

Glycemic Control in the Hospitalized Patient: A multidisciplinary approach

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What is Hyperglycemia?

Normal BG 80-100 mg/dl

> 100 mg/dl

Causes of Hyperglycemia in the hospitalized patient

- Type 1 DM – insulin deficiency
- Type 2 DM – insulin resistance
- Stress-induced hyperglycemia
- Glucose administration
- Drugs – catecholamines, steroids

Blood gets sugar-coated – So what?



Physiological Effects of Hyperglycemia

Studies have shown that:

- Heart functions less effectively – more heart damage and heart failure after heart attack
- Worsens brain injury; poorer outcomes
- Immune function and killing ability of phagocytes impaired
 - Healing impaired
 - More infections
- Impairs oxygen delivery
- Promotes inflammation

Other Effects of Hyperglycemia

- Increased mortality and complications
 - 75% for every 50mg increase
 - 3x mortality when BG 144 vs 110
- Increased costs and LOS
 - For each 50 mg/dl increase in BG on the 1st POD in CABG patients
 - ❖ Increases LOS by 0.76 days
 - ❖ Increases charges by \$2824
 - ❖ Increases costs by \$1769

Tight Glycemic Control and Outcomes

- Reduced hospital-acquired infections, sepsis, halved blood stream infections
- Reduced mortality (30-50%)
- Reduced important complications
- Decreased time on the ventilator
- Decreased LOS and costs
- Improved functional recovery
- Benefit in ***both DM and non-DM***



Glycemic Control Project

Systemwide **U**ndertaking for **G**lycemic **A**chievable **R**esults

Orlando Regional Medical Center, Orlando, Florida

- Set up a multi-professional team: RNs, CDEs, APNs, MDs, pharmacists, nutrition, POCT lab
- Goal: Improve glycemic control in hospital system
- Evaluated areas where practice could improve
- ROL for research and evidence based guidelines for glycemic control

Project Activities

- Developed protocols/guidelines/order sets for:
 - Hypoglycemia
 - IV Insulin Infusion
 - Sliding Scale insulin
 - DKA/HHS
 - Insulin pump management
- Educational program development (patients and staff) on intranet
- Order sets incorporated into computerized medical record



Glycemic Control in Critical Care

Systemwide **U**ndertaking for **G**lycemic **A**chievable **R**esults

Orlando Regional Medical Center, Orlando, Florida

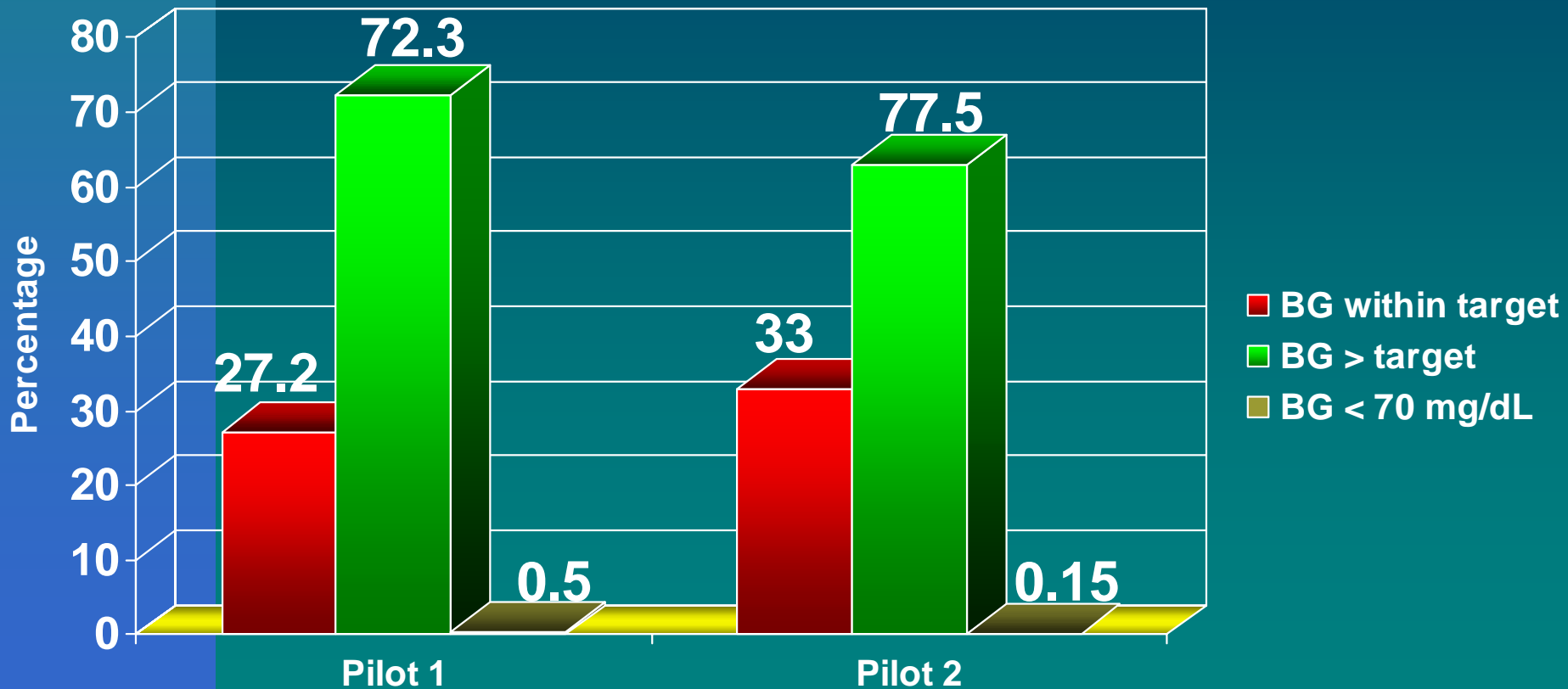
- Part of PI initiative aimed to improve existing protocols for glycemic control in critical care
- Pilot study over 6 months with incremental implementation: CVRR, then ICU, then step-down units
- BG > 150 X 2 prompted a call to MD
- Established 2 target ranges: 80-120; 100-150
- Goal: Reduce BG by 50-70mg/dl/H
- Hourly BG testing while adjustments are made, then once stable, q2-4h
- Monitored for safety, effectiveness, compliance

Insulin Infusion Orders

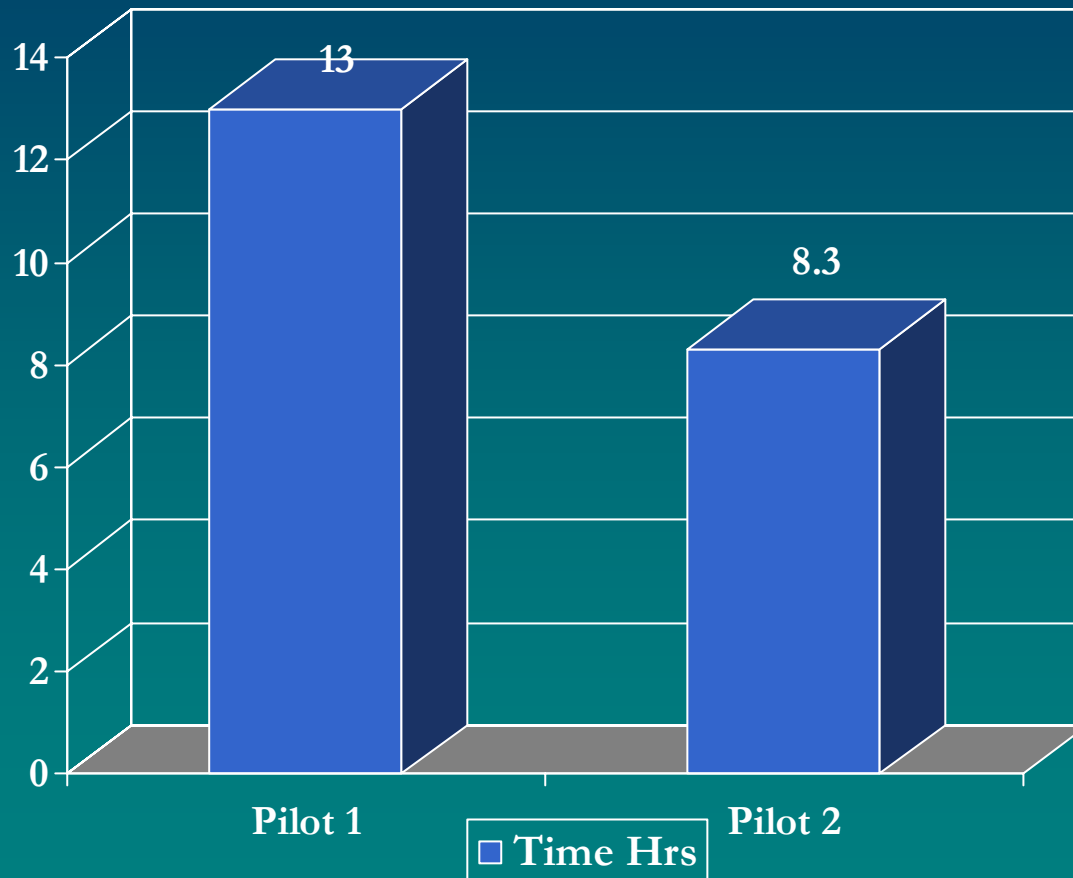
Column 1		Column 2		Column 3		Column 4	
☐ Low Dose		☐ Medium Dose		☐ High Dose		Very high dose	
BG level (mg/dL)	Units/H	BG level (mg/dL)	Units/H	BG level (mg/dL)	Units/H	BG level (mg/dL)	Units/H
> 360	6	>360	12	>360	16	>360	32
330-359	4	330-359	8	330-359	14	330-359	28
300-329	4	300-329	7	300-329	12	300-329	24
270-299	3	270-299	6	270-299	10	270-299	20
240-269	3	240-269	5	240-269	8	240-269	16
210-239	2	210-239	4	210-239	6	210-239	12
180-209	2	180-209	3	180-209	4	180-209	8
150-179	1.5	150-179	2	150-179	3	150-179	4
120-149	1	120-149	1.5	120-149	2	120-149	2
100-119	0.5	100-119	1	100-119	1	100-119	1
<100	OFF	<100	OFF	< 100	OFF	< 100	OFF
<70 (mg/dL)		Start hypoglycemia protocol (see below.)					

Results – Blood Glucose

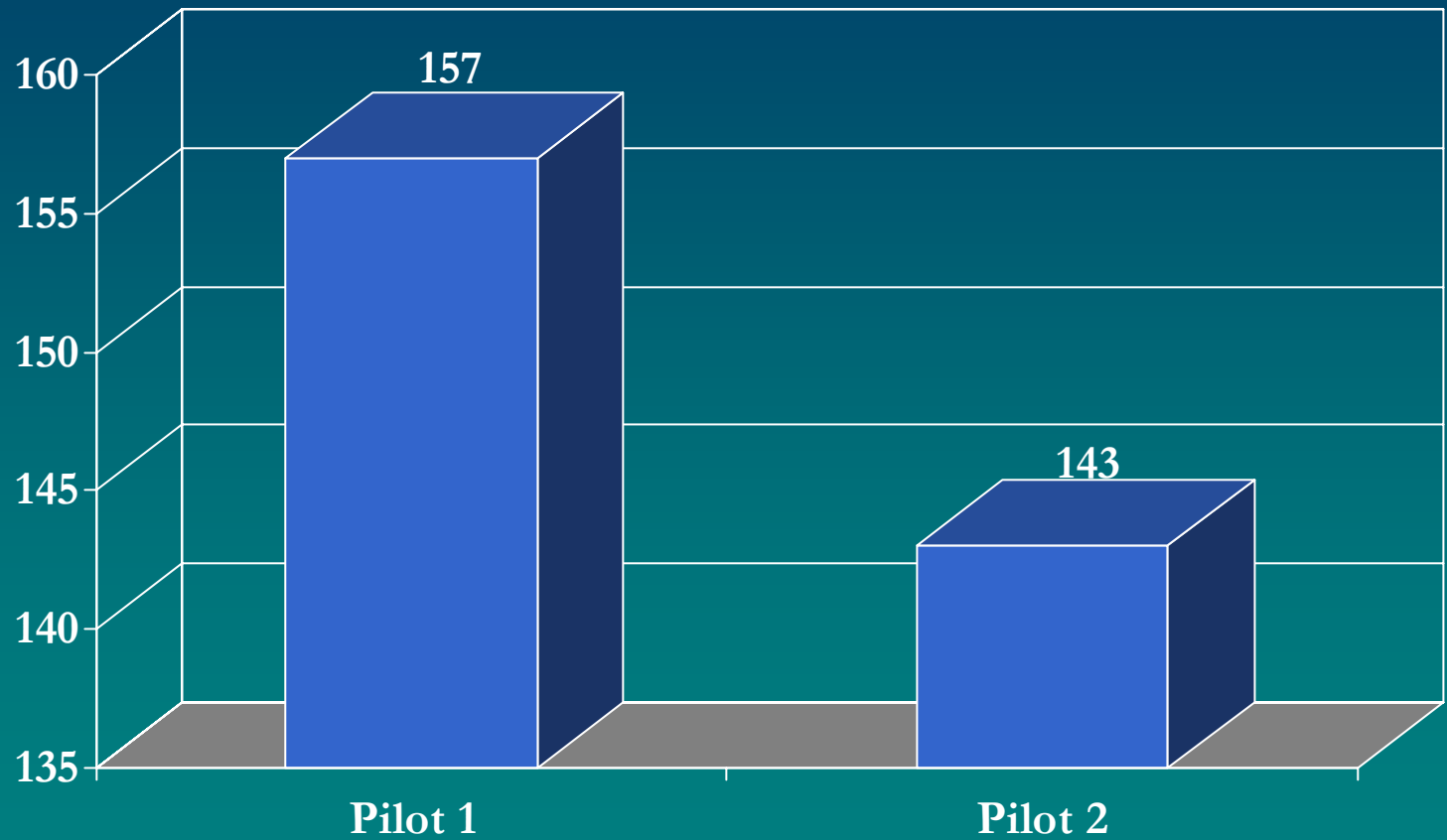
Percent of BG Testing at Goal



Time to Target



Average BG

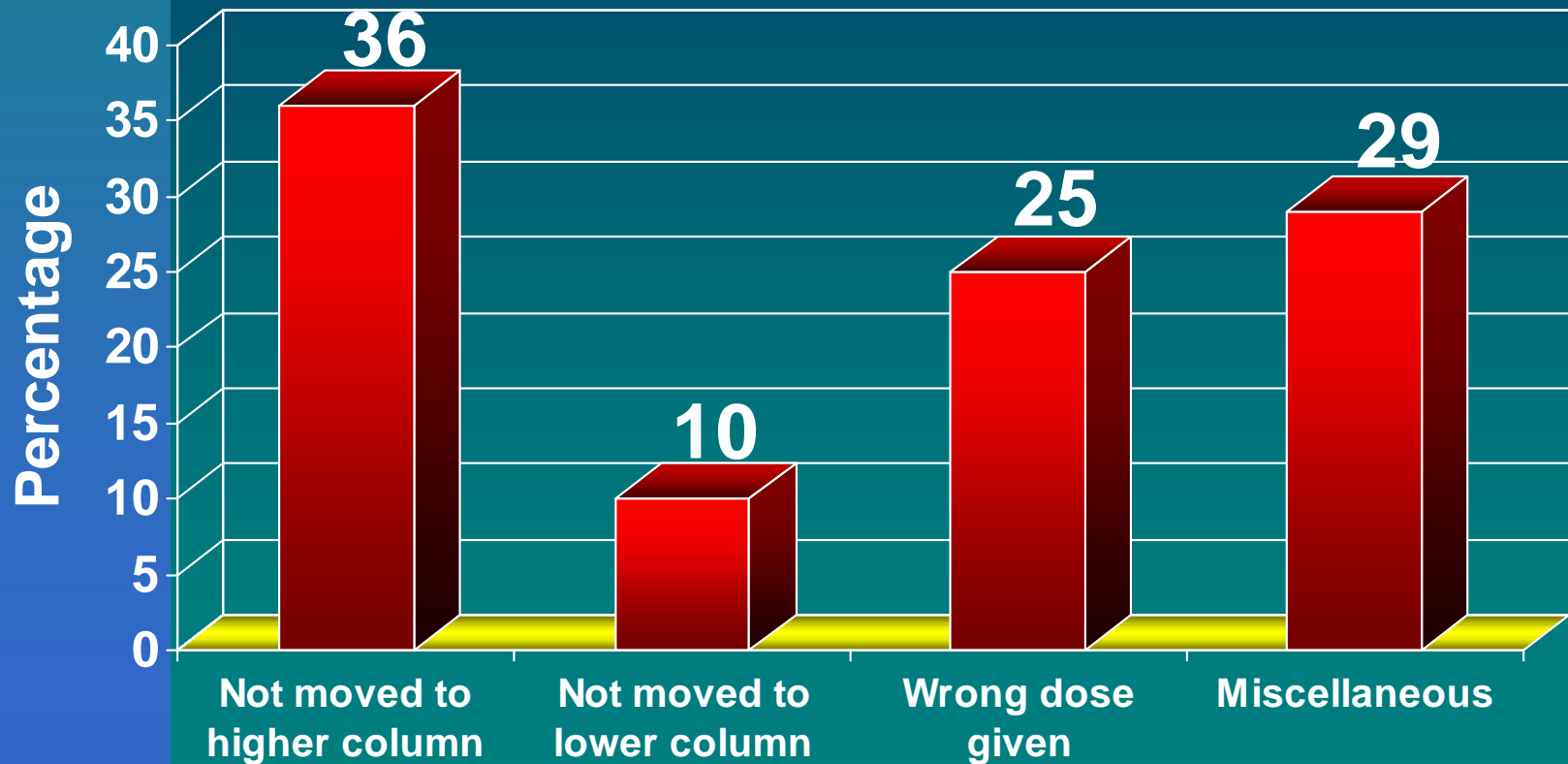


Results – Compliance

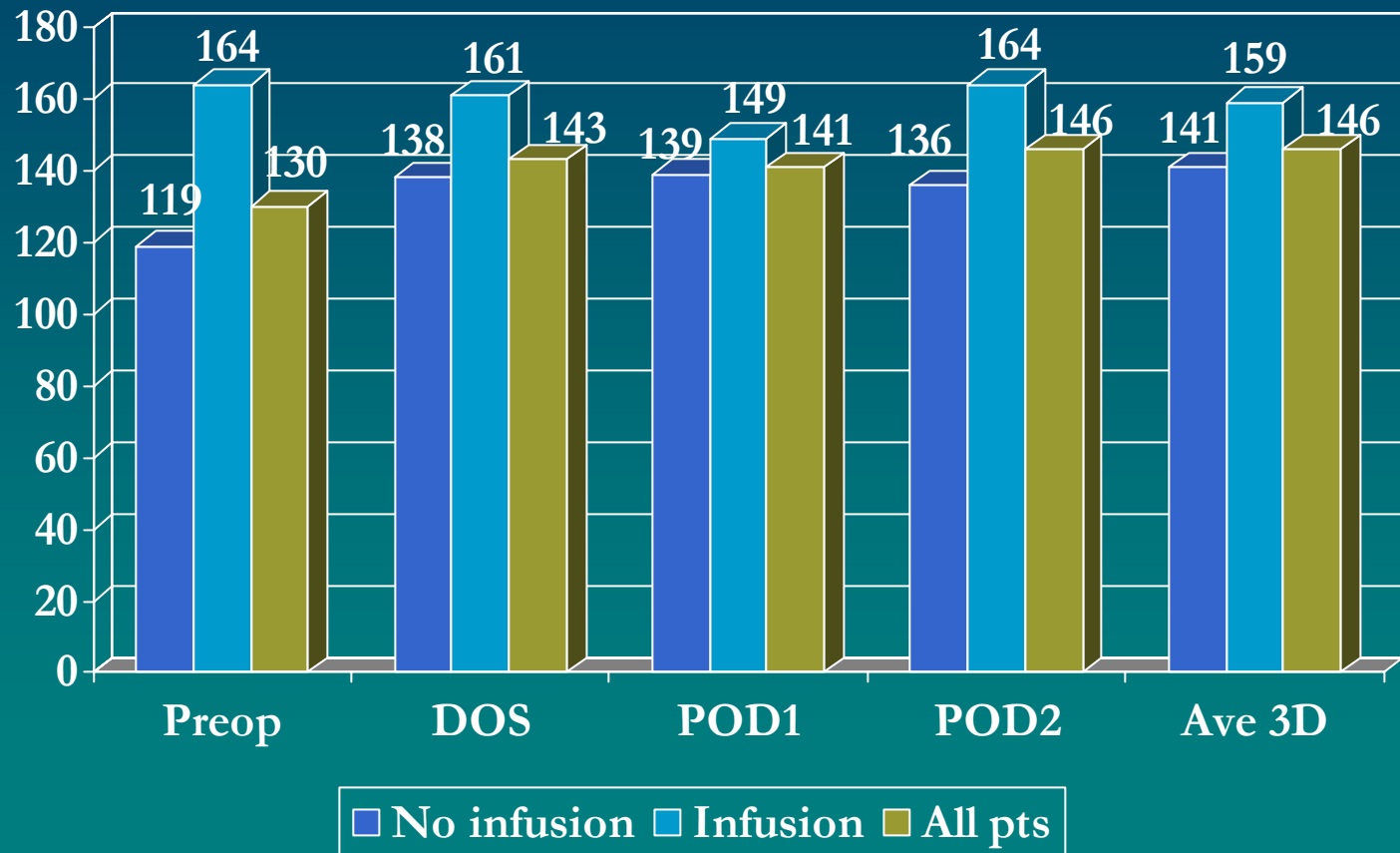
- 10 % of hourly blood glucose monitoring was omitted in ICU; 13% in CVRR
- 22 % hourly infusion rates were incorrect

Results – Compliance

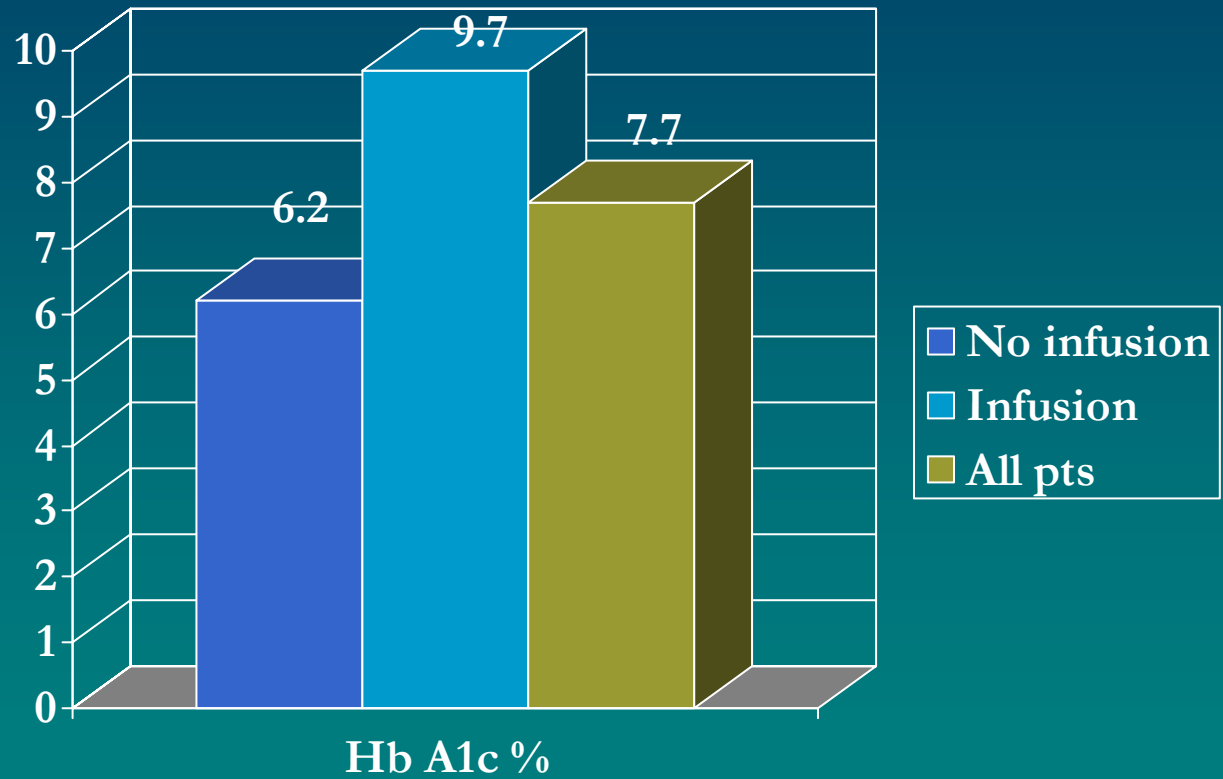
Reasons for incorrect infusion rates



Differences between groups (n=198)



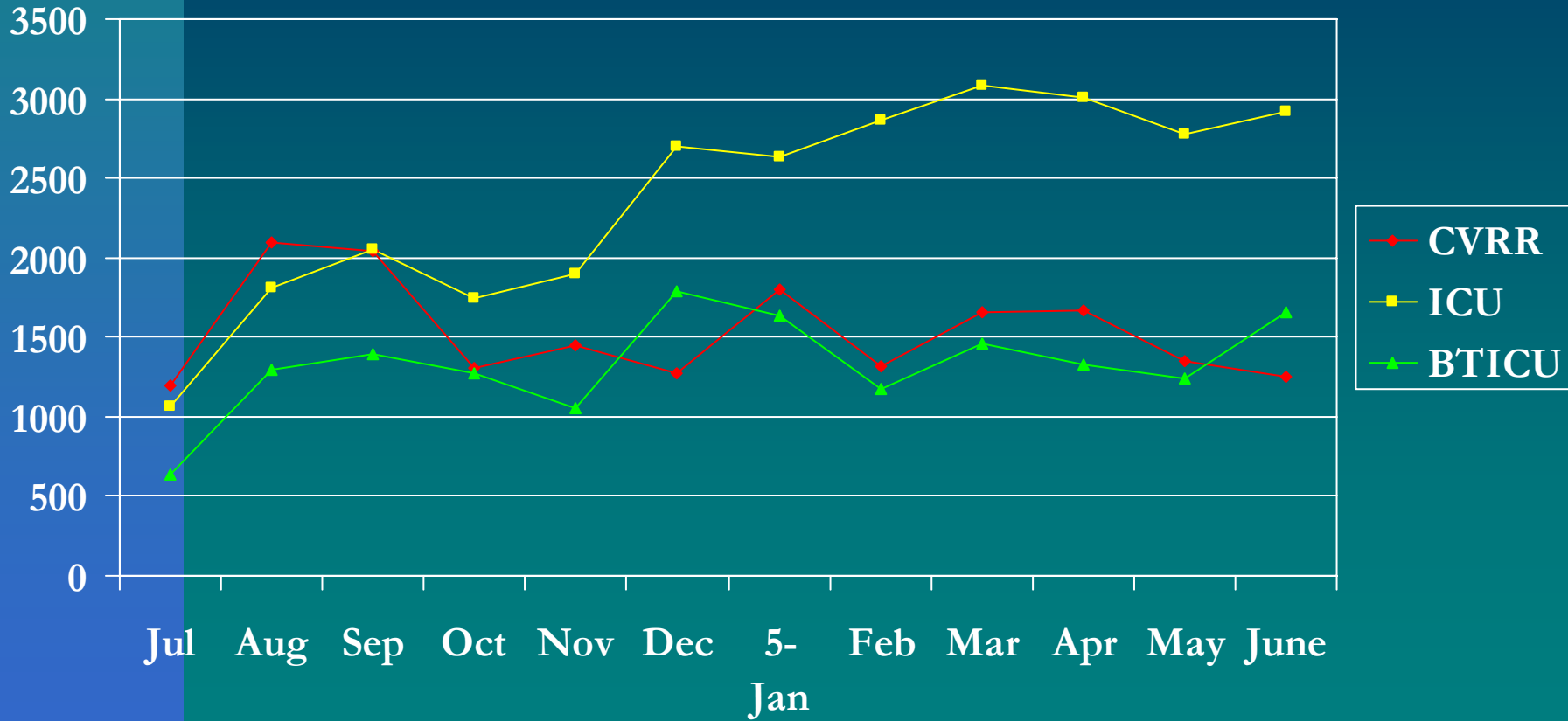
Hb A1c



Glucose Meter Inventory in Pilot Areas

Unit	Pre-TGC	After pilot testing TGC
CVRR Cardiac Surg	3	6
ICU	3	6
BTICU	2	3

POC BG Testing



Clinical implications of tight glycemic control?

- Changing strong belief systems
 - Fear of hypoglycemia
 - Don't believe hyperglycemia is an issue
- Increased work to monitor BG and adjust IV insulin infusions
- Patient fingersticks and blood testing
- Burden on POCT lab personnel with increased need for monitors, QC, education

Next Steps in SUGAR Project

- Implemented revised IV insulin orders with 6 columns
- Work with POC testing in lab to monitor BG trends in units over time
- Evaluating the workload and costs for BG monitoring
- Evaluating outcomes of TGC in ICU and other populations
- Expanding tighter glycemic control to non-critical care areas

Questions?

Feel free to contact me at
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