



Dripping with Safety

Multidisciplinary Approaches to Standardize Insulin Infusions

Midwest Medication Safety Symposium
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Presenters

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Objectives

1. Justify the need for standardized insulin protocols
2. Understand the implementation of insulin protocols that can improve patient safety
3. Discuss the clinical outcomes of a pharmacist driven transition from intravenous to subcutaneous insulin protocol

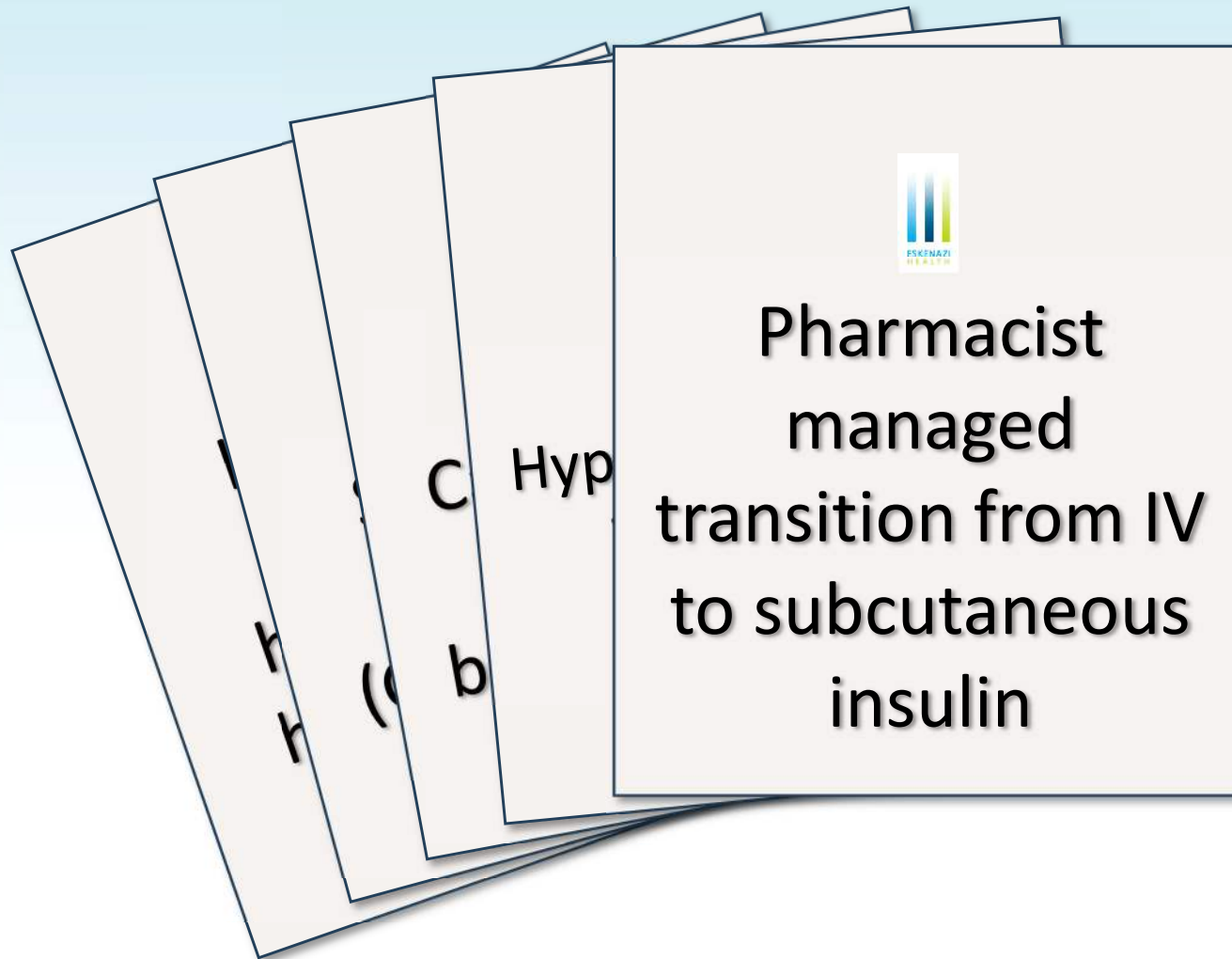


Eskenazi Health

- 333 beds
- Academic, safety-net hospital
- Indianapolis, IN
- Level I trauma center
- >100,000 annual ED visits
- Electronic health record (EHR):
Epic



Insulin Infusion Protocols





Audience Poll

How many of your institutions have similar protocols?
Please vote for which ones you have.

- A. DKA/HHS
- B. Stress-induced hyperglycemia (GlucoStabilizer[®])
- C. Calcium channel blocker/beta blocker overdose
- D. Hypertriglyceridemia-induced acute pancreatitis
- E. Pharmacist managed transition from IV to subcutaneous insulin



Insulin: A High Alert Medication



Hypoglycemia Definitions

Level 1

54–70 mg/dL

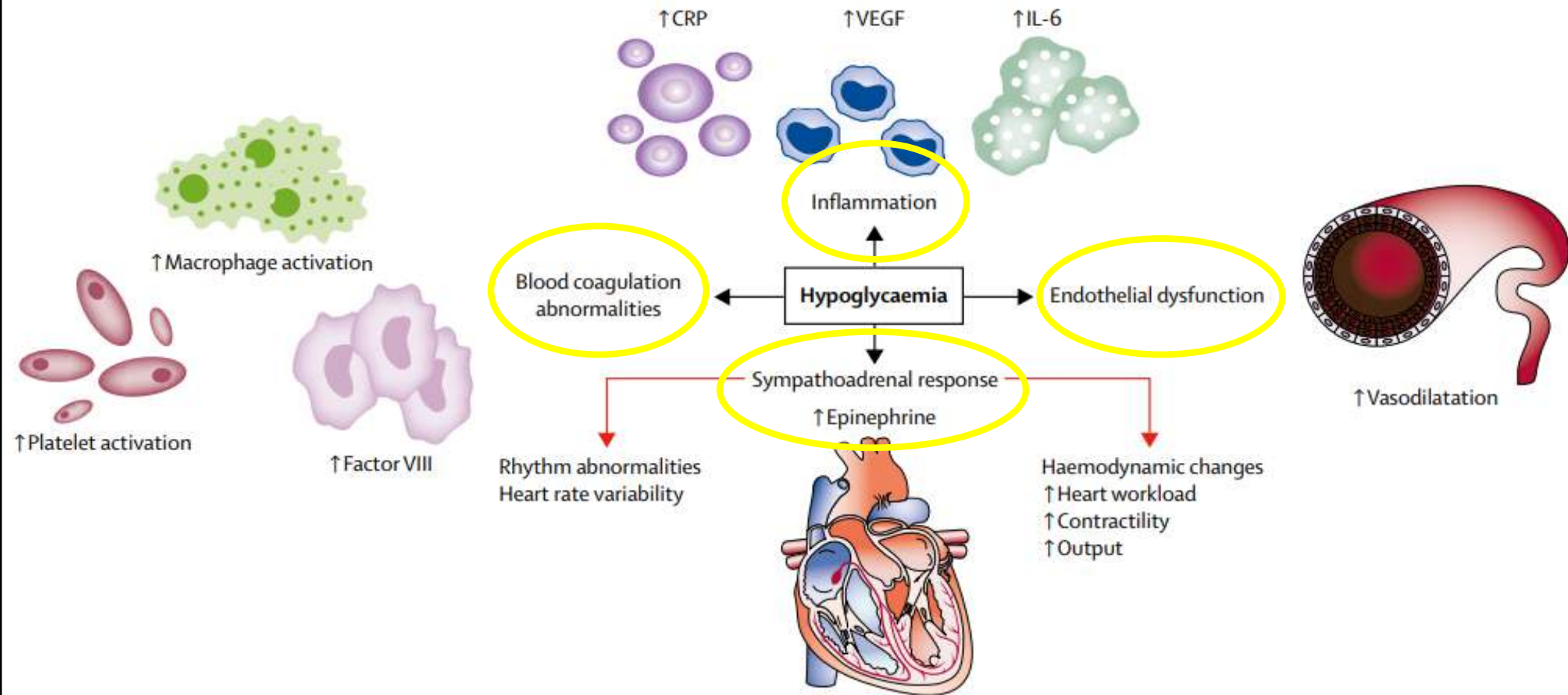
Level 2

<54 mg/dL

Level 3

Altered mental status
and/or
Impaired physical functioning requiring assistance

Pathophysiology



1.5 – 6x increase in cardiovascular events and mortality

Insulin Medication Errors



High rate of
harm

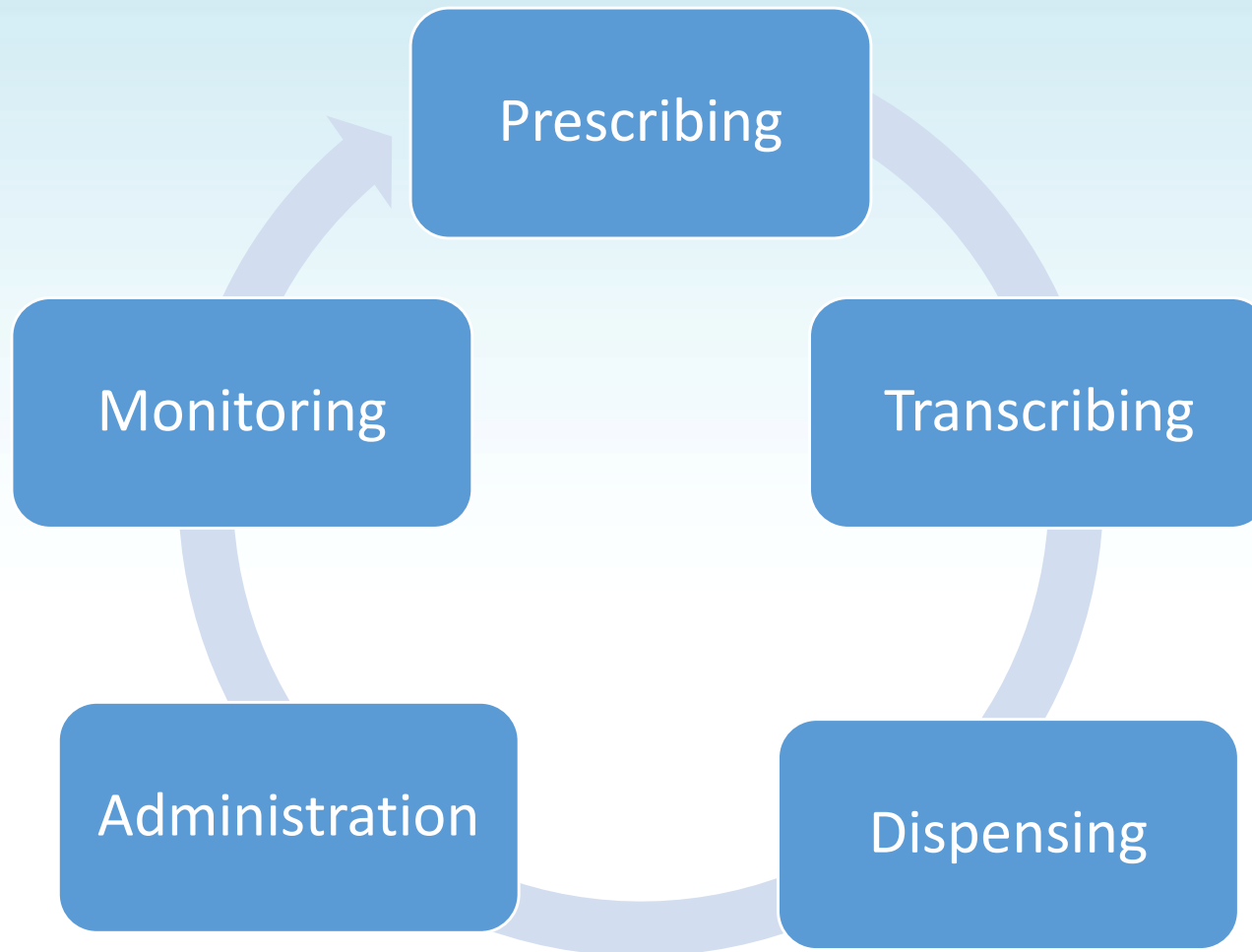
Represented 16% of all med errors
that caused harm



Most common medication error in
the intensive care unit

186 errors per 1000 days
of insulin treatment

Med Process Steps



Prescribing and Transcribing

“Insulin should be administered using **validated** written or computerized **protocols** that allow for **predefined adjustments** in the insulin dosage based on glycemic fluctuations”



Prescribing and Transcribing

Default weight based dosing

Customized for various diagnoses and comorbidities

Embed glucose monitoring and hypoglycemia protocols

Dispensing, Administration, and Monitoring



Standardized insulin drip concentrations



Prepare insulin infusions in the pharmacy



Utilization of smart infusion technology



Blood glucose monitoring every 1 to 2 hours



Prompt action in response to changes in glucose

AJHP 2013;70:1404-13.

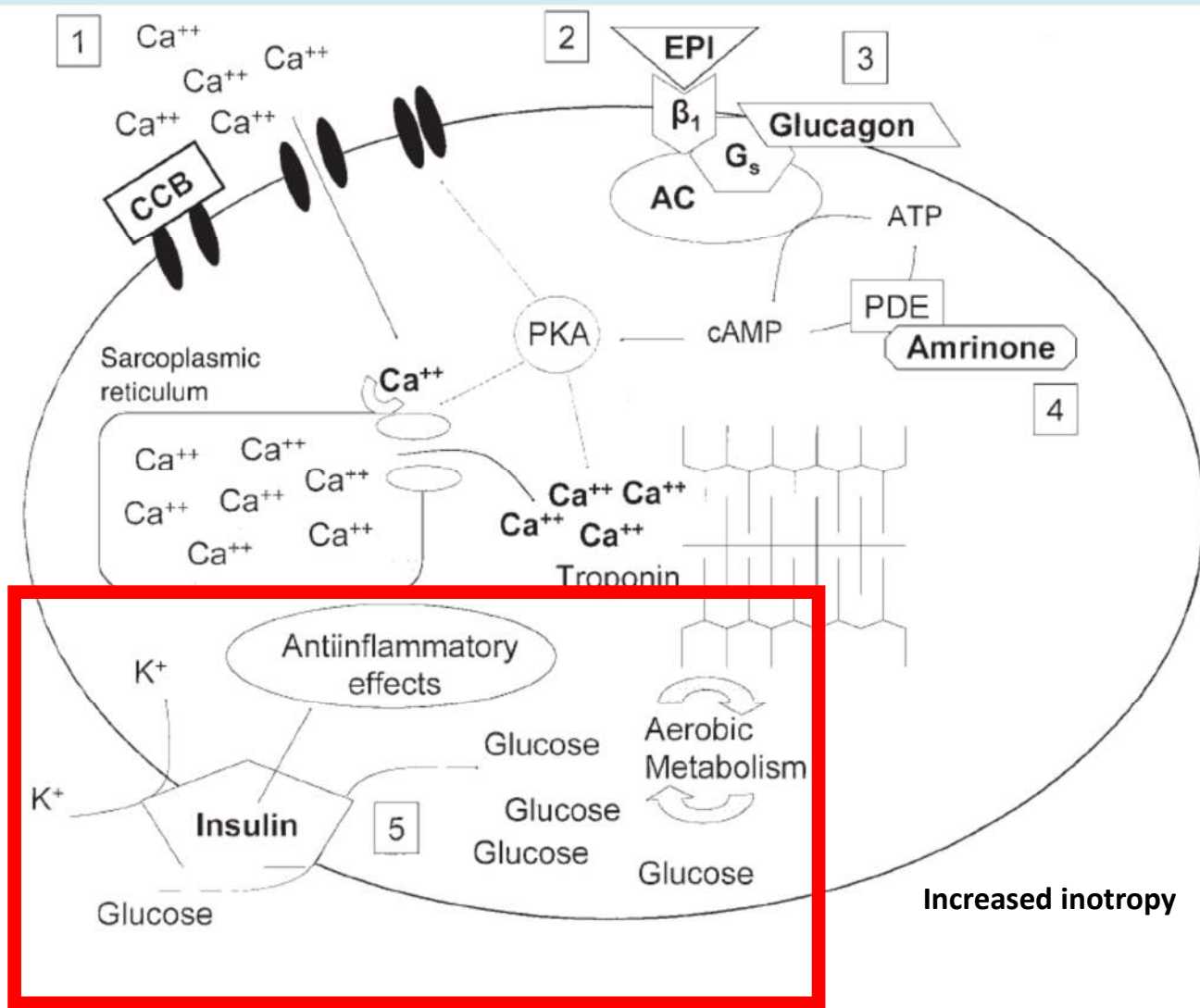
J Patient Saf 2021;17:430-6.

Nat Rev Endocrinol 2016;12(4):222-32.



High-Dose Insulin Therapy for Beta Blocker/Calcium Channel Blocker Overdoses

How Does It Work?





High-Dose Insulin Euglycemic Therapy (HIET)

- Dosing
 - Insulin infusion at 0.5 to 10 units/kg/hr (physician titrated)
 - Titrate every 30 to 50 minutes to systolic blood pressure greater than 90 to 100 mmHg or effect (improved contractility, decreased symptoms)
 - Dextrose 10% infusion at 5 to 10 mL/kg/hr
- Monitoring
 - Improved contractility within 15 to 60 minutes
 - Goal glucose: 100 to 250 mg/dL
 - Serum electrolytes every 1 to 2 hours (glucose, potassium)



Patient Example

- 28 yom s/p ingestion of amlodipine 10 mg x 90 tablets, 90 kg)
 - Insulin infusion 1 unit/kg/hr = **90 units/hr**
 - If using insulin infusion 100 units/100 mL, bag would run empty every 60 minutes
 - If titrated to max dose of 10 units/kg/hr = **900 units/hr**
 - If using insulin infusion 100 units/100 mL, bag would run empty every 6 to 7 minutes
 - Patient would be receiving over 21 L every 24 hours from insulin infusion alone



Patient Safety Concerns

- Need for concentrated insulin infusion
- Large deviation from insulin infusion concentration utilized for other indications (e.g., DKA)
- Potential for errors during medication use process
 - Prescribing and transcribing
 - Dispensing
 - Administration

Prescribing and Transcribing

▼ High dose insulin and dextrose therapy

Insulin/Dextrose

insulin bolus and infusion

insulin regular (HumuLIN) bolus from bag 104 Units

104 Units (1 Units/kg × 104 kg), intravenous, Once, today at 1500, For 1 dose
Bolus from bag.
Routine

insulin regular (HumuLIN R, NovoLIN R) 4,000 Units in sodium chloride 250 mL (16 Units/mL) infusion

0.5 Units/kg/hr × 104 kg (3.25 mL/hr), intravenous, Continuous, Starting today at 1500
MD to titrate.

If high dose insulin therapy initiated, transfer to ICU level of care and ICU team is required (see Policy 950-189, Patient Throughput).
Routine

dextrose

dextrose 10 % IVPB for hypoglycemia 12.5 g

12.5 g, intravenous, at 999 mL/hr, As needed, low blood sugar, Starting today at 1435

For blood glucose less than or equal to 70 if the patient is NPO and/or non-responsive and an IV is in place. If patient is on insulin infusion or GlucoStabilizer- refer to D10 order for IV infusion or glucostabilizer.

Routine

dextrose infusion

dextrose 10 % infusion

5 mL/kg/hr × 104 kg (520 mL/hr), intravenous, Continuous, Starting today at 1500

Routine

dextrose 5 % (D5W) infusion

10 mL/kg/hr, intravenous, Continuous

dextrose 5% and lactated ringers (D5LR) infusion

Whole blood glucose (POC)

As needed, Starting today at 1434, Until Specified, POC glucose every 15-30 minutes until glucose is 100-200 mg/dL for 4 hours, then every hour.

Potassium

Every 4 hours, First occurrence today at 1600, Until Specified, Blood, Blood, Peripheral

Notify physician - Glucose

Until discontinued, Starting today at 1435, Until Specified

Glucose less than (mg/dL): 100



Prescribing and Transcribing

insulin regular (HumuLIN R, NovoLIN R) 4,000 Units in sodium chloride 250 mL (16 Units/mL) infusion ✓ Accept ✗ Cancel

Reference Links: [Lexicomp Drug Information](#)

Dose: Units/kg/hr **0.5 Units/kg/hr** 1 Units/kg/hr

Weight Type:
Recorded 104 kg **Ideal** 82.2 kg **Adjusted** 90.9 kg
Order-Specific Weight

Additional Details:
Weight: 104 kg (153 days ago)

Calculated dose: 52 Units/hr ⓘ

Route: **intravenous**

Frequency: **Continuous**

Starting **Today** Tomorrow | For **Hours** **Days**
At

Starting: **Today 1500** Ending: **Until Discontinued**

Admin Instructions: [MD to titrate.](#)

Prod. Admin. Inst.: If high dose insulin therapy initiated, transfer to ICU level of care and ICU team is required (see Policy 950-189, Patient Throughput).

Note to Pharmacy: [+ Add Note to Pharmacy](#)



Dispensing

HIGH DOSE INSULIN THERAPY

Masked, Test

MFRN: 100002426

ED-1404-A

30 yrs [3/31/1990]

CSN: 10000122171

Ord#2114882

insulin regular (HumuLIN, NovoLIN) 4,000 Units in sodium chloride 250 mL (16 Units/mL) infusion

Dose: 0.5 Units/kg/hr

Frequency: Continuous

Route: intravenous

Due time: 9/25/20 14:46

sodium chloride 210 mL

insulin regular 4,000 Units 40 mL

Total Volume: 250 mL



Administer using insulin - toxicology Alaris Guardrail.

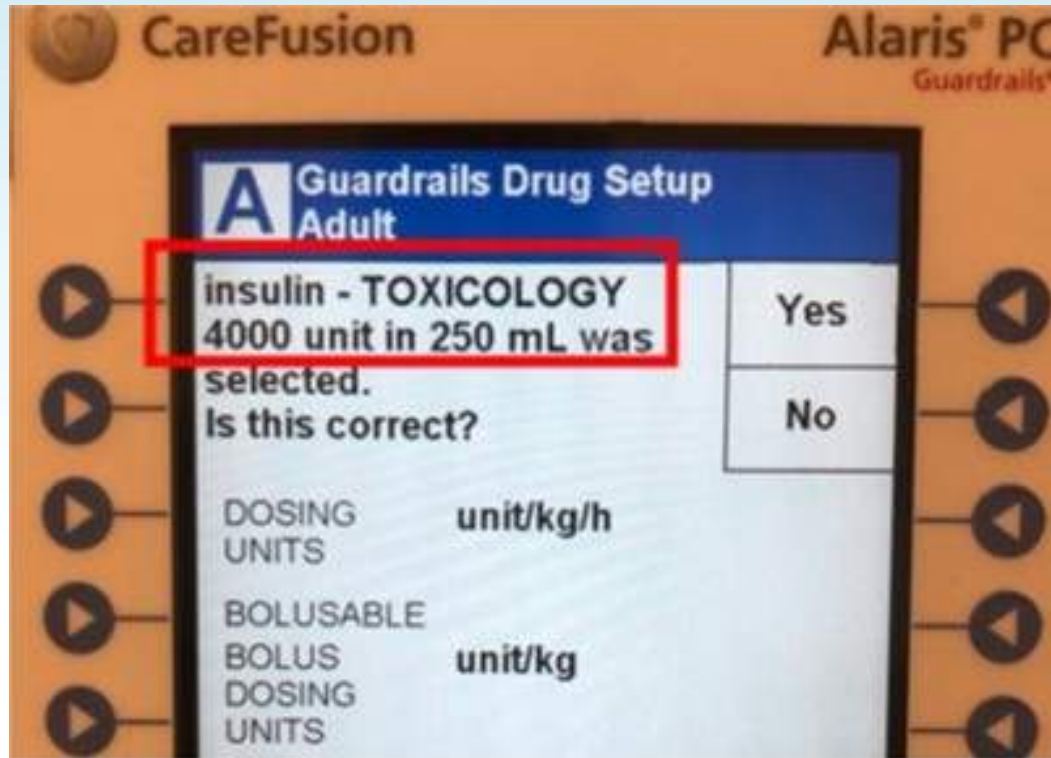
Transcribed by: _____ Tech: _____ RPh: _____
[FD:1st REPRINT] 9/25 14:45

Administration

CareFusion Alaris® PC
Guardrails

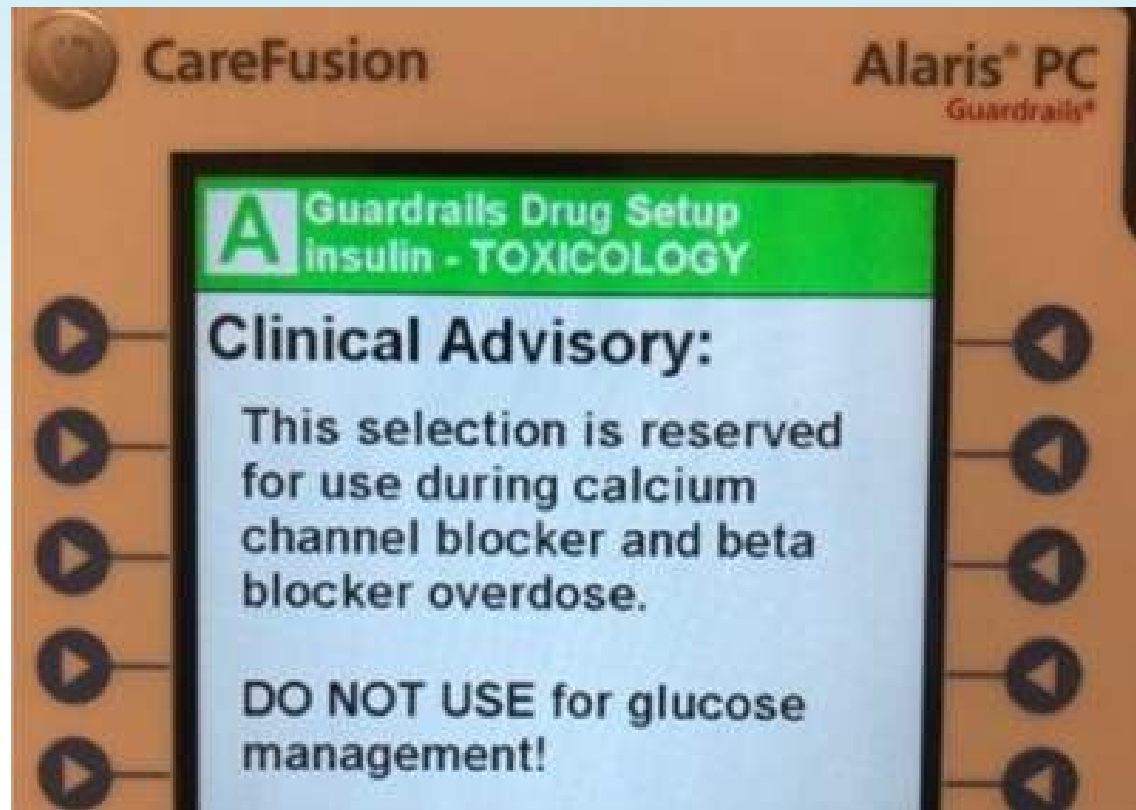
A Guardrails Drugs Adult	
insulin - TOXICOLOGY	F
insulin-GLUCOSE/DKA	G

Administration





Administration





How Has It Gone?

Strengths

- Minimizes interruptions in insulin infusion administration
- Decreases burden on bedside nurse
- Provides ability to maximize dose to optimized therapy
- Aligns with local poison center recommendations

Areas for Improvement

- Prescriber comfort with titration
- Dextrose volume
 - Procurement of premixed 20% product
- Frequent education needed for all health care professionals
 - Low utilization, high stress



Hypertriglyceridemia-Induced Acute Pancreatitis



Background

- Proposed mechanism: breakdown of triglycerides (TG) to free fatty acids → lipotoxicity
- TG > 500 mg/dL increase risk of developing pancreatitis
- No clear therapeutic guidelines: insulin, heparin, plasmapheresis
 - Insulin often used as a minimally-invasive and cheaper strategy
 - Insulin triggers enzymatic activity of lipoprotein lipase (to decrease TG) and inhibition of lipase (to reduce inflammation)



Available Insulin Literature

No specific dextrose recommendations

Citation	Design	Insulin	Dextrose
Inayat F, et al. <i>Cureus</i> 2018;10:e3501	<ul style="list-style-type: none">Review of 34 case reports (N = 34 patients)	<ul style="list-style-type: none">Usually given at 0.1-0.3 u/kg/hr	<ul style="list-style-type: none">Titrate to maintain BG 150-200 mg/dLAll started on empiric D5W or D10W
Reed J, et al. <i>Mayo Clin Proc Innov Qual Out</i> 2021;5:230-5	<ul style="list-style-type: none">Single case reportPatient without diabetes (A1c 4.7%)	<ul style="list-style-type: none">0.1 > 0.07 u/kg/hr per endocrinology	<ul style="list-style-type: none">Started D5W @125 mL/hr, required up to D20W @200 mL/hrRN titration

Lower rate for patients without diabetes

Gaps and Safety Considerations



No standardized recommendation for insulin or dextrose infusion rate



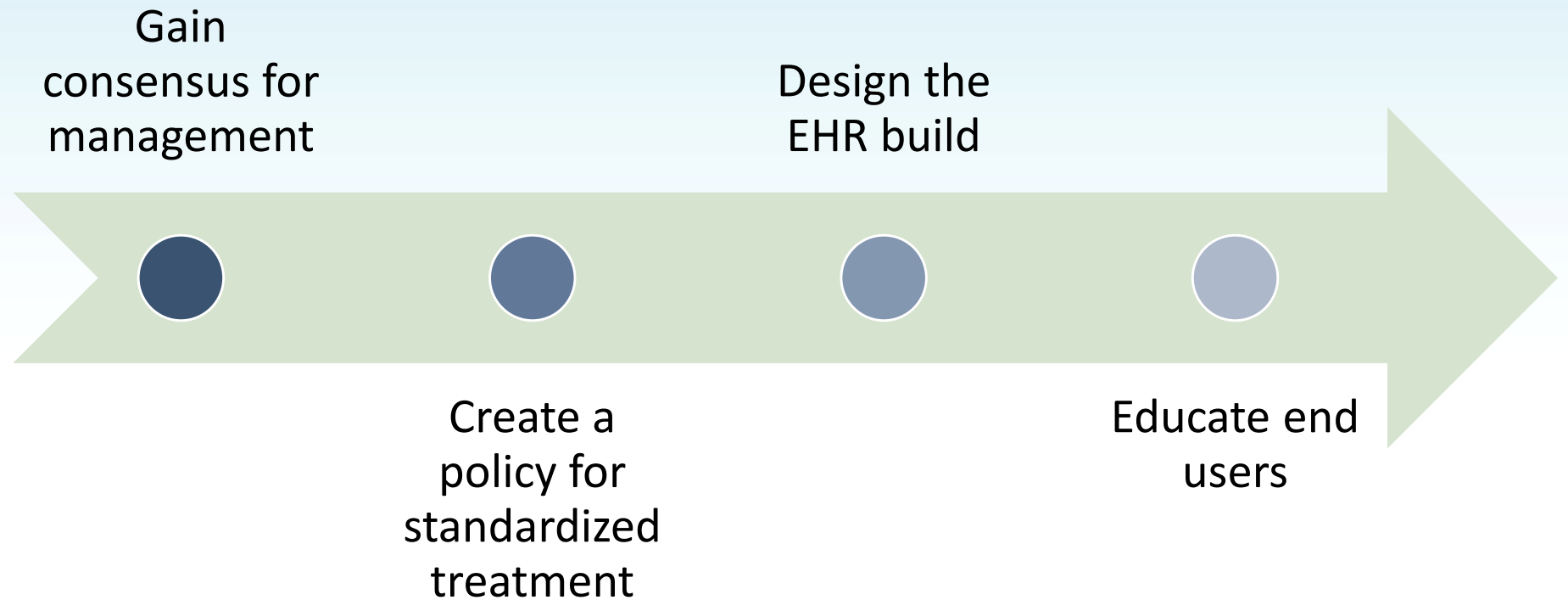
Concern for hypoglycemia, especially for patients without diabetes



Providers must either order insulin infusion outside of a protocol or utilize an orderset for a different indication (i.e., DKA), which can lead to confusion



Project Steps



Orderset Overview



IV Fluids, Labs, Diet



Insulin/Dextrose



Lipid-Lowering Therapy



Orderset Overview



IV Fluids, Labs, Diet



Insulin/Dextrose



Lipid-Lowering Therapy



Insulin Orders

▼ Insulin

Once triglycerides are less than 500 mg/dL and the patient is tolerating an oral diet, discontinue the insulin infusion and if indicated for treatment, start oral insulin.

Insulin infusion (for patients WITHOUT diabetes)
0.07 Units/kg/hr, intravenous, Continuous, Do NOT titrate

insulin regular (HumuLIN R, NovoLIN R) 100 Units in sodium chloride 100 mL (1 Units/mL) infusion
10 Units/hr (10 mL/hr), intravenous, Continuous, Starting today at 1400
Do NOT titrate
Routine

The original dose of ~~24 Units/hr (0.2 Units/kg/hr Continuous)~~ exceeded the recommended single dose limit of 10 Units/hr.
The dose has been automatically changed to 10 Units/hr.



Dextrose Orders

▼ Dextrose

- dextrose 10 % IVPB for hypoglycemia 25 g
25 g, intravenous, at 999 mL/hr, Once, today at 1400, For 1 dose
Administer PRIOR to insulin infusion initiation. Notify provider if initial blood glucose is greater than 250 mg/dL prior to administering.
Routine

▼ Dextrose Infusion

D20W infusion is reserved for patients who cannot tolerate a high volume of fluid AND have central IV access

- dextrose 5 % (D5W) infusion
0-250 mL/hr, intravenous, Titrated, Refer to Hypertriglyceridemia Induced Acute Pancreatitis Protocol Form, 701-3062, for starting infusion rate and titration instructions.
Routine
- dextrose 10 % infusion
0-250 mL/hr, intravenous, Titrated, Starting today at 1400
Refer to Hypertriglyceridemia Induced Acute Pancreatitis Protocol Form, 701-3062, for starting infusion rate and titration instructions.
Routine

Nurse Driven Dextrose Titration

Dextrose Therapy for Hypertriglyceridemia Form, 701-3062

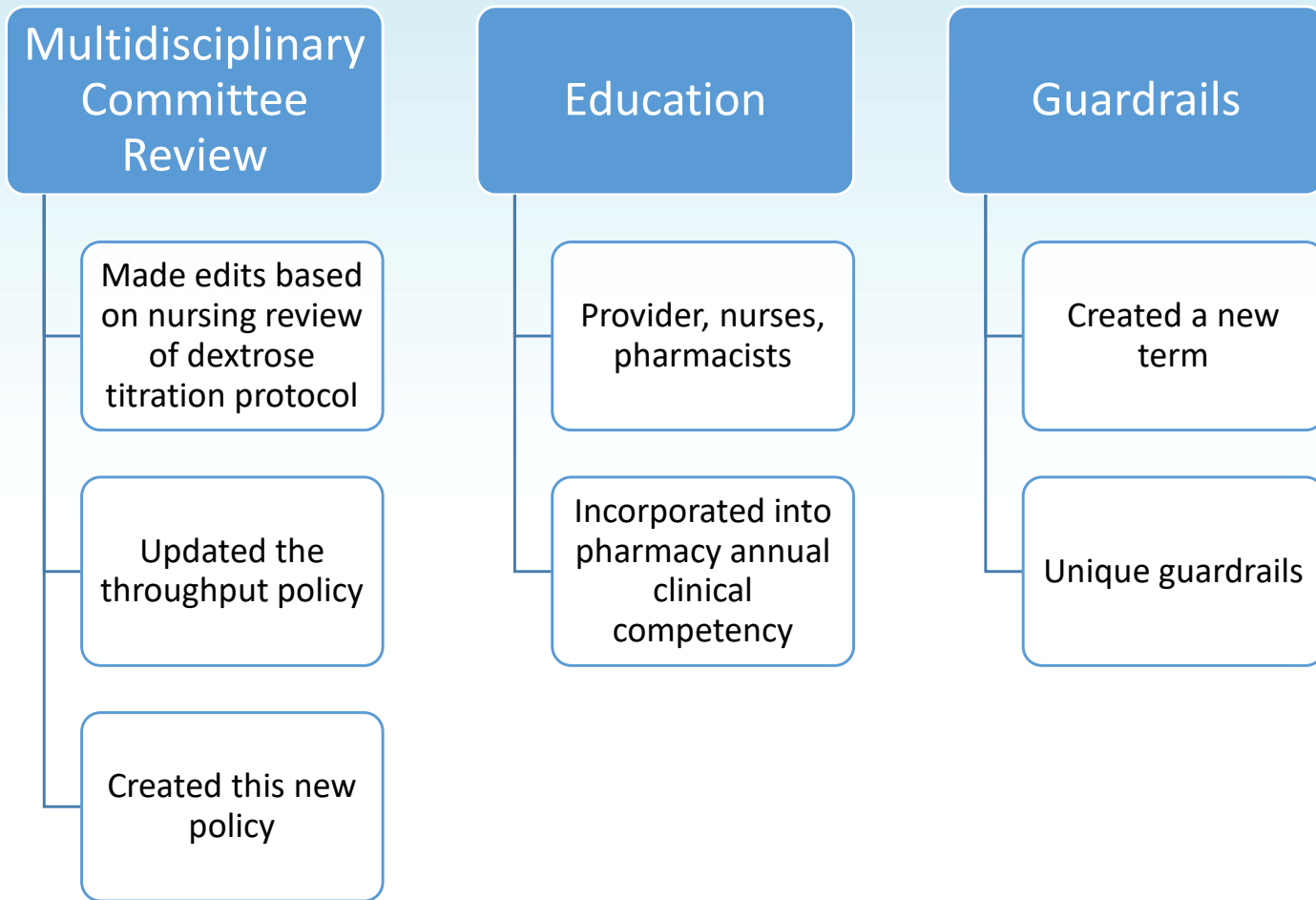
Patient Name: _____

MRN: _____

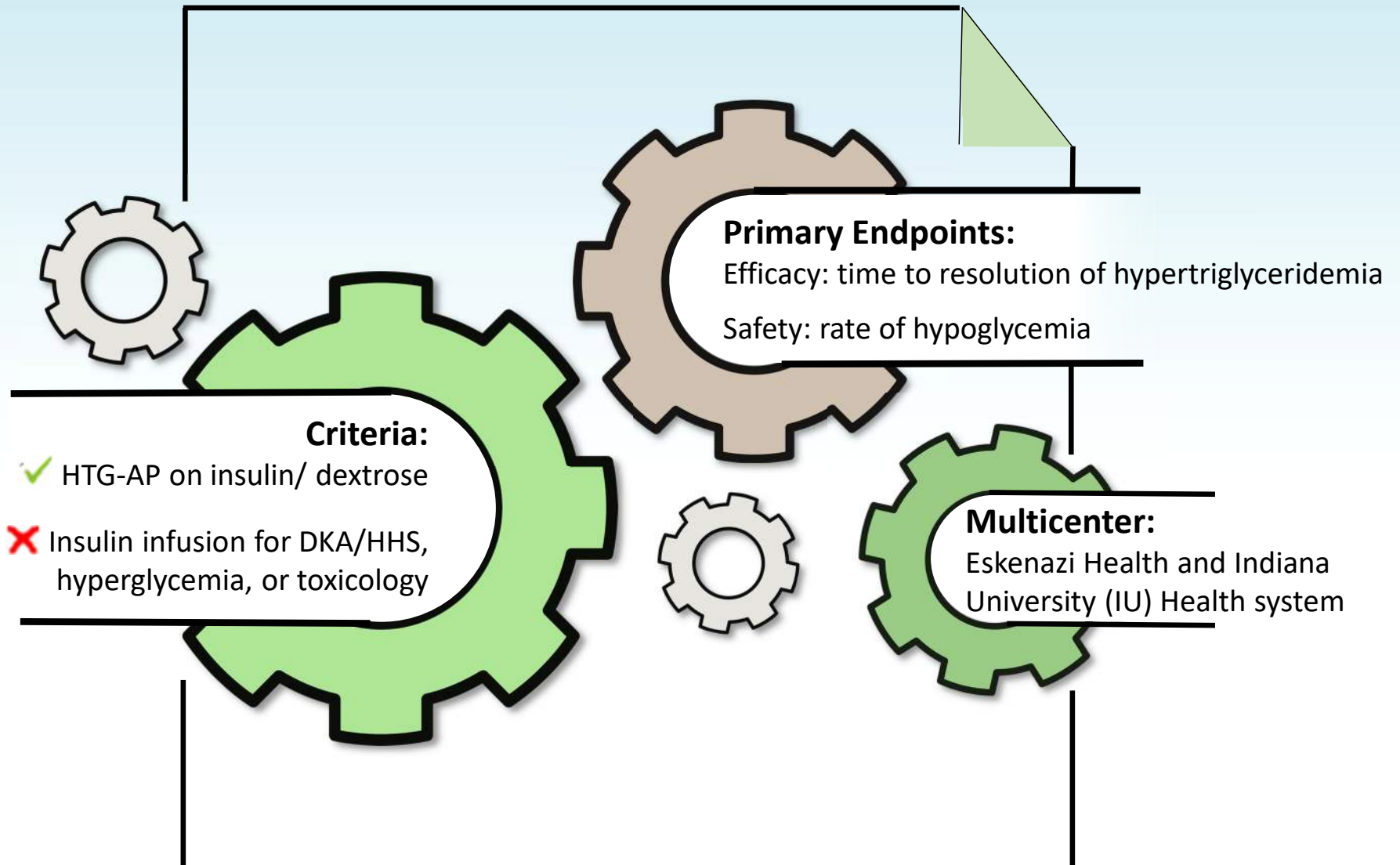
Patient Name:	_____	Pharmacist Name:	_____
MRN:	_____	Room:	_____
Step 1: INITIAL DEXTROSE INFUSION RATE			
<p>*** DO NOT initiate insulin therapy if serum potassium is <3.3 mEq/L, unless deemed appropriate by provider or potassium replacement has been initiated. ***</p>			
Initial Blood Glucose	Initial Dextrose Infusion (D5W or D10W)	Next Glucose	
251 mg/dL or greater	None - Do not initiate	1 h and move to step 2	
201 - 250 mg/dL	Initiate 50 mL/hr		
151 - 200 mg/dL	Initiate 100 mL/hr		
101 -150 mg/dL	Initiate 150 mL/hr		
70 - 100 mg/dL	Initiate 200 mL/hr		
69 mg/dL or less	Initiate 250 mL/hr, Hold INSULIN infusion for 1 hour, utilize hypoglycemia protocol, and notify provider		
Step 2: DEXTROSE INFUSION TITRATIONS			
Blood Glucose	Dextrose Infusion Adjustment	Next Glucose	
251 mg/dL or greater	HOLD dextrose infusion	1 h	
201 - 250 mg/dL	Decrease by 50 mL/hr	1 h	
151 - 200 mg/dL	Continue current rate - at goal	1 h. If four consecutive hourly glucoses are within target range, check glucoses every 2 hours. Then if four consecutive every 2 hour glucoses are within target range, check glucoses every 4 hours.	
101 -150 mg/dL	Increase by 50 mL/hr to a max of 250 mL/hr (if already at 250 mL/hr, contact MD)	1 h	
70 - 100 mg/dL	Increase by 100 mL/hr to a max of 250 mL/hr and contact MD to consider a more concentrated dextrose (e.g., D10W, D20W)	1 h	
69 mg/dL or less	Increase by 150 mL/hr to a max of 250 mL/hr and contact MD to consider a more concentrated dextrose (e.g., D10W, D20W), hold INSULIN infusion for 1 hour, and utilize hypoglycemia protocol		



Implementation



Retrospective Study



Data Points

Insulin infusion

- Initial rate
- Max rate
- Min rate
- Duration

Dextrose infusion

- Initial bolus
- Initial concentration
- Initial rate
- Max rate
- Max concentration

Blood glucose (BG)

- Initial BG
- BG < 70 mg/dL
- BG < 50 mg/dL
- BG > 200 mg/dL

Oral therapies

- Baseline and at discharge
- Statin, fibrate, fish oil, orlistat

Other endpoints

- Heparin, plasmapheresis
- Length of stay
- 30-day readmission
- Protocol insulin infusion ordered from



Pharmacist-Managed Transition from IV to Subcutaneous Insulin



Audience Poll

How is the transition off an insulin drip typically performed at your institution?

- A. Provider-managed
- B. Collaborative with provider and pharmacist but *provider* enters orders
- C. Collaborative with provider and pharmacist but *pharmacist* enters orders
- D. Pharmacy-driven protocol
- E. Other – please type in the Q&A

Guideline Recommendations

1. Utilize a protocol with a **low rate of hypoglycemia**
2. Transition to a **protocol-driven** basal/bolus insulin regimen before insulin infusion is stopped



How?

When?

Who?



Laying the Groundwork

- Prior study at Eskenazi Health sought to identify the safest and most effective method of transitioning off IV insulin
- Groups stratified according to initial dose of basal insulin as a % of their prior 24-hr IV requirement
- Highest percentage of BG in goal range within 48 hrs after transition in the 50-70% basal insulin group with lowest incidence of hypoglycemia as well

Project Goals



Standardize approach to transition



Leverage the pharmacist role in transition

Pharmacist-Managed IV to Subcutaneous Insulin Protocol

Provider Assessment

- Provider ensures patients are clinically eligible for transition by analyzing factors impacting insulin requirements
- Ineligibilities include:
 - Fluctuating nutrition therapy
 - Inadequate subcutaneous absorption (i.e., peripheral edema, vasopressors)
 - Glucose-altering medications (e.g., steroids)
 - Upcoming major surgery

Consult Order

- Provider enters a Pharmacy Consult for “Pharmacy to dose transition from IV to subcutaneous insulin therapy”



Consult Order

Pharmacy to dose IV to subcutaneous insulin

Accept Cancel

Priority:

Frequency: **Once**
At

Protocol document: (do not edit)

! This consult should NOT be ordered if protocol exclusion criteria are met. Does patient meet exclusion criteria: age < 18 years OR receiving IV insulin for DKA, HHS, beta blocker/calcium channel blocker overdose, or hypertriglyceridemia?

! Does the patient have fluctuating nutrition therapy?

! Do you anticipate the patient will have inadequate subcutaneous absorption (e.g. significant peripheral edema, use of vasoactive agents)?

! Is there a recent initiation or change in glucose altering medications (e.g. steroids)?

! Does the patient have an upcoming major surgery in the next 24-48 hours?

Reference Links: [• 2.8.21 - IV to Subcutaneous Insulin Protocol \(701-3050\) - Linked Epic Protocol](#)

!

Accept Cancel

Pharmacist-Managed IV to Subcutaneous Insulin Protocol

Pharmacist Evaluation

- Reviews patient for any ineligibilities
- Reviews insulin requirements and ensures infusion has been stable for ≥ 6 hours
 - Consider waiting to transition if total daily dose (TDD) of insulin is ≥ 150 -200 units or significantly higher than home dose

Insulin Orders

- Basal: 50-70% of 24-hour IV insulin requirement as NPH divided every 6 or 8 hours
- Sliding scale: insulin lispro based on calculated ISF
 - For NPH every 6 hours, sliding scale insulin and BG checks will be ordered every 3 or 6 hours
 - For NPH every 8 hours, sliding scale insulin and BG checks will be ordered every 4 hours



Custom Sliding Scale Insulin

$$\text{Insulin Sensitivity Factor (ISF)} = \frac{1800}{\text{TDD}}$$

Glucose	ISF < 10	ISF 10-15	ISF 16-19	ISF 20-30	ISF > 30
71-150 mg/dL	No treatment necessary				
151-200 mg/dL	6 units	4 units	3 units	2 units	1 unit
201-250 mg/dL	12 units	8 units	6 units	4 units	3 units
251-300 mg/dL	17 units	11 units	8 units	5 units	5 units
301-350 mg/dL	22 units	14 units	10 units	7 units	6 units
>350 mg/dL	27 units	17 units	14 units	9 units	8 units



Custom Sliding Scale Insulin

▼ Medications

▶ Subcutaneous Insulin - Basal

▶ Subcutaneous Insulin - Prandial

▼ Subcutaneous Insulin - Supplemental

Low-dose supplemental algorithm (patient requiring less than 40 units/day)

Medium-dose supplemental algorithm (patients requiring 40-80 units/day)

High-dose supplemental algorithm (patients requiring more than 80 units/day)

Individualized supplemental insulin dose

Pharmacy consult - IV to subcutaneous insulin transition supplemental algorithm

**This was custom
built for this protocol
and is only viewable
by pharmacy**



Custom Sliding Scale Insulin

Pharmacy consult - IV to subcutaneous insulin transition supplemental algorithm

insulin lispro (HumaLOG) injection (ISF less than 10) (\$\$)

0-27 Units, Every 4 hours standard, If BG is less than or equal to 70 mg/dL, use Adult Hypoglycemia Protocol (701-3008), hold any ordered insulin, and call House Officer immediately. If BG 71-150 mg/dL, no adjustment, give scheduled insulin dose if ordered. If BG 151-200 mg/dL, give 6 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 201-250 mg/dL, give 12 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 251-300 mg/dL, give 17 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 301-350 mg/dL, give 20 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG is greater than 350 mg/dL, notify House Officer. If no response in 30 minutes, give 27 unit(s) subcutaneous (or add to if there is a short-acting insulin dose) and continue to call House Officer. Indications: type 2 diabetes mellitus

insulin lispro (HumaLOG) injection (ISF 10-15) (\$\$)

0-17 Units, Every 4 hours standard, If BG is less than or equal to 70 mg/dL, use Adult Hypoglycemia Protocol (701-3008), hold any ordered insulin, and call House Officer immediately. If BG 71-150 mg/dL, no adjustment, give scheduled insulin dose if ordered. If BG 151-200 mg/dL, give 4 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 201-250 mg/dL, give 8 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 251-300 mg/dL, give 11 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 301-350 mg/dL, give 14 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG is greater than 350 mg/dL, notify House Officer. If no response in 30 minutes, give 17 unit(s) subcutaneous (or add to if there is a short-acting insulin dose) and continue to call House Officer.

insulin lispro (HumaLOG) injection (ISF 16-19) (\$\$)

0-14 Units, Every 4 hours standard, If BG is less than or equal to 70 mg/dL, use Adult Hypoglycemia Protocol (701-3008), hold any ordered insulin, and call House Officer immediately. If BG 71-150 mg/dL, no adjustment, give scheduled insulin dose if ordered. If BG 151-200 mg/dL, give 3 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 201-250 mg/dL, give 6 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 251-300 mg/dL, give 8 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 301-350 mg/dL, give 10 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG is greater than 350 mg/dL, notify House Officer. If no response in 30 minutes, give 14 unit(s) subcutaneous (or add to if there is a short-acting insulin dose) and continue to call House Officer.

insulin lispro (HumaLOG) injection (ISF 20-30) (\$\$)

0-9 Units, Every 4 hours standard, If BG is less than or equal to 70 mg/dL, use Adult Hypoglycemia Protocol (701-3008), hold any ordered insulin, and call House Officer immediately. If BG 71-150 mg/dL, no adjustment, give scheduled insulin dose if ordered. If BG 151-200 mg/dL, give 2 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 201-250 mg/dL, give 4 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 251-300 mg/dL, give 5 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 301-350 mg/dL, give 7 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG is greater than 350 mg/dL, notify House Officer. If no response in 30 minutes, give 9 unit(s) subcutaneous (or add to if there is a short-acting insulin dose) and continue to call House Officer.

insulin lispro (HumaLOG) injection (ISF greater than 30) (\$\$)

0-8 Units, Every 4 hours standard, If BG is less than or equal to 70 mg/dL, use Adult Hypoglycemia Protocol (701-3008), hold any ordered insulin, and call House Officer immediately. If BG 71-150 mg/dL, no adjustment, give scheduled insulin dose if ordered. If BG 151-200 mg/dL, give 1 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 201-250 mg/dL, give 3 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 251-300 mg/dL, give 5 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG 301-350 mg/dL, give 6 unit(s) subcutaneous (or add to if there is a short-acting insulin dose). If BG is greater than 350 mg/dL, notify House Officer. If no response in 30 minutes, give 8 unit(s) subcutaneous (or add to if there is a short-acting insulin dose) and continue to call House Officer.

Other Protocol Considerations

Pharmacist ensures insulin infusion is discontinued 1 or 2 hours after the initial NPH dose is administered by entering a **STOP DATE** and **TIME** for the IV insulin



Transition off of IV insulin is not considered urgent, and therefore, pharmacists should only complete the consult between 0700 and 2300





Protocol Implementation

- Multidisciplinary committee review process
- Education – provider, nursing, pharmacy
 - Incorporated into clinical competencies for pharmacy
- Comprehensive EHR build



Evaluating the Pharmacist-Managed IV to Subcutaneous Insulin Protocol



Retrospective Study

Objective

- To evaluate the efficacy and safety of a pharmacist managed protocol compared to a provider managed process to transition critically ill adults from IV to subcutaneous insulin

Criteria

- Inclusion: adult patients admitted to burn, medical, or surgical/trauma ICU who received insulin infusion
- Exclusion: IV insulin for DKA/HHS, HTG-AP, or toxicology indication

Study Period

- January 2019 – April 2021



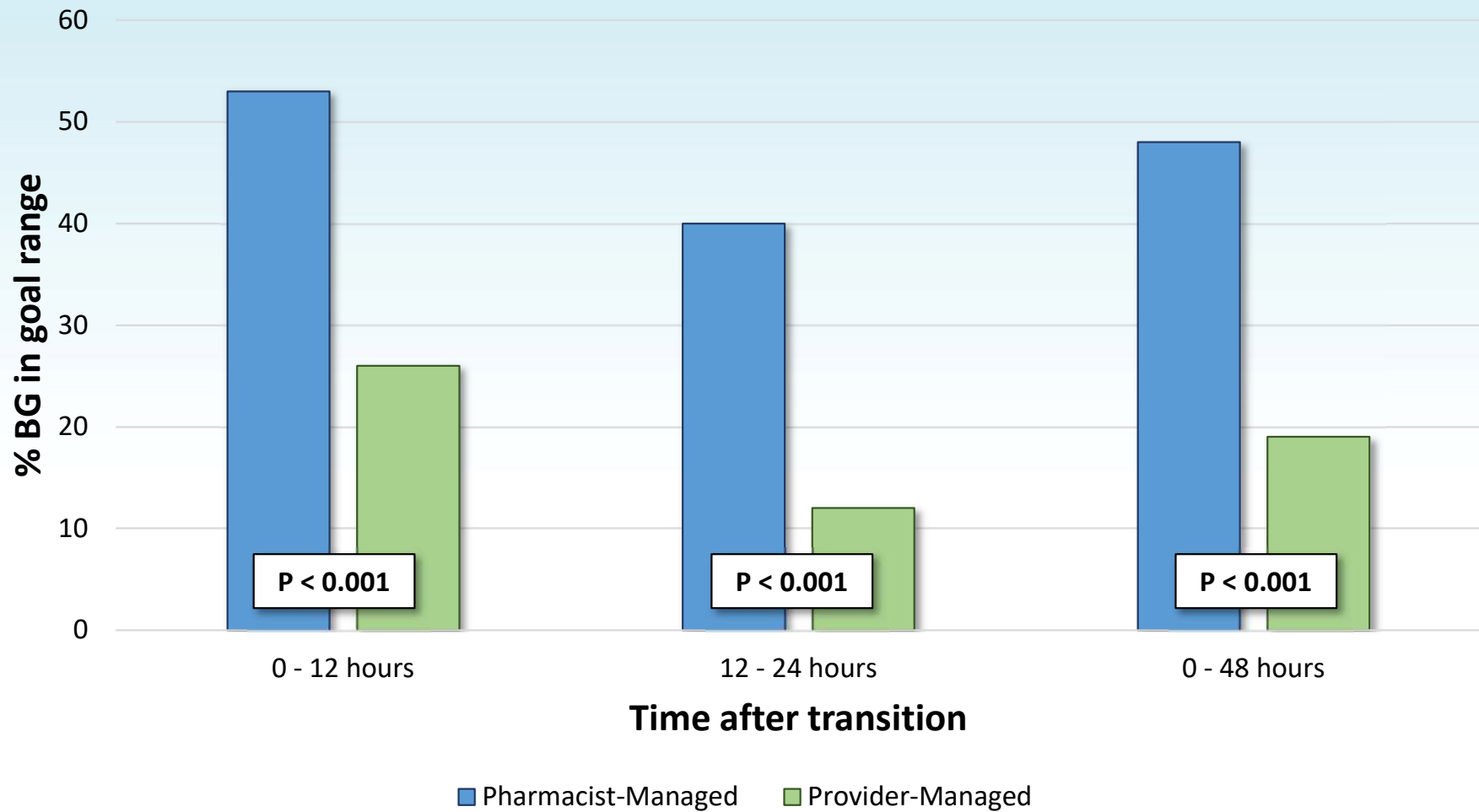
Baseline Demographics

Characteristics	Pharmacist Managed (n=40 patients) n (%)	Provider Managed (n=70 patients) n (%)	P value
Demographic			
Age (years)*	63 ± 11	57 ± 15	0.008
Sex, male	21 (53%)	41 (59%)	0.538
Ethnicity, Hispanic	10 (25%)	10 (14%)	0.182
Ethnicity, non-Hispanic	30 (75%)	60 (86%)	
Race, Black	12 (30%)	32 (46%)	0.264
Race, White	17 (43%)	24 (34%)	
Race, Other	11 (28%)	14 (20%)	
Baseline Characteristic			
BMI (kg/m2)*	30.4 ± 8.1	28.5 ± 7.7	0.367
Diabetes mellitus	28 (70%)	50 (71%)	0.874
A1c [†]	7.6 [7.2, 9.4]	9.3 [6.8, 12.0]	0.205
Admitting team, MICU	24 (60%)	39 (56%)	0.661

*Reported as mean (± SD)

[†]Reported as median (IQR)

BG in Goal Range





Safety Outcomes

	Pharmacist Managed (n=512 BG) n (%)	Provider Managed (n=1382 BG) n (%)	P value
Hypoglycemia	5 (1%)	53 (3.8%)	0.001
Severe hypoglycemia	0 (0%)	5 (0.4%)	0.332
Hyperglycemia	142 (28%)	1074 (78%)	0.001
Severe hyperglycemia	140 (27%)	782 (57%)	<0.001



Additional Outcomes

	Provider Managed (n=1394 BG) n (%)	Pharmacist Managed (n=512 BG) n (%)	P value
ICU length of stay (days) [†]	16 (7, 28)	11 (4, 15)	0.002
Survivors [†]	16 (7, 26)	8 (4, 12)	0.004
Mortality	12 (12%)	21 (52.5%)	< 0.001
Re-initiation of IV insulin	8 (8%)	3 (7.1%)	1.000
Dose change within 48 hrs	28 (28%)	22 (52.4%)	0.006



Limitations and Challenges

- Difficult to assess glycemic control in a dynamic patient due to variables such as
 - Severity of critical illness
 - Impact of nutrition therapy
 - Absorption of subcutaneous insulin
- Groups were stratified based on ordering discipline
 - Routine pharmacist/provider collaboration made data collection difficult to determine the management of the transition
- Potential for underutilization of consult due to routine clinical pharmacy coverage

Conclusions



Pharmacists can safely and effectively transition patients from IV to subcutaneous insulin



Under this new institutional protocol, pharmacists practice at the top of their licenses, leveraging clinical expertise with deliberate attention to detail



Think and Share

- Is there a need for these protocols or protocols for other indications at your institutions?
- What barriers do you think you would encounter if you were to try to implement insulin drip protocols like these?
- Do any institutions have other creative protocols surrounding insulin they'd like to share?
- What clarifying questions do you have?



Dripping with Safety

Multidisciplinary Approaches to Standardize Insulin Infusions

Midwest Medication Safety Symposium
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