

Beyond Sliding Scale: Modern Glycemic Management in the Hospital Setting

Casey J. Metts, PharmD

Pharmacy Clinical Manager

Glycemic Management Committee Co-chair

Baptist Health Richmond, Richmond, Kentucky

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Objectives

1. Review evidence-based glycemic management strategies to achieve safe and effective glycemic control for hospitalized patients.
2. Identify patient-specific factors that influence the selection and dosing of insulin in the inpatient setting.
3. Explain the clinical benefits, workflow considerations, and integration barriers associated with glucose management technologies
4. Describe the role of glucose management technologies in improving glycemic performance and meeting CMS eCQM measures.

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- The map displays the following counties by region:
- Purple (West):** Alexander, Ballard, Boone, Breathitt, Butcher, Caldwell, Calloway, Carter, Cass, Casey, Chambers, Chatham, Clark, Clay, Clinton, Crittenden, Cumber, Cumberland, Davidson, De Kalb, Dickson, Elliott, Estill, Fenton, Floyd, Franklin, Fulton, Gallatin, Gallia, Hancock, Harlan, Harrison, Hart, Henderson, Hickman, Highland, Holmes, Holt, Howell, Humphreys, Jackson, Jefferson, Johnson, Jones, Knott, Knox, Kuykendall, Labadie, Letcher, Lincoln, Logan, Lyon, Madison, Magoffin, Marion, Marshall, Martin, Mason, Meade, Mercer, Merrett, Morgan, Moultrie, Muhlenberg, Nelson, Nicholas, Nolin, Owsley, Owen, Paducah, Paine, Pendergast, Perry, Pike, Polk, Powell, Pulaski, Putnam, Raleigh, Randall, Ray, Reade, Robertson, Rowan, Russell, Rutherford, Scott, Shelby, Simpson, Smith, Spalding, Spencer, Stewart, Stillman, Sullivan, Telford, Todd, Trimble, Union, Vance, Warren, Washington, Watkins, Wayne, West, Whitley, Wolfe, Woodford, Woodson, Wright, York, Zachary.
 - Blue (Southwest):** Adams, Allen, Anderson, Boone, Breathitt, Butcher, Caldwell, Calloway, Carter, Cass, Casey, Chambers, Chatham, Clark, Clay, Clinton, Crittenden, Cumber, Cumberland, Davidson, De Kalb, Dickson, Elliott, Estill, Fenton, Floyd, Franklin, Fulton, Gallatin, Gallia, Hancock, Harlan, Harrison, Hart, Henderson, Hickman, Highland, Holmes, Holt, Howell, Humphreys, Jackson, Jefferson, Johnson, Jones, Knott, Knox, Kuykendall, Labadie, Letcher, Lincoln, Logan, Lyon, Madison, Magoffin, Marion, Marshall, Martin, Mason, Meade, Mercer, Merrett, Morgan, Moultrie, Muhlenberg, Nelson, Nicholas, Nolin, Owsley, Owen, Paducah, Paine, Pendergast, Perry, Pike, Polk, Powell, Pulaski, Putnam, Raleigh, Randall, Ray, Reade, Robertson, Rowan, Russell, Rutherford, Scott, Shelby, Simpson, Smith, Spalding, Spencer, Stewart, Stillman, Sullivan, Telford, Todd, Trimble, Union, Vance, Warren, Washington, Watkins, Wayne, West, Whitley, Wolfe, Woodford, Woodson, Wright, York, Zachary.
 - Orange (Northwest):** Adams, Allen, Anderson, Boone, Breathitt, Butcher, Caldwell, Calloway, Carter, Cass, Casey, Chambers, Chatham, Clark, Clay, Clinton, Crittenden, Cumber, Cumberland, Davidson, De Kalb, Dickson, Elliott, Estill, Fenton, Floyd, Franklin, Fulton, Gallatin, Gallia, Hancock, Harlan, Harrison, Hart, Henderson, Hickman, Highland, Holmes, Holt, Howell, Humphreys, Jackson, Jefferson, Johnson, Jones, Knott, Knox, Kuykendall, Labadie, Letcher, Lincoln, Logan, Lyon, Madison, Magoffin, Marion, Marshall, Martin, Mason, Meade, Mercer, Merrett, Morgan, Moultrie, Muhlenberg, Nelson, Nicholas, Nolin, Owsley, Owen, Paducah, Paine, Pendergast, Perry, Pike, Polk, Powell, Pulaski, Putnam, Raleigh, Randall, Ray, Reade, Robertson, Rowan, Russell, Rutherford, Scott, Shelby, Simpson, Smith, Spalding, Spencer, Stewart, Stillman, Sullivan, Telford, Todd, Trimble, Union, Vance, Warren, Washington, Watkins, Wayne, West, Whitley, Wolfe, Woodford, Woodson, Wright, York, Zachary.
 - Teal (East and Central):** Adams, Allen, Anderson, Boone, Breathitt, Butcher, Caldwell, Calloway, Carter, Cass, Casey, Chambers, Chatham, Clark, Clay, Clinton, Crittenden, Cumber, Cumberland, Davidson, De Kalb, Dickson, Elliott, Estill, Fenton, Floyd, Franklin, Fulton, Gallatin, Gallia, Hancock, Harlan, Harrison, Hart, Henderson, Hickman, Highland, Holmes, Holt, Howell, Humphreys, Jackson, Jefferson, Johnson, Jones, Knott, Knox, Kuykendall, Labadie, Letcher, Lincoln, Logan, Lyon, Madison, Magoffin, Marion, Marshall, Martin, Mason, Meade, Mercer, Merrett, Morgan, Moultrie, Muhlenberg, Nelson, Nicholas, Nolin, Owsley, Owen, Paducah, Paine, Pendergast, Perry, Pike, Polk, Powell, Pulaski, Putnam, Raleigh, Randall, Ray, Reade, Robertson, Rowan, Russell, Rutherford, Scott, Shelby, Simpson, Smith, Spalding, Spencer, Stewart, Stillman, Sullivan, Telford, Todd, Trimble, Union, Vance, Warren, Washington, Watkins, Wayne, West, Whitley, Wolfe, Woodford, Woodson, Wright, York, Zachary.

Baptist Health Richmond

- 105-bed acute care hospital in Richmond, Kentucky
 - 94 acute care beds
 - 11 Psychiatric beds
- Baptist Health System Immediate Past Top Performer in Safety, Quality, and Patient Experience
- Average Monthly Admissions: 512
- Average Monthly Discharges: 618



Diabetes in the Hospital Setting

Impact of Diabetes in the Hospital

- **Prevalence: (Diabetes as any listed diagnosis)**
 - 16.8 million emergency department visits in 2020
 - 267,000 for hyperglycemic crisis
 - 240,000 for diabetic ketoacidosis
 - 202,000 for hypoglycemia
 - 7.86 million hospital discharges in 2020 (335.4 per 1000 adult patients with diabetes)
- **Morbidity:**
 - Leading cause of:
 - End-stage kidney disease
 - New cases of blindness
- **Mortality:**
 - Eighth leading underlying cause of death in 2021 (103,294 deaths)

Guideline Landscape:

- **Glycemic Goal:** Recommended if it can be achieved without significant hypoglycemia
 - Critically Ill: 140-180 mg/dL
 - Noncritically Ill: 100-180 mg/dL
- **Insulin Initiation or Intensification Recommendation:**
 - Patients with BG $\geq$ 180 mg/dL on **two** occasions within 24-hours
- **Glucose-lowering Treatment Option Recommendations:** Emphasis on *individualized* approach to glycemic management
 - Critically Ill: Continuous insulin infusion
 - Noncritically Ill:
 - Poor / No PO Intake: Basal +/- correction scale insulin
 - Adequate Nutritional Intake: Basal, prandial (bolus), AND correction insulin

What about Sliding Scale?

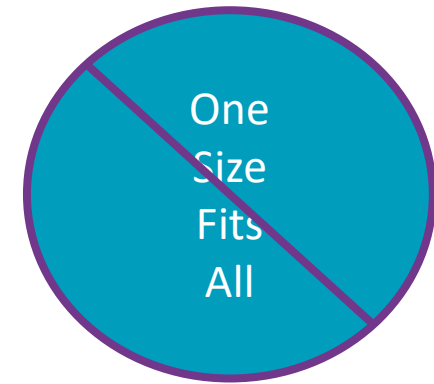
- Sliding Scale → Correction Scale or Supplemental Insulin Therapy
- American Diabetes Association recommends **against** the sole use of correction insulin except for patients with **mild** hyperglycemia or stress hyperglycemia
 - Basal-bolus insulin compared to correction scale insulin resulted in a difference in BG of 23 to 58 mg/dL. ($P < 0.01$)
 - 66% of patients achieved their blood glucose target of < 140 mg/dL in the basal-bolus group compared to 38% in the correction scale insulin group
 - No difference in rate of hypoglycemia or LOS between groups

Evidence based Recommendation:

Patients on correction scale insulin therapy should be monitored for worsening hyperglycemia to transition them to basal-bolus + correction insulin therapy

Patient Specific Considerations to Insulin

- Both IV and SubQ insulin listed as an ISMP High-Alert Medication
- **Pathophysiological Considerations:** (insulin sensitivity)
 - T1DM – inability to produce insulin
 - T2DM – insulin resistance
- **Pharmacokinetic Considerations**
 - Insulin is renally and hepatically eliminated
- **Pharmacodynamic Considerations:**
 - Onset and duration of action difference based on the type of insulin (long-acting, rapid-acting, regular)
- **Other Patient Specific Considerations:**
 - Prior to admission diabetes management
 - Prior A1C
 - Nutritional Status
 - Concurrent, high-dose, steroids



CMS eCQM Metrics on Glycemic Management

- New quality metrics highlight need for appropriate inpatient glycemic management
 - Severe Hypoglycemia
 - % of patient stays with a BG < 40 mg/dL AND hypoglycemic medication administered within 24 hours prior to event
 - Severe Hyperglycemia
 - % of patient days with one or more BG > 300 mg/dL, excluding the first 24-hours following admission

Inpatient Glucose Management Technologies

Available Glucose Management Technologies

Company	Product	Recommends IV Insulin Doses?	Supports IV to SQ Transitions?	Recommends SQ Insulin Doses?	Additional Notes
Glytec	<i>Glucommander</i>	Yes	Yes	Yes	
Monarch Medical Technology	<i>EndoTool</i>	Yes	Yes	Yes	Supports parenteral nutrition
Medical Decision Network	<i>GlucoStabilizer</i>	Yes	Yes	No	
Transformative Med	<i>Core Diabetes App</i>	Yes	Yes	Yes*	*Does not adjust the insulin doses automatically

Published literature compares dosing software to standard of care, no head-to-head comparison data available

Benefits of Glucose Management Technologies

- Reduced incidence of hypoglycemia compared to standard of care.
 - Retrospective observational crossover study with Glucomander SubQ reported BG < 70 mg/dL of 1.9% compared to 2.6% (P = 0.001) and 2.8 (P = 0.001)
 - Single Center Retrospective review of Glucomander IV reported BG < 40 in 0.02% of BGs compared to 0.44% in standard of care. (P < 0.01)
- Reduced time to target BG range
- Increased time in target BG range
- Reduced length of stay
- Development of safe discharge regimen

Aloi *AACE* (2016)

Messler (2019)

Ullal *Curr Diab Rep* (2019)

Integration of Glucommander at Baptist Health

- Baptist Health System incorporated Glucommander IV & SubQ (with IV to SubQ transition). Software fully integrated into Epic EHR and built as follows:
 - **Glucommander IV – Go-live 01/2023**
 - Targeted patients for Glucommander IV:
 - DKA/HHS
 - Post-operative Cardiovascular Surgery
 - Obstetrics
 - Critically Ill with Hyperglycemia
 - **Glucommander SubQ – Go-live 05/2023**
 - Targeted patients for SubQ therapy:
 - T1DM patients
 - T2DM patients with prior to admission insulin utilization
 - Patients with acute, uncontrolled, hyperglycemia on presentation to the hospital (≥ 2 BGs > 180 mg/dL in a 24-hour window)
 - Options for weight-based initiation or custom starts based on provider's professional discretion
 - **Glucommander IV to Glucommander SubQ Transition**
 - Set clinical and technical transition criteria
 - Recommends patient specific transition dose based on IV insulin therapy

Integration of Glucommander at Baptist Health Richmond

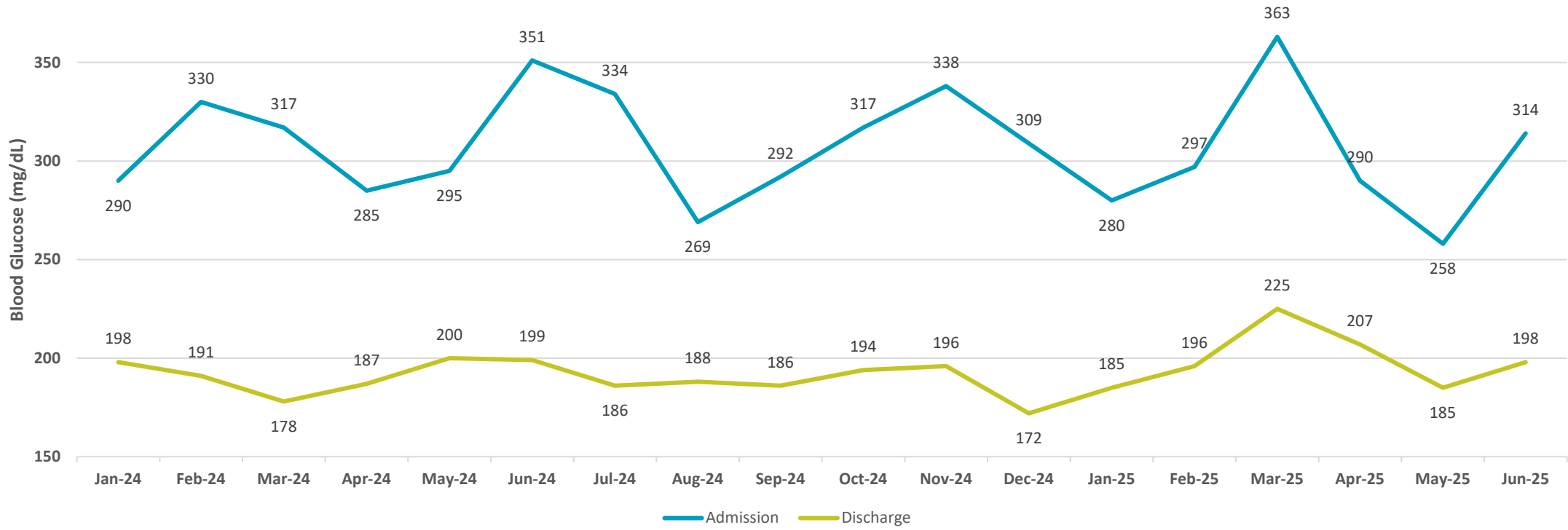
Observed Benefits

- Strong reduction in hypoglycemic events, notable absence of severe hypoglycemia in both IV and SubQ Glucommander
- Patients with improved glucose control through hospitalization
- Route Specific:
 - **SubQ:** Reduced daily maintenance for providers to adjust orders
 - **IV:** Algorithm based dose adjustments rather than nurse driven titrations

Experienced Barriers

- Heavy education burden at implementation of software and new staff onboarding
- Maintaining interdisciplinary competency with software for existing staff
- Provider and/or nursing pushback of workflow
 - Increased “Clicks” compared to non-Glucommander insulin orders

Impact of Glucommander SubQ at Baptist Health Richmond: Admission vs. Discharge Blood Glucose Values with Glucommander



1/24	2/24	3/24	4/24	5/24	6/24	7/24	8/24	9/24	10/24	11/24	12/24	1/25	2/25	3/25	4/25	5/25	6/25
-92	-139	-139	-98	-95	-152	-148	-81	-106	-123	-142	-137	-95	-101	-138	-83	-73	-116

Baptist Health Richmond Glycemic Management Committee

- Local extension of interdisciplinary system Glycemic Management Committee
 - Co-chaired by Director of Pharmacy and Pharmacy Clinical Manager with both a physician and administrative Champion
 - Nursing Leadership (ICU and Telemetry)
 - Ancillary Service Involvement: Quality Department, Pharmacy, Clinical Informatics, Clinical Nutrition, Diabetes Education
- Bi-monthly meeting cadence
- Focus on the promotion of quality improvement in glycemic management

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Questions and Answers

Contact Information:

Email: casey.metts@bhsi.com

Office: 859-625-3533

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