



# Evaluation of Glycemic Management in Hospitalized, Non-Critical, Type 2 Diabetic Patients

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Midwest Pharmacy Residents Conference

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# Disclosure Statement

- The speaker has no conflicts of interest to disclose

## Learning Objective

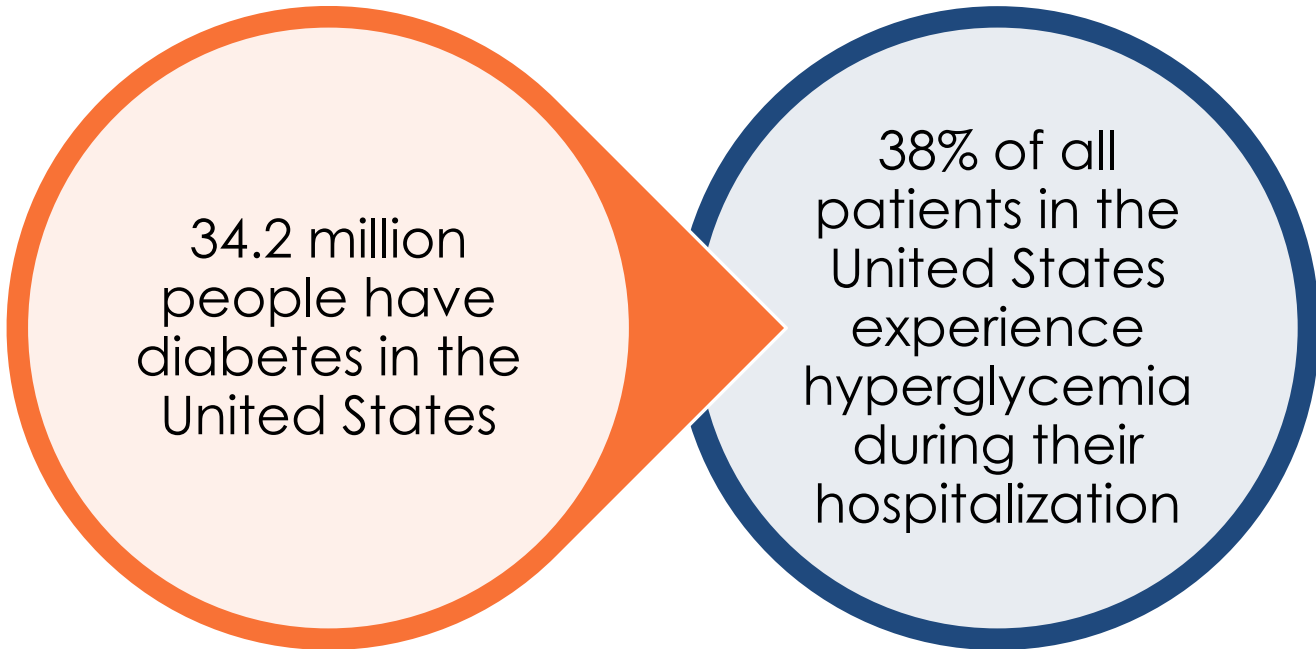
- To assess for appropriate glycemic management in hospitalized, non-critical, type 2 diabetic patients

# Cox Medical Center South

- 650-bed hospital in Southwest Missouri
- Level-1 trauma center
- Level-1 stroke center



# Diabetes



34.2 million  
people have  
diabetes in the  
United States

38% of all  
patients in the  
United States  
experience  
hyperglycemia  
during their  
hospitalization

# American Diabetes Association (ADA) Guidelines

## Hyperglycemia

- Blood glucose level > 140 mg/dL

## Hypoglycemia

- Blood glucose level < 70 mg/dL

## Goal Glucose Range

- 140 -180 mg/dL

## Ideal Insulin Regimens

- Basal-bolus insulin +/- correction insulin

# Inpatient Glycemic Management

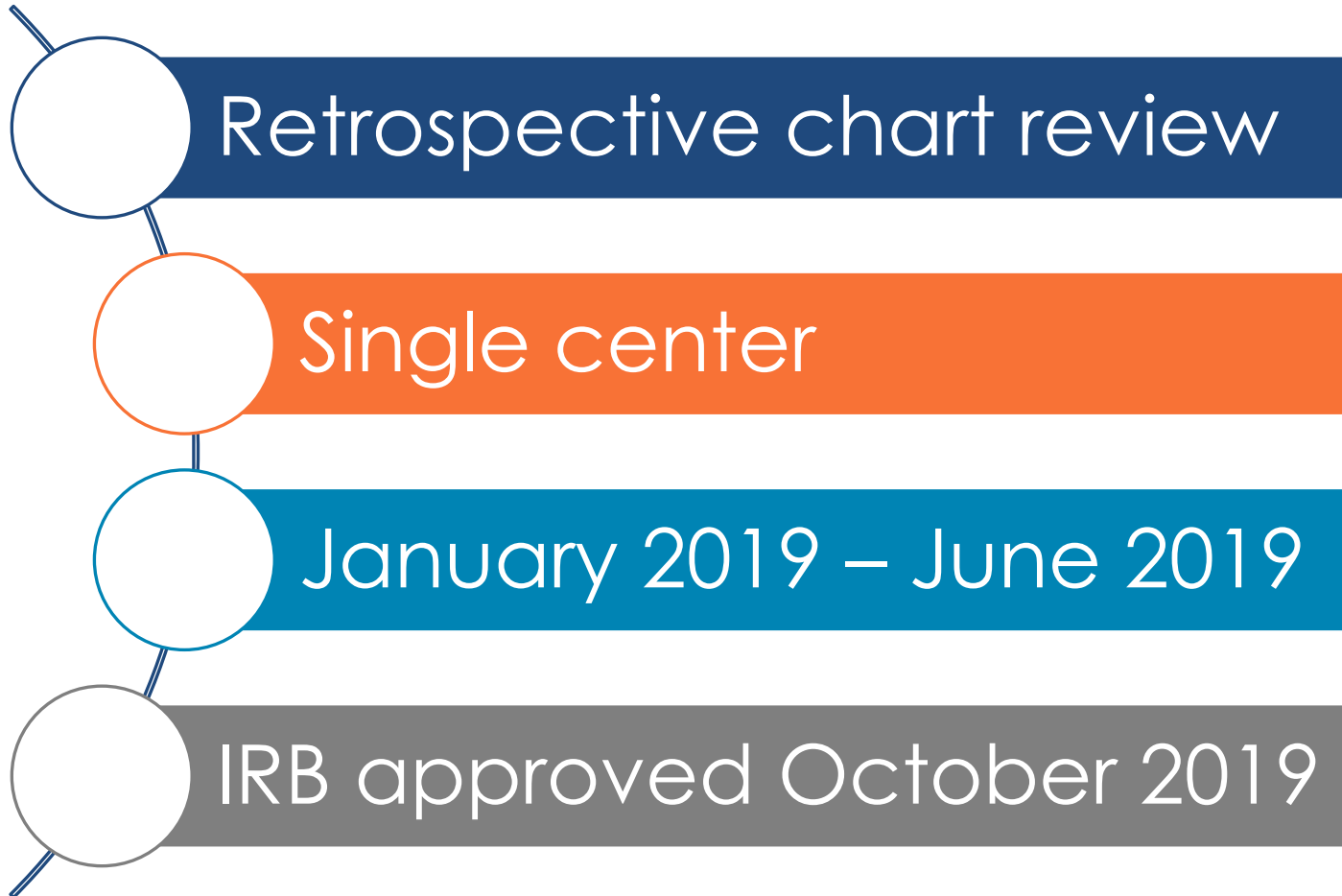
## Challenges

- Fluctuating courses of acute illness
- Unpredictable dietary schedules
- Hospitalists varied knowledge and comfort in ordering insulin

## Complications


- Length of stay
- Cost
- Infection risk
- Mortality

# Study Design





## Purpose



To evaluate the efficacy and safety of appropriate glycemic management compared to inappropriate glycemic management in hospitalized, non-critical, type 2 diabetic patients

## Primary Outcome

- Number of patients with blood glucose readings outside of the goal range (70 – 180 mg/dL) in comparative groups

## Secondary Outcomes

- Rate of hyperglycemic ( $>180$  mg/dL) episodes per patient stay
- Rate of hypoglycemic ( $<70$  mg/dL) episodes per patient stay
- Mean blood glucose level per patient stay
- Standard deviation of blood glucose levels
- Mean daily basal-bolus insulin ratio administration
- Rate of use of non-insulin glucose lowering agents
- Length of stay

# Inclusion Criteria

≥18 years old

Diagnosis of type 2 diabetes

Admission to Cox Medical Center South from  
January 2019 through June 2019

# Exclusion Criteria

Discharged within 48 hours of admission

Admission to critical care unit

Glycemic management consult

Order for NPO status  $\geq 24$  hours

Received an alternate source of nutrition  $\geq 24$  hours

Diagnosis of end-stage renal disease on hemodialysis

Patient did not require or refused insulin during hospital stay

On hospice care

# Comparator Groups

## Appropriate Glycemic Management (Group 1)

- Initiated on basal and bolus insulin within 24 hours from admission
  - Basal insulin: 50-70% of total daily required
  - Bolus insulin: 30-50% of total daily required

## Inappropriate Glycemic Management (Group 2)

- Anyone who does not meet “Appropriate Glycemic Management” criteria
  - E.g. bolus insulin monotherapy

# Study Population

691 patients identified for retrospective chart review

- 546 patients excluded from analysis
- o 183 patients were discharged in <48 hours
  - o 64 patients did not require insulin
  - o 53 patients were admitted to the ICU
  - o 53 patients were NPO  $\geq$ 24 hours
  - o 52 patients refused insulin
  - o 48 patients had a glycemic management consult
  - o 39 patients did not have a diagnosis for DMT2
  - o 28 patients had ESRD
  - o 26 patients were on enteral feeds  $\geq$ 24 hours

145 patients included for analysis

11 patients in comparator group 1: appropriate GM

134 patients in comparator group 2: inappropriate GM

- o 84 patients did not receive basal
- o 21 patients were not given basal insulin within 24 hours
- o 29 patients did not have the correct basal:bolus ratio

ESRD: End stage renal disease  
NPO: Nothing by mouth  
DMT2: Diabetes myelitis type 2  
ICU: Intensive care unit  
GM: Glycemic Management

# Baseline Characteristics

Comparator Groups	Appropriate GM Group 1 (n=11)	Inappropriate GM Group 2 (n=134)
Mean Age [Range]	66 [46-80]	68 [41-96]
Gender (%)		
<i>Male</i>	5 (45%)	60 (45%)
<i>Female</i>	6 (55%)	74 (55%)
Ethnicity (%)		
<i>African American</i>	2 (18%)	4 (3%)
<i>Asian</i>	0 (0%)	1 (1%)
<i>Caucasian</i>	8 (73%)	128 (95%)
<i>Hispanic</i>	1 (9%)	1 (1%)
Mean A1C [Range]	8.6 [6.5-10.9]	7.6 [4.3-12.7]
Mean BMI [Range]	28.5 [25.7-50.3]	35.4 [21.7-85]
Mean GFR [Range]	69 [26-139]	72 [16-174]
Insulin-Naïve (%)	1 (9%)	75 (56%)

GM: Glycemic Management



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# Primary Outcome

Comparator Groups	Appropriate GM Group 1 (n=11)	Inappropriate GM Group 2 (n=134)
Number of patients with blood glucose readings outside of goal range (%)	11 (100%)	129 (96%)

# Secondary Outcomes

Comparator Groups	Appropriate GM Group 1 (n=11)	Inappropriate GM Group 2 (n=129)
Number of patients with hyperglycemic (>180 mg/dL) episodes (%)	10 (91%)	129 (100%)
Mean rate of hyperglycemic (>180 mg/dL) episodes per patient stay [range]	13 [2-24]	9 [1-33]
Range of hyperglycemic (>180 mg/dL) episodes	181-494	181-438

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# Secondary Outcomes

Comparator Groups	Appropriate GM Group 1 (n=11)	Inappropriate GM Group 2 (n=129)
Number of patients with hypoglycemic (<70 mg/dL) episodes (%)	1 (9%)	15 (12%)
Mean rate of hypoglycemic (<70 mg/dL) episodes per patient stay [range]	8 [8]	2 [1-6]
Range of hypoglycemic (<69 mg/dL) episodes	51-67	39-69



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Comparator Groups	Appropriate GM Group 1 (n=11)	Inappropriate GM Group 2 (n=134)
Mean blood glucose level	198 [88-310]	175 [107-296]
Standard deviation blood glucose level	59	39
Mean daily basal:bolus insulin administration ratio	60:40	24:76
Rate of use of non-insulin glucose lowering agents (%)	5 (45%)	39 (29%)
Length of stay [range]	5 [3-9]	6 [3-26]

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Length of stay [range]	5 [3-9]	6 [3-26]

# Limitations

Retrospective  
study

Uneven  
comparator  
groups

Small sample  
size

Multiple  
providers

Multiple  
pharmacists

Comparator  
group criteria



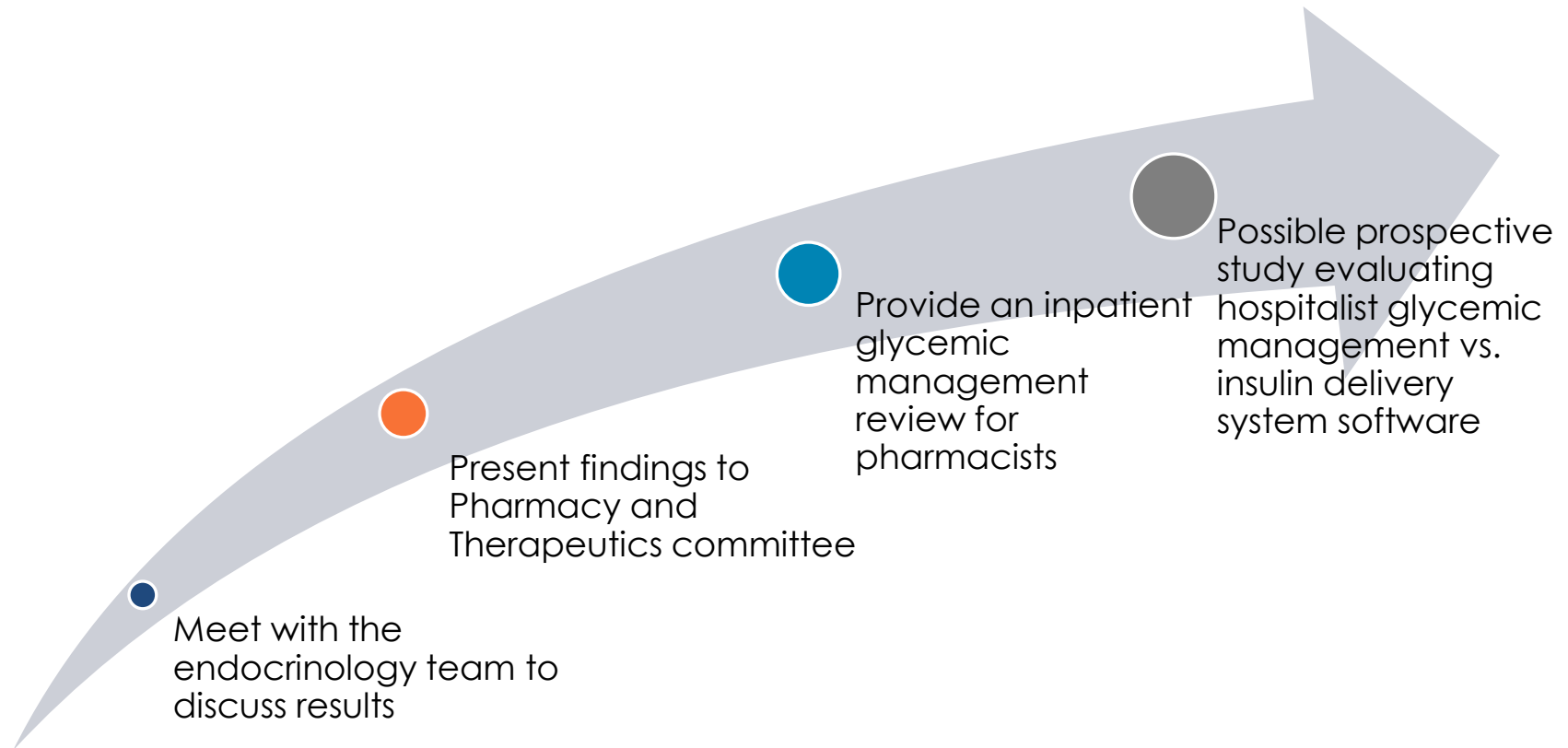
# Conclusion

Group 1 had higher rates of blood glucose readings outside of the goal range (70 – 180 mg/dL) compared to group 2

Providers deviated away from guideline recommendations for inpatient glycemic management

Management of type 2 diabetes can be improved outside of the ICU

# Future Direction



# Acknowledgements

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- Chelsea Landgraf, PharmD, BCPS
- Brian Miller, PharmD

# References

- American Diabetes Association Guidelines
- Bogun M, Inzucchi SE. Inpatient management of diabetes and hyperglycemia. *Clin Ther.* 2013;35:724–733
- Gerard S, Ritchie J. Challenges of Inpatient Glycemic Control. *J Nurs Care Qual.* 2017 Jul/Sep; 32(3):267-271
- Lansang M, Umpierrez G. Inpatient Hyperglycemia Management: A Practical Review for Primary Medical and Surgical Teams. *Cleve Clin J Med.* 2016 May; 83:S34-43.
- Mendez C, Der Mesropian P, Mathew R, et al. Hyperglycemia and Acute Kidney Injury During the Perioperative Period. *Curr Diab Rep.* 2016 Jan; 16(1):10.
- Moghissi E, Korytkowski M, DiNardo M, et al. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. *Endocr Pract.* 2009 May-Jun; 15(4):353-69.
- Umpierrez G, Smiley D, Zisman A, et al. Randomized study of basal-bolus insulin therapy in the inpatient management of patients with type 2 diabetes (RABBIT 2 trial). *Diabetes Care.* 2007 Sep;30(9):2181-6.



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