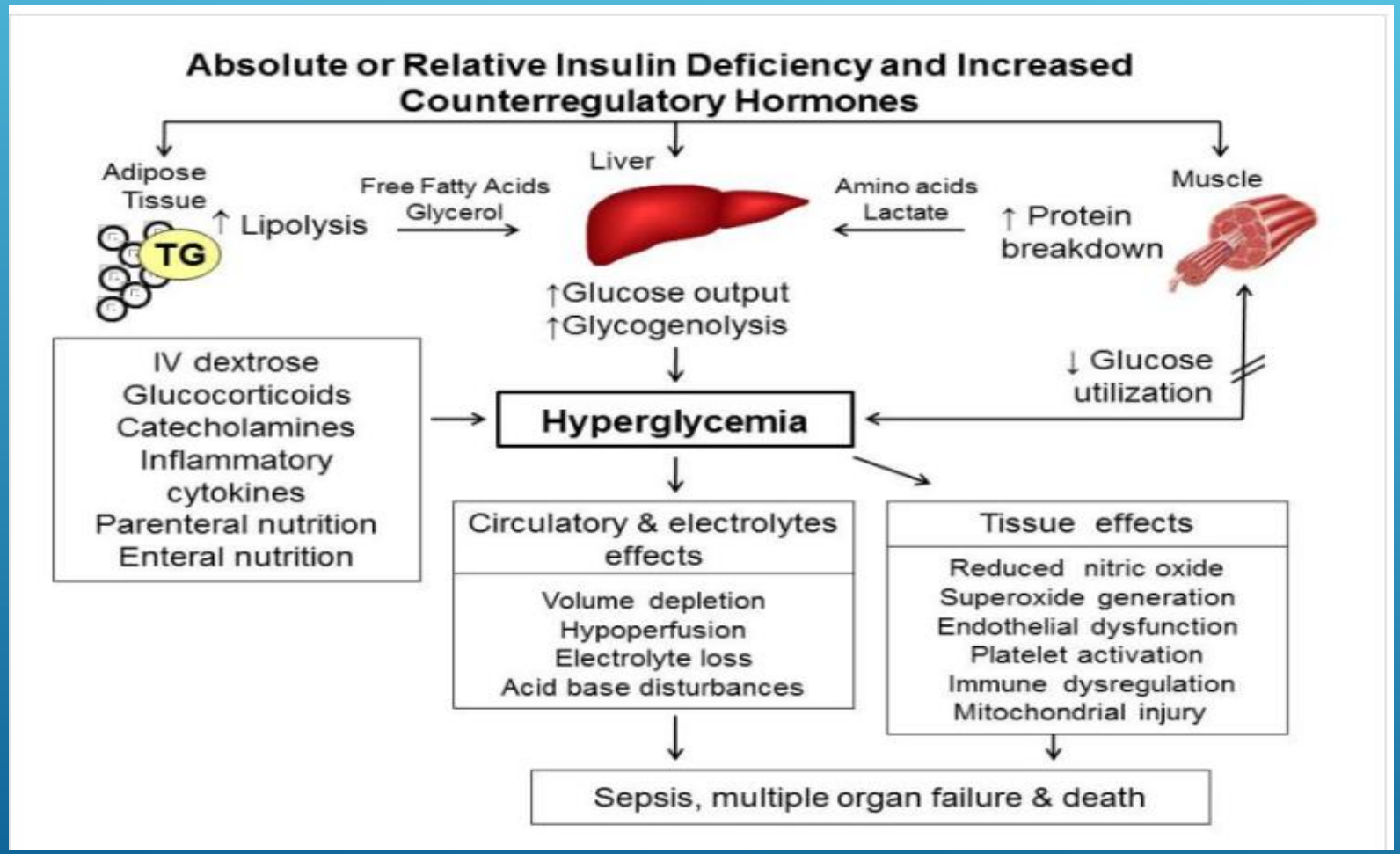


# HYPOGLYCEMIA: WHAT CAN AN INPATIENT DO?

# PREVALENCE OF DIABETES AND HYPERGLYCEMIA IN THE HOSPITALIZED PATIENT

- 32.2% of ICU patients and 32.0% of non-ICU patients reported hyperglycemia
- These numbers include both newly identified or stress hyperglycemia as well as those with prior diagnosis of  diabetes
- Patients with both an elevated blood glucose >140 mg/dL and an A1C of 6.5% or higher can be identified as having diabetes

# HYPERGLYCEMIA: WHAT HAPPENS DURING ILLNESS?



# HYPERGLYCEMIA: HARMFUL EFFECTS

- Increased risk of nosocomial and postoperative infections
- Increased risk of sepsis, pneumonia, and wound infection
- Decreased neurologic recovery
- Worsened outcomes in patients with acute stroke
- Higher mortality associated with acute myocardial infarction

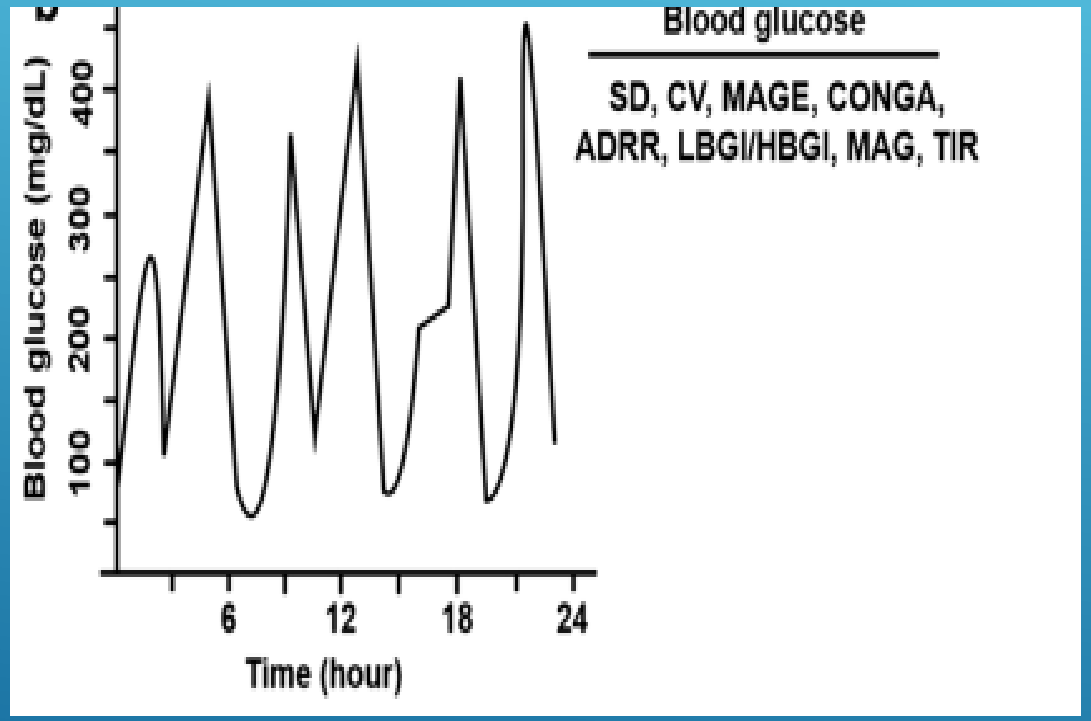
# GLYCEMIC TARGETS IN THE ICU AND NON-ICU SETTINGS

| | ICU | Non-ICU |
|---|---|---|
| ADA/AACE | Initiate insulin therapy:<br>persistent hyperglycemia<br>glucose > 180mg/dL<br><br>Treatment goal:<br>Target 140-180mg/dL<br>More stringent goals may be appropriate for certain patients, if achievable without hypoglycemia. | No specific guidelines.<br>If treated with insulin, pre-meal glucose targets should generally be <140 mg/dl, with random glucose levels <180 mg/dl.<br>More stringent targets may be appropriate for those with previously tight glycemic control. Less stringent targets may be appropriate in people with severe comorbidities. |
| Critical Care Society | Initiate insulin therapy:<br>glucose >150 mg/dL<br><br>Treatment goal:<br>maintain glucose <150 mg/dl for most adults in ICU<br>Maintain glucose levels <180 mg/dl while avoiding hypoglycemia. | |

# GLYCEMIC VARIABILITY

- Glycemic variability (GV) is defined as  the fluctuations in blood glucose.
- GV can either be measured short term (days or weeks) or long term (weeks or months).
- GV is a more meaningful measure of glycemic control than A1C.

# SHORT TERM GLYCEMIC VARIABILITY

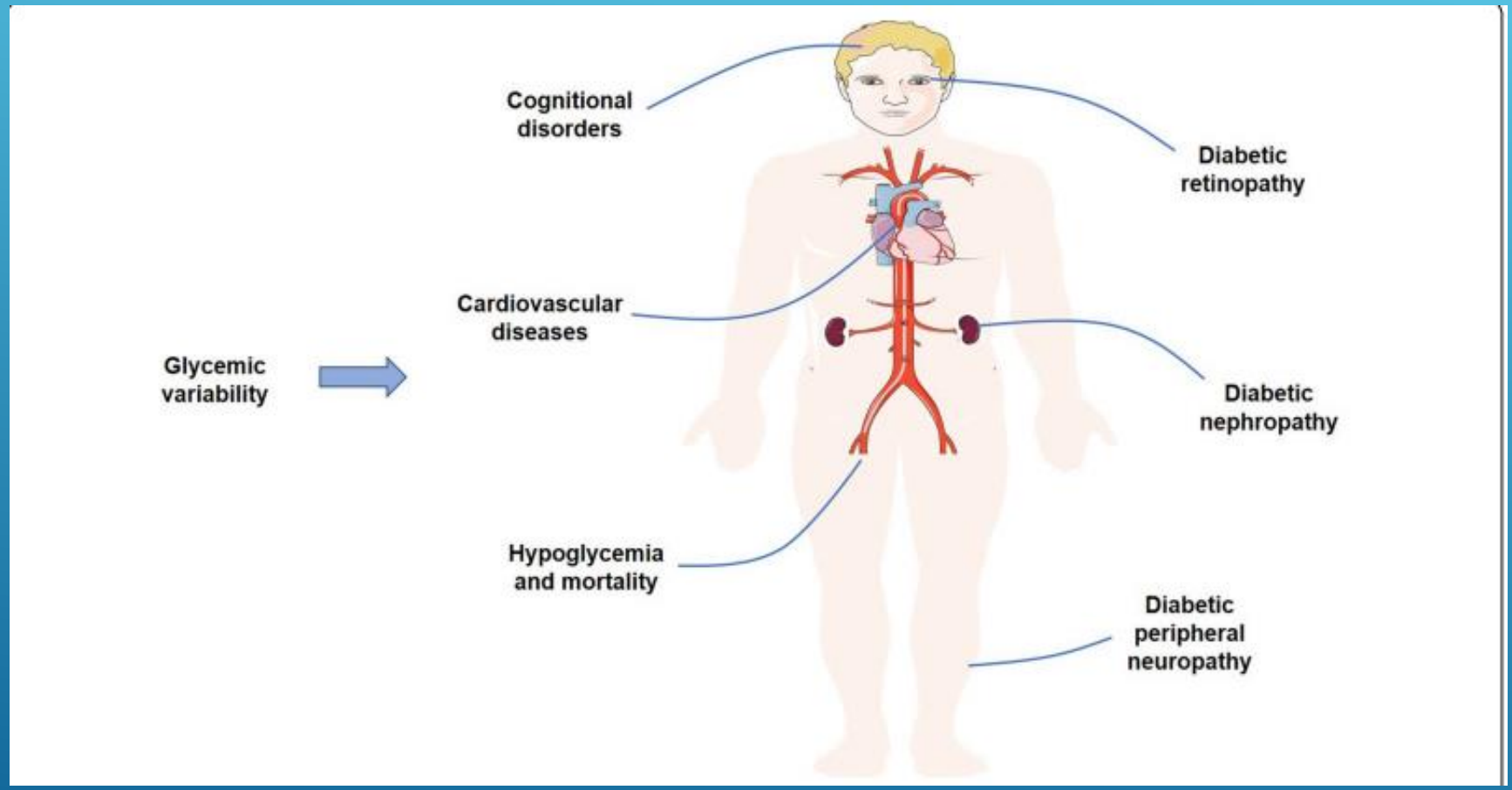



- SD= standard deviation
- CV =  coefficient of variation
- MAGE = mean amplitude of glycemic excursions
- CONGA = continuous overlapping net glycemic action
- ADRR = average daily risk range
- LBGI/HBGI = low blood glucose index/high blood glucose index
- MAG= mean absolute glucose
- TIR = time  in range

# EFFECTS OF GLYCEMIC VARIABILITY ON ADVERSE CLINICAL OUTCOMES

- SD and CV during hospitalization showed an increased hospitalization stay and mortality
- MAGE studies revealed a positive correlation with coronary artery spasm and poor prognosis in patients with CAD
- CONGA, MAG, and MAGE predicted nocturnal hypoglycemia
- Day to day FPG variability showed an increased risk of severe hypoglycemia and all-cause mortality
- TIR inversely correlates with diabetic retinopathy

# ADVERSE CLINICAL OUTCOMES ASSOCIATED WITH GLYCEMIC VARIABILITY



# WHAT CAN WE DO TO IMPROVE? …

# QUALITY IMPROVEMENT MEASURES

- What can we do better?
- What is best practice for hospitalized patients with diabetes mellitus?
- How can we find the data?

# BEST PRACTICE

- ADA standards utilize protocols
- Measure adherence to protocols
- Report adverse events

# SIMPLE DATA EXAMPLE

- Count all the patients who had a glucose < 50 mg/dL during a single admission this month. Remove duplicates. (Numerator)
- Count all patients who received insulin this month. (Denominator)
- Divide Numerator by Denominator = Rate for the month.

# HYPO HUDDLE- ACTIONABLE DATA


- Involve the nursing staff, the patient and the patient's family, and the diabetes care team
- Ask the patient what do they think contributed to the event
- Is there documentation in the EMR concerning % of meals eaten in the past 12 hours?
- What is the plan to prevent future events of hypoglycemia  for this patient?

# KEYS TO INPATIENT GLYCEMIC CONTROL

Standards of Medical Care in Diabetes

# CONSIDERATION ON ADMISSION

- All patients with diabetes or hyperglycemia (blood glucose > 140 mg/dL) should have an A1C performed if not performed in the prior 3 months.
  - A1C will direct the patient's care
  - This metric can be used to track, gather, and analyze data to measure progress

- A standardized order set for insulin using computerized provider order entry should be utilized for admission orders.
  - With the assistance of the IT team, the use of CPOE for ordering insulin via order sets can be measured.

# GLYCEMIC TARGETS IN HOSPITALIZED PATIENTS

- Insulin therapy should be started for treatment of persistent hyperglycemia of > 180 mg/dL.
- More or less stringent goals should be set on an individual basis.
- Most patients will require basal insulin with correction insulin.

# HEALTHCARE TEAM INVOLVEMENT

- Patient involvement to assist in coordinating insulin administration with meal time.
- Nurse needs to check with patient regarding level of hunger before administering bolus insulin.
- During interdisciplinary care conference, patient's needs should be assessed.

# HOW DO WE DISCOVER WHAT PROCESSES NEED IMPROVEMENT?

Discovery Tool

# HYPOGLYCEMIC PROCESS IMPROVEMENT DISCOVERY TOOL

| Mini RCA Hypoglycemia Process Improvement Discovery Tool (Minimum 10 charts/Maximum 20 charts) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Note: Do NOT spend more than 20-30 minutes per chart! | | | | | | | | | | |
| Instructions: (1) Mark an X in the box where a process failure occurred. You may check more than one box per chart. (2) The processes with the most common failures could be a priority focus. | | | | | | | | | | |
| PROCESS | Chart # | Chart # | Chart # | Chart # | Chart # | Chart # | Chart # | Chart # | Chart # | Chart # |
| Target glucose is 140 - 180 mg/dL | | | | | | | | | | |
| If Glucose < 100 occurred the insulin regimen was reduced. Otherwise "N/A" | | | | | | | | | | |
| If Glucose < 70 occurred the insulin regimen was reduced. Otherwise "N/A" | | | | | | | | | | |
| Patient was receiving basal insulin | | | | | | | | | | |
| Patient eating AND receiving bolus insulin | | | | | | | | | | |
| Patient was NOT receiving Sliding Scale Insulin alone | | | | | | | | | | |
| If sudden loss of parenteral glucose occurred, it was managed promptly through standing nursing orders. Otherwise "N/A" | | | | | | | | | | |
| If sudden NPO occurred, it was managed promptly through standing nursing orders. Otherwise "N/A" | | | | | | | | | | |
| If sudden loss of appetite occurred (includes nausea, vomiting, etc), it was managed promptly through standing nursing orders | | | | | | | | | | |
| Home dietary intake and insulin regimen were evaluated on admission and insulin doses were reduced as appropriate for expected lower carb intake in hospital | | | | | | | | | | |
| Documentation exists showing appropriate meal-insulin coordination (insulin within 15 minutes before or after meal delivery to patient) | | | | | | | | | | |
| Other (specify) | | | | | | | | | | |

Source: http://cynosurehealth.org/wp.content/uploads/2019/11/Hypoglycemia-Process-Improvement-Discovery-Tool.pdf

# Jackson Purchase Medical Center

JacksonPurchase.com