Inpatient Diabetes

Dr. John Palmer
Kelly Grimshaw, BSN, RN, CDCES
SaraBeth Soetmelk, BSN, RN, CDCES

MONUMENT HEALTH

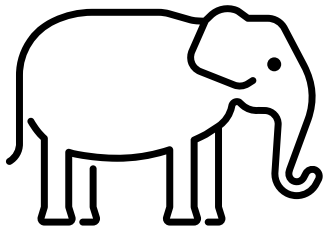
Introductions

- Dr. John Palmer
- Kelly Grimshaw, BSN, RN, CDCES
- SaraBeth Soetmelk, BSN, RN, CDCES

Objectives

- Identify signs and symptoms of hypoglycemia
- Understand how hypoglycemia effects multiple systems in the body
- Acknowledge the importance of hypoglycemia prevention
- Value the role of the interdisciplinary team in making process changes

How do you eat an elephant?



One bite at a time.

Hypoglycemia Definition

Level	Glycemic Criteria/Description
Level 1	Glucose <70 mg/dL and ≥54 mg/dL
Level 2	Glucose <54 mg/dL
Level 3	A severe event characterized by altered mental and/or physical status requiring assistance

American Diabetes Association. (2022). Standards of Medical Care in Diabetes – 2022.

Why Hypoglycemia Matters

- In hospitalized patients, hypoglycemia is associated with increased short and long term mortality.
- Patients who experience hypoglycemia during hospitalization have longer lengths of stay, higher costs and greater odds of being discharged to a SNF.
- More than 40% of patients experiencing one iatrogenic episode go on to suffer at least one additional event, of which these recurrent events appear to be largely preventable. (3)
- ISMP identifies insulin as a high alert medication in the inpatient setting.
  - Approximately 25% of all patient safety incidents involving insulin result in patient harm.
  - Insulin has been implicated in 1/3 of all medication related deaths.

- (3) Maynard, Gregory; Huynah, Maggie Patricia; & Renvall, Marian. (2008). Iatrogenic inpatient Hypoglycemia: Riks Factos, Treatment, and Prevention. Diabetes Spectrum 21(4). Pp 241-247
- Akirov A, et al. Mortality among hospitalized patients with hypoglycemia: insulin related and noninsulin related. Journal of Clinical Endocrinology and Metabolism 2017;102:416-424.
- Draznin, Boris. Managing Diabetes and Hyperglycemia in the Hospital Setting: A Clinician's Guide. 2016

Common Concern

- In Oct 2014 DHHS National Action Plan for Adverse Drug Event Prevention highlighted diabetes agent-associated hypoglycemia as a primary concern.

- In April 2016, The Juvenile Diabetes Research Foundation (JDFR) launched a multi-stakeholder initiative to address gaps in care for T1C that includes efforts to develop consensus for differing hypoglycemia severity.

- In 2016 Endocrine Society established the Hypoglycemia Quality Collaborative created the HQC Strategic Blueprint

- (2)Endocrine Society. 2016. Hypoglycemia Quality Collaborative Strategic Blueprint

Physiology of hypoglycemia… On the surface

- Symptoms
  - Neurogenic/autonomic:
    - Adrenergic: palpitations, tremor, anxiety/arousal
    - Cholinergic: sweating, hunger, paresthesia
  - Neuroglycopenic: cognitive impairments, behavioral changes, psychomotor abnormalities, seizure, coma, nausea, diplopia
- Signs
  - Pallor
  - Diaphoresis
  - Elevated heart rate
  - Elevated systolic blood pressure

The body's response to falling plasma glucose levels

- In an individual **without** diabetes:
  - Insulin secretion decreases
  - Glucagon secretion increases
  - Epinephrine increases
  - Cortisol and growth hormone increase (several hours later)

How does this list change in someone with Diabetes?

- In an individual with diabetes:
  - ~~Insulin secretion decreases~~
  - ~~Glucagon secretion increases~~
  - Epinephrine increases
  - Cortisol and growth hormone increase (several hours later)

Epinephrine

- The epinephrine response is initiated at lower glucose levels when
  - A previous low has been experienced
  - Previous exercise
  - During sleep

Glucose Level

Epinephrine

Glucagon

Type 1 (1-5 years)

Type 1 (14-31 years)

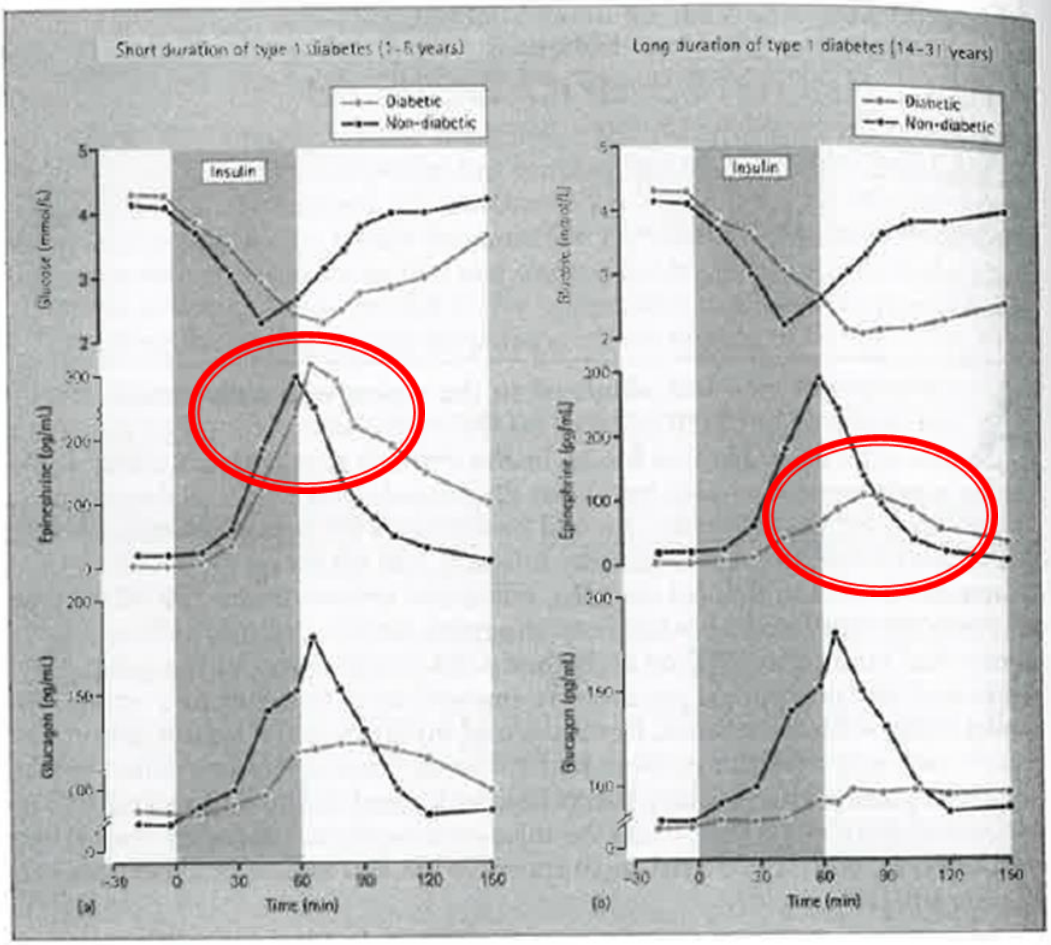


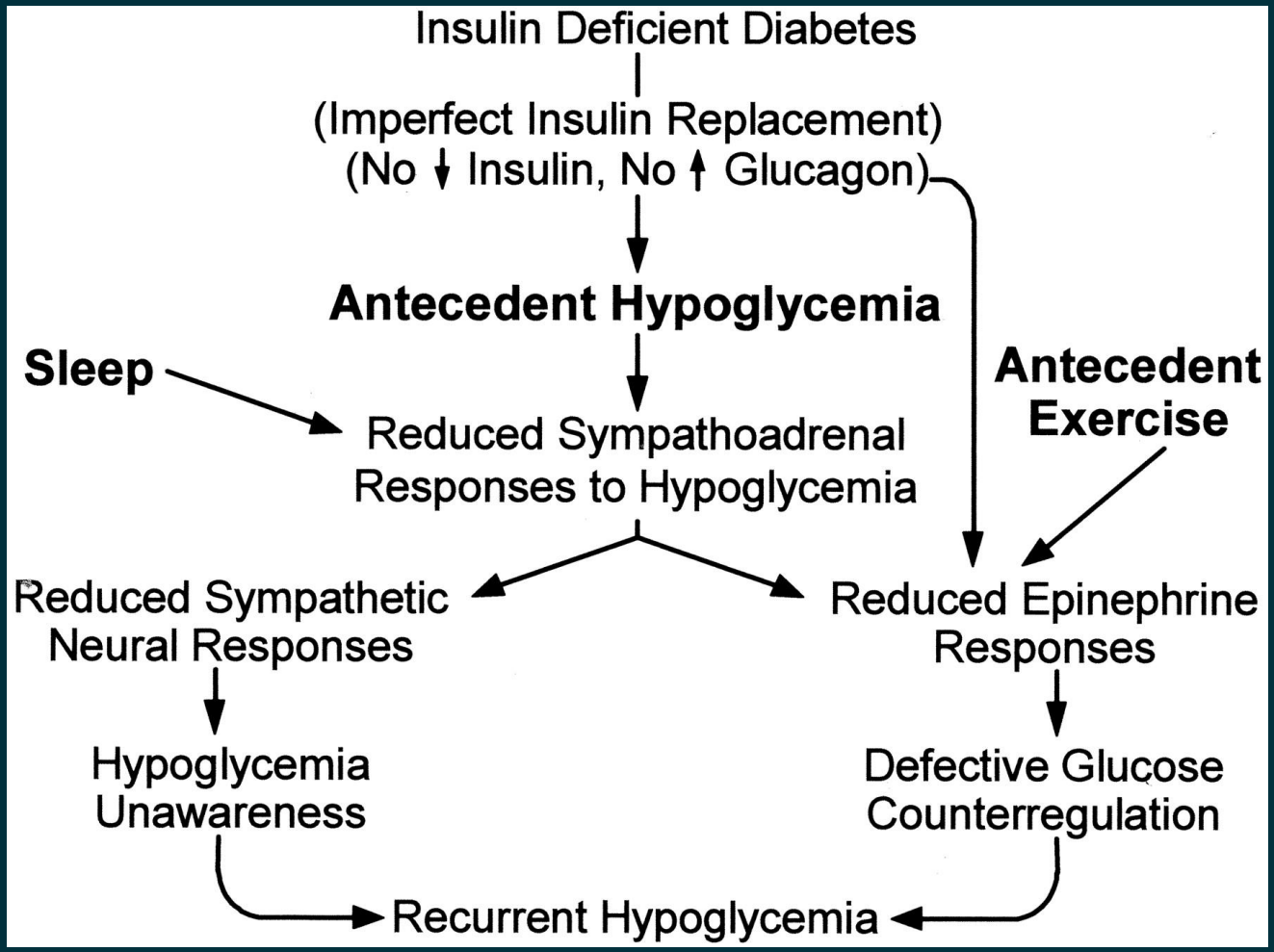
Figure 91.1—Counter-regulatory response to hypoglycemia in T1D patients with short- and long-term duration.

MONUMENT HEALTH

But it can get worse…

- If a patient has autonomic neuropathy, the epinephrine response is diminished and the patient will experience even fewer symptoms, leading to a higher risk of severe hypoglycemia.

Hypoglycemia-Associated Autonomic Failure (HAAF)

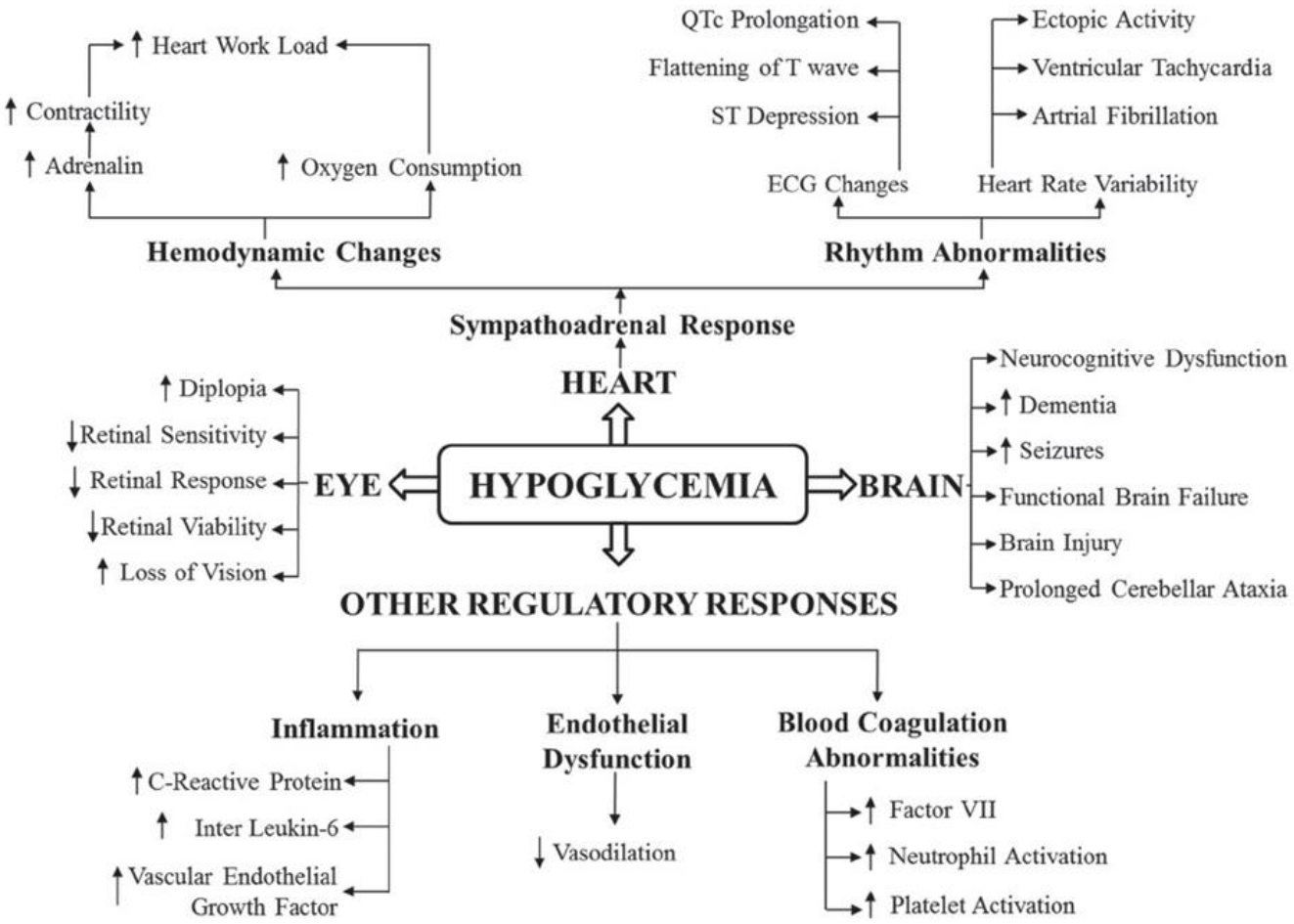


Hypoglycemia and the Heart

- Activation of inflammation, endothelial dysfunction, coagulopathies – all have been noted with hypoglycemia
- The biggest concern are the proarrhythmic abnormalities, specifically the increase in the QT interval
- The ACCORD study was pivotal in showing this relationship (between lows and the heart)

Indian Journal of Endocrinology and Metabolism

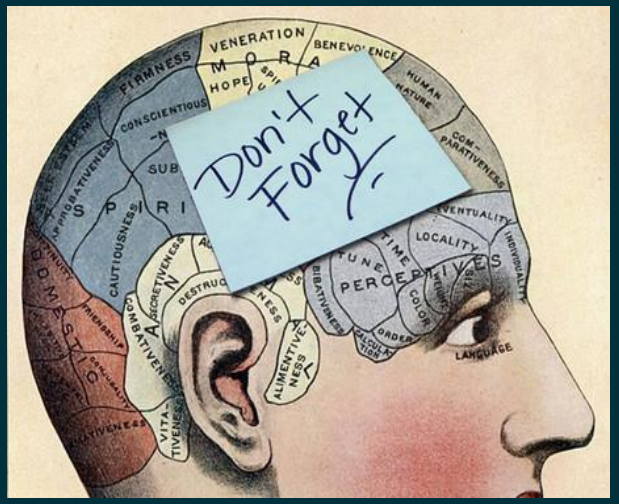
Figure 2: Physiological impact of hypoglycemia on different systems and their counter-regulatory responses. ECG: Electro cardiogram; ↑ denotes increased response; ↓ denotes decreased response



Clinical Pearls

- Hypoglycemia is serious.

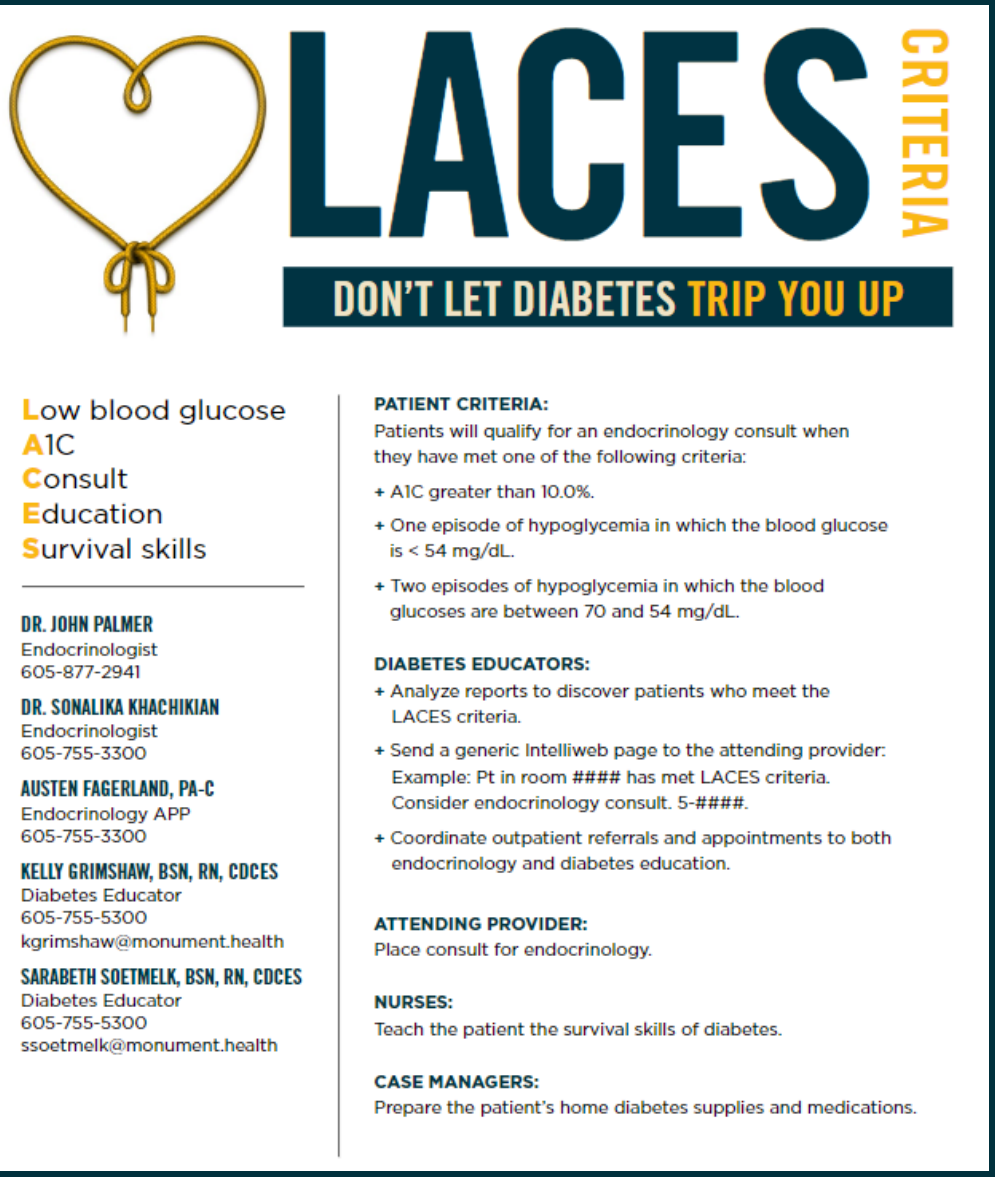
- When a patient experiences hypoglycemia, action needs to be taken to prevent a subsequent event.



At Monument Health

- All projects require interdisciplinary collaboration
- Diabetes Steering Team – formed in Spring of 2019
- Two major projects aimed at decreasing hypoglycemia
  - LACES Endocrinology Consult Criteria
  - DKA Order Set Overhaul

LACES Endocrinology Consult Criteria



MONUMENT HEALTH

DKA Order Set Revision

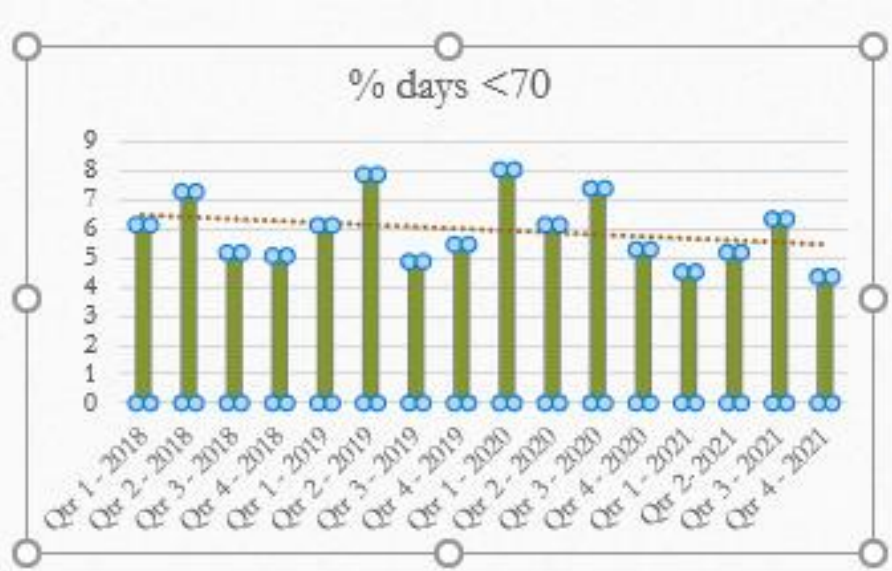
Previous Order Set

- Insulin started at a rate of 0.14 u/kg/hr and ran continuously, despite change in blood glucose
- Caused burden to providers and nurses with numerous phone calls required to change/edit orders as patient condition improved
- Patients often experienced **hypoglycemia – average of 7 episodes per month**

New Order Set

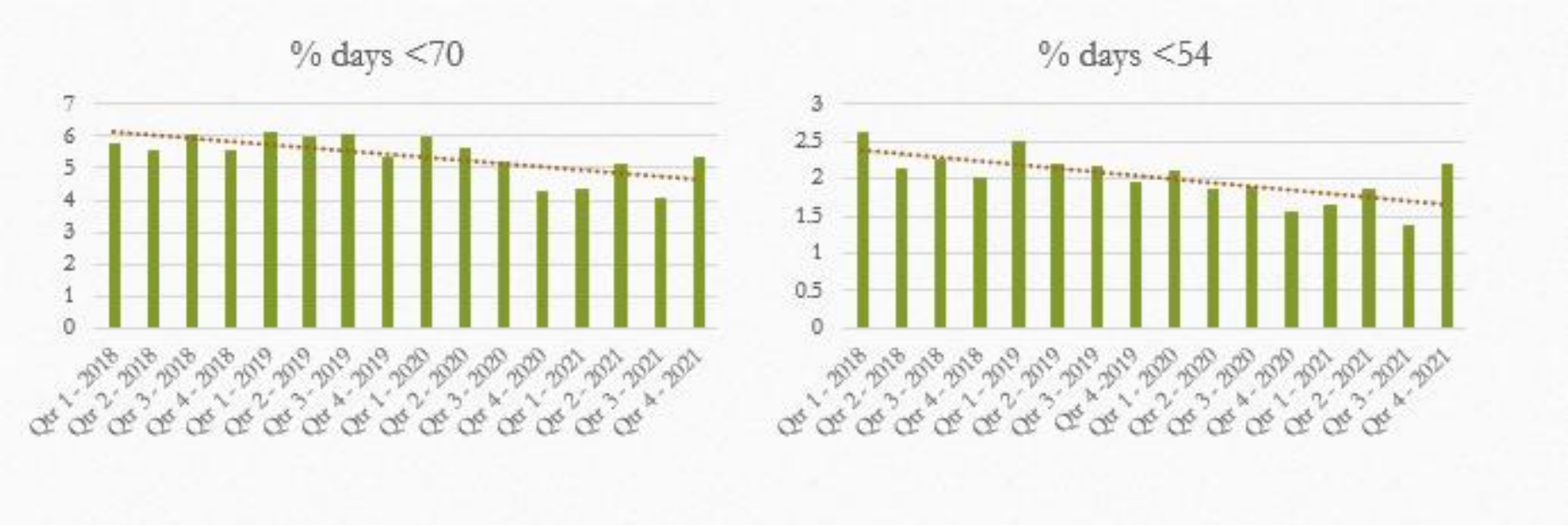
- Incorporates a dosing table to adjust the insulin dose as the blood glucose improves
- Includes nurse-driven orders and protocols for fluids and electrolytes
- Causes far less **hypoglycemia – average of 0.2 episodes per month**

Results!
ICU


% days <70
9
8
7
6
5
4
3
2
1
0
Qtr 1 - 2018
Qtr 2 - 2018
Qtr 3 - 2018
Qtr 4 - 2018
Qtr 1 - 2019
Qtr 2 - 2019
Qtr 3 - 2019
Qtr 4 - 2019
Qtr 1 - 2020
Qtr 2 - 2020
Qtr 3 - 2020
Qtr 4 - 2020
Qtr 1 - 2021
Qtr 2 - 2021
Qtr 3 - 2021
Qtr 4 - 2021


% days <54
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Qtr 1 - 2018
Qtr 2 - 2018
Qtr 3 - 2018
Qtr 4 - 2018
Qtr 1 2019
Qtr 2 - 2019
Qtr 3 - 2019
Qtr 4 - 2019
Qtr 1 - 2020
Qtr 2 - 2020
Qtr 3 - 2020
Qtr 4 - 2020
Qtr 1 - 2021
Qtr 2 - 2021
Qtr 3 - 2021
Qtr 4 - 2021

Results!
Non-ICU



Remember the Elephant?

- Celebrate success
- But success needs to be maintained
- Ongoing collaboration with the interdisciplinary team is key
- More quality improvement projects await

Thank You!